NEW CONSTRUCTION
HIGH SCHOOL CENTER II

ALBEMARLE COUNTY PUBLIC SCHOOLS
CHARLOTTESVILLE, VIRGINIA

October 8, 2024
BID DOCUMENTS

Revision:

IFB #2025 IFB- 1007262

QE Project No:
42351310

QUINN EVANS
1840 West Broad Street
Suite 400
Richmond, Virginia 23220
804.788.4774

SECTION 000110

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REFERENCE DOCUMENTS AND REPORTS

001000 - Geotechnical Report
001100 - ACM Testing Report – Existing Building Services Facility
001200 – Controls Scope of Work (Siemens Proposal “AHS Center 2”)
001300 – Statement of Special Inspections
001400a – Geothermal Test Well - Formation Thermal Conductivity Test & Data Analysis
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013216 - Construction Progress Schedule
013329.02 - Sustainable Design Reporting - LEED v4 and v4.1
013329.07 - Prohibited Content Installer Certification
013566.12 - Sustainability Certification Project Procedures - LEED v4 and v4.1
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015000 – Temporary Facilities and Controls
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016000 - Product Requirements
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017800 - Closeout Submittals

017900 - Demonstration and Training

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033000 – Cast-in-Place Concrete

033545 - Polished Concrete and Concrete Topping - Floor Seal Technology

034500 - Precast Architectural Concrete

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054000 - Cold-Formed Metal Framing

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057100 - Decorative Metal Stairs

057300 - Decorative Metal Railings

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064100 - Architectural Wood Casework
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095100 - Acoustical Ceilings
095423 - Linear Metal Ceilings
095426 - Suspended Wood Ceilings
096500 - Resilient Flooring
096623 - Resinous Matrix Terrazzo Flooring
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210548 - Vibration And Seismic Controls For Fire Suppression Piping And Equipment
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END OF LIST OF DRAWINGS

NOTICE OF
INVITATION FOR BIDS
2025-IFB-1007262

Sealed bids from prequalified Bidders are invited for the construction of a new High School Center, located on existing area of previous Building Services location at 2751 Hydraulic Road, Charlottesville Virginia, 22901. Note, this is the second part of a two-part procurement process; the first part has been completed and has identified pre-qualified Bidders, listed below:

Branch Builds
3635 Peters Creek Rd
Roanoke, VA 24019
540.989.5215

English Construction Company
615 Church St
Lynchburg, VA 24504
434.845.0301

Hourigan
120 Garrett Street, Suite 300,
Charlottesville, VA 22902
434.329.7842

Kenbridge Construction Co
1101 E 5th Ave
Kenbridge, VA 23944
434.676.8221

Howard Shockey and Sons
1057 Martinsburg Pike
Winchester, VA 22603
540.667.7700

Nielsen Builders
3588 Early Rd
Harrisonburg, VA 22801
540.434.7376

Southwood Building Systems
627 N Washington Hwy
Ashland, VA 23005
804.798.9225

Jamerson-Lewis Construction
1306 Stephenson Ave
Lynchburg, VA 24501
434.845.3468

S. B. Ballard Construction
104 Shockoe Slip
Richmond, VA 23219
757.440.5555

Bids submitted by parties other than those listed above will not be considered.

NOTICE OF
INVITATION FOR BIDS
2025-IFB-1007262

Sealed bids are invited for the New Construction High School Center II at 2775 Hydraulic Road, Charlottesville, Va. The project is generally described as a 62,000 sf, 2 story, masonry with steel frame, metal stud wall, school building, with sitework and landscape including driveways, fields, parking lots, and stormwater infrastructure.

Sealed bids will be received at the Albemarle County Procurement Office, Room 248, Albemarle County Office Building, 401 McIntire Road, Charlottesville, Virginia. The deadline for submitting bids is 2:00 P.M., as determined by the Purchasing Agent, on **November 7, 2024**. The bids will be opened publicly and read aloud immediately following the receipt of bids. If the County of Albemarle is closed for business at the time scheduled for bid opening, for whatever reason, sealed bids will be accepted and opened on the next scheduled business day, at the originally scheduled time.

The estimated construction cost range for this project is greater than $30,000,000 - $40,000,000. A Bid Bond is required for any bid which exceeds $100,000. The "Time for Completion" will be as detailed in the Bid Form.

Bids to be considered shall be received in a sealed envelope marked as follows: County of Albemarle, Procurement Office, Room 248, Albemarle County Office Building, 401 McIntire Road, Charlottesville, VA 22902 / Contract: New Construction High School Center II/ IFB No. 2025-IFB-1007262

Procedures for submitting a bid, claiming an error, withdrawal of bids, and other pertinent information are contained in the Instructions to Bidders, which is part of the Invitation for Bids. Withdrawal due to error in bid shall be permitted in accord with Section 9 of the Instructions to Bidders and §2.2-4330A (i), Code of Virginia. The Owner reserves the right to reject any or all bids.

An In Person pre-bid conference will be held at the old Building Services Facility adjacent to Albemarle High School, 2751 Hydraulic Rd, Charlottesville, Va, **at 10:00 am on Tuesday October 15, 2024.** Attendance will be **non-mandatory** for those submitting a bid.

The contract shall be awarded on a lump sum basis as follows: the Total Base Bid Amount plus such successive Additive Bid Items as the Owner in its discretion decides to award.

Contractor registration in accordance with Title 54.1, Chapter 11, of the Code of Virginia, is required. See the Instructions to Bidders for additional qualification requirements.

The Invitation for Bids for the above project, including the drawings and the specifications prepared by Quinn Evans and containing the information necessary for bidding, may be downloaded online from the Albemarle County Procurement web site at https://www.albemarle.org/government/finance/procurement/solicitations. Please note that Bidders are responsible to check the Procurement web site and download any Addenda issued for this Bid.

The County of Albemarle does not discriminate on the basis of race, religion, color, sex, national origin, age or disability, or against faith-based organizations as defined under the Virginia Public Procurement Act on the basis of such organization's religious or charitable character.

INSTRUCTIONS TO BIDDERS

The Invitation For Bids (IFB) consists of the Notice, this Instructions to Bidders, the Bid Form, the Pre-Bid Question Form, the Construction Contract General Conditions, the Supplemental General Conditions (if any), the Special Conditions (if any), the Forms to be used, and the Scope of Work as described by the Plans and Specifications, other documents listed in the Specifications, and any addenda which may be issued, all of which request qualified bidders to submit competitive prices or bids for providing the described work on the project.

1. **CONDITIONS AT SITE OR STRUCTURE:** Bidders shall be responsible for ascertaining pertinent local conditions such as location, accessibility, general character of the site or building, and the character and extent of existing work within or adjacent to the site. Claims, as a result of failure to have done so, will not be considered by the Owner. See Section 7 of the General Conditions entitled "Conditions at Site."

2. **EXPLANATIONS TO BIDDERS:** Bidders may not rely on any oral explanation in regard to the meaning of drawings and specifications or oral instructions given before the award of the contract. Discrepancies, omissions or doubts as to the meaning of drawings and specifications shall be communicated in writing to the Architect/Engineer for interpretation. Bidders must use the "Prebid Question Form" provided in the bid documents. Bidders must so act to assure that questions reach the Architect/Engineer at least seven (7) days prior to the time set for the receipt of bids to allow a sufficient time for an addendum to reach them before the submission of their bids. If an addendum is required for clarification or interpretation of the Bid Documents, the addendum will be issued not later than five (5) days prior to the date set for the receipt of bids except an addendum withdrawing the invitation for bid or one which includes postponement of the date set for the receipt of bids. Any interpretation made will be in the form of an addendum to the Invitation For Bids, which will be made available to all bidders, and its receipt shall be acknowledged, in writing, by the bidder on the Bid Form.

3. **TIME FOR COMPLETION:**

   (a) "Time for Completion" shall be designated by the Owner on the Invitation for Bids or other pre-bid documents and shall mean the number of consecutive calendar days following the issuance of the Notice to Proceed which the Contractor has to substantially complete all Work required by the Contract. In some instances, the Time for Completion may be stated in the form of a Contract Completion Date based on a stipulated date of Notice to Proceed.

   Unless otherwise specified, the Contractor shall achieve Final Completion within thirty (30) days after the date of Substantial Completion.

   (b) When the Notice to Proceed is issued, it will state a Contract Completion Date, which has been set by the Owner based on date of the Notice to Proceed and the Time for Completion.

   (c) The Contractor, in preparing and submitting his bid, is required to take into consideration normal weather conditions. No additional compensation will be paid to the Contractor because of adverse weather conditions; however, an extension of time for abnormal weather will be considered by the Owner as indicated in the General Conditions.

4. PREPARATION AND SUBMISSION OF BIDS:

(a) Bids shall be submitted on the forms furnished, or copies thereof, and shall be signed in ink. Erasures or other changes in a bid must be explained or noted over the signature of the bidder. Bids containing any conditions, omissions, unexplained erasures, alterations or items not called for in the proposal, or irregularities of any kind, may be rejected by the Owner as being incomplete or nonresponsive.

(b) Each bid must give the complete legal name and full business address of the bidder and be signed by the bidder, or the bidder's authorized representative, with his usual signature. Bids by partnerships must be signed in the partnership name by one of the general partners of the partnership or an authorized representative, followed by the designation/title of the person signing. Bids by corporations must be signed with the legal name of the corporation followed by the name of the state in which it is incorporated and by the signature and title of the person authorized to bind it in this matter. The name of each person signing shall be typed or printed below the signature. A signature on a bid by a person who identifies his title as "President," "Secretary," "Agent" or other designation without disclosing the principal firm, shall be held to be the bid of the individual signing. When requested by the Owner, satisfactory evidence of the authority of the officer signing on behalf of the corporation shall be furnished. Trade or fictitious names may be referenced by using "t/a ___" but bids shall be in the legal name of the person or entity submitting the bid.

(c) Bids with the bid guarantee shall be enclosed in a sealed envelope which shall be marked and addressed as indicated by the advertisement. If a contract is for one hundred twenty thousand dollars ($120,000) or more, or if the total value of all construction, removal, repair or improvements undertaken by the bidder within any twelve-month period is seven hundred fifty thousand dollars ($750,000) or more, the bidder is required under Title 54.1, Chapter 11, Section 1100, Code of Virginia, as amended, to be licensed in Virginia as a "Class A Contractor." If a contract is for ten thousand dollars ($10,000) or more, but less than one hundred twenty thousand dollars ($120,000), or if the total value of all construction, removal, repair or improvements undertaken by the bidder within any twelve-month period is one hundred fifty thousand dollars ($150,000) or more, but less than seven hundred fifty thousand dollars ($750,000), the bidder is required to be licensed in Virginia as a "Class B Contractor."

If the bidder is not properly licensed in Virginia at the time the bid is submitted, or if the bidder fails to provide this information on his bid or fails to promptly provide said Contractor license number to the Owner in writing when requested to do so after the opening of bids, he shall be deemed to be in violation of Section 54.1-1115 of the Code of Virginia, as amended, and his bid will not be considered.

(d) The Board for Contractors has interpreted its regulations to mean "a licensed Contractor can bid on a contract which contains work outside his license classification(s) as long as he subcontracts those items for which he is not qualified to licensed contractors with the appropriate License Classification and the work of the second party is incidental to the contract." Therefore, the Owner may, as a part of determining whether the bidder is "responsible," require the apparent low bidder

to submit a listing of his subcontractors along with the license number and classification or specialty of each.

(e) The bidder must also place its Employer Identification Number (SSN or FEIN) in the space provided on the Bid Form.

(f) Every bidder organized as a stock or nonstock corporation, limited liability company, business trust, or limited partnership or registered as a registered limited liability partnership must be authorized to transact business in the Commonwealth as a domestic or foreign business entity if so required by Title 13.1 or Title 50 of the Code of Virginia, as amended, or as otherwise required by law. Any bidder organized or authorized to transact business in the Commonwealth pursuant to Title 13.1 or Title 50 must include in its bid the identification number issued to it by the State Corporation Commission. Any bidder that is not required to be authorized to transact business in the Commonwealth as a foreign business entity under Title 13.1 or Title 50 or as otherwise required by law shall include in its bid or proposal a statement describing why the bidder or offeror is not required to be so authorized. A bidder required to be authorized to transact business in Virginia that fails to provide the required information shall not receive an award unless a waiver of this requirement and of any administrative policies and procedures established to implement Section 2.2-4311.2 of the Code of Virginia, as amended, is granted by the Owner.

If awarded the Contract, the bidder shall not allow its existence to lapse or its certificate of authority or registration to transact business in the Commonwealth, if so required under Title 13.1 or Title 50, to be revoked or cancelled at any time during the term of the Contract. Doing so shall be deemed to be a violation of Section 2.2-4311.2 and the bidder understands and agrees that the Owner may void the Contract if the bidder fails to comply with this provision.

5. BID GUARANTEE:

(a) Any bid (including the Total Base Bid plus all Additive Bid Items) which exceeds one hundred thousand dollars ($100,000) shall be accompanied by a Bid Bond payable to the Owner as obligee in an amount equal to five percent (5%) of the amount of the bid. A Bid Bond may be required for projects having bids of less than one hundred thousand dollars ($100,000) if such requirement is stated in the Notice of Invitation for Bids. The Bid Bond must be issued by a surety company which is legally authorized by the Virginia State Corporation Commission to do fidelity and surety business in the Commonwealth of Virginia. **The bid bond shall identify the name and address of an attorney-in-fact who is appointed to act on behalf of the surety. The attorney-in-fact shall affix to the bond a certified and current copy of the power of attorney.** Such Bid Bond shall guarantee that the bidder will not withdraw his bid during the period of sixty (60) days following the opening of bids; that if his bid is accepted, he will enter into a formal contract with the Owner in accordance with the Contract Between Owner and Contractor included as a part of the IFB Documents; that he will submit a properly executed and authorized Standard Performance Bond and Standard Labor and Material Payment Bond on the forms included in the IFB documents; and that in the event of the withdrawal of said bid within said period, or failure to enter into said contract and give said bonds within ten (10) days after he has received notice of acceptance of his bid, or other forfeiture under the Bid Bond, the bidder shall be liable to the Owner for the difference between the amount specified in said bid and such larger amount for which the Owner may contract with another party to perform the work covered by said bid, up to the amount of the bid guarantee.

This amount represents the damage to the Owner on account of the default of the bidder in any particular hereof. See §2.2-4336 of the Code of Virginia.

(b) See §2.2-4338 of the Code of Virginia for provisions allowing alternative forms of bid security in lieu of a Bid Bond.

(c) The Bid Bonds or other bid security will be returned to all except the three lowest bidders after the formal opening of bids. The remaining Bid Bonds or bid security will be returned to the bidders after the Owner and the accepted bidder have executed the Contract and the Performance Bond and the Payment Bond have been approved by the Owner.

(d) If the required Contract and bonds have not been executed within sixty (60) days after the date of the opening of the bids, then the bond or other bid security of any bidder will be returned upon his request, provided he has not been notified of the acceptance of his bid prior to the date of such request.

6. WITHDRAWAL OR MODIFICATION OF BIDS:

(a) WITHDRAWAL: Bids may be withdrawn by written or telefaxed notice received from bidders prior to the deadline fixed for bid receipt. The bidder has sole responsibility to ensure that such notice is received by the Owner in the appropriate office designated in the Instructions to Bidders, and the Owner shall not be responsible for ensuring accurate or prompt delivery. A withdrawal must be signed by the person signing the sealed bid or by other individual(s) who is authorized to act on behalf of the bidder. Such authorization must be provided in writing at the time of withdrawal, and stated on the face of the withdrawal notice. Withdrawn bids may be resubmitted by the bidder up to the deadline fixed for bid receipt.

(b) MODIFICATION: Bids may be modified only in the following manner. E-mail or telefaxed modifications are not acceptable. All modifications must be signed by the person signing the sealed bid or by an individual(s) who is authorized by him/her on the face of the bid. Written modifications may only be made on the bid form itself. Written modifications must be signed by the person making the modification. The modification must state specifically what is to be modified and by what amount or it must state the item to be modified and what the corrected amount should be. (e.g. "Deduct $25,000 from Part A and from the Total Base Bid Amount"; or "Add $23,456 to the Total Base Bid Amount"; or "Deduct $15,650 from the Additive # 2 amount". A modification to "Deduct $25,000 from Part A" will only be applied to Part A and not to the Total Base Bid Amount). Unless otherwise specified by the Bidder in the modification, the modification will be applied to the TOTAL BASE BID AMOUNT shown on the Bid Form (e.g. a modification stating only "Deduct $25,000" which is properly signed will be deducted from the Total Base Bid Amount shown on the Bid Form).

7. RECEIPT OF BIDS:

(a) Bids will be received at or before the date and the hour and at the place stipulated in the Invitation for Bids as may be modified by subsequent Addenda.

(b) It is the responsibility of the bidder to assure that his bid and any bid modifications are delivered to the place designated for receipt of bids by the date and hour (deadline) set for receipt of bids.

Therefore, it is the bidder's responsibility to take into account all factors which may impact on its bid deliverer/courier's ability to deliver the bid and to implement whatever actions are necessary to have the bid delivered to the proper bid receipt location prior to the bid receipt deadline. No bids or bid modifications submitted or offered after the date and hour designated for receipt of bids will be accepted or considered.

(c) The Purchasing Agent is the Owner's representative designated to receive bids at the time and place noted in the IFB and to open the bids received at the appointed time.

(d) The official time used for the receipt of responses is determined by reference to the clock designated by the Purchasing Agent. The Purchasing Agent shall determine when the Bid Receipt Deadline has arrived and shall announce that the Deadline has arrived and that no further bids or bid modifications will be accepted. All bids and bid modifications in the possession of the Purchasing Agent and his assistants at the time the announcement is completed are deemed to be timely, whether or not the bid envelope has been physically date/time stamped or otherwise marked by the time the Purchasing Agent makes the deadline announcement.

8. OPENING OF BIDS:

(a) Bids will be opened at the time and place stated in the Invitation for Bids or as modified by subsequent Addenda, and their contents publicly announced. The Purchasing Agent shall decide when the specified time for bid opening has arrived. No responsibility will be attached to any officer or agent for the premature opening of a bid not properly addressed and identified.

(b) The provisions of §2.2-4342 of the Code of Virginia shall be applicable to the inspections of bids received.

9. ERRORS IN BIDS: A bidder may withdraw his bid from consideration if the price bid was substantially lower than the other bids due solely to a mistake therein, provided the bid was submitted in good faith, and the mistake was a clerical mistake as opposed to a judgment mistake, and was actually due to an unintentional arithmetic error or an unintentional omission of a quantity of work, labor or material made directly in the compilation of a bid, which unintentional arithmetic error or unintentional omission can be clearly shown by objective evidence drawn from inspection of original work papers, documents and materials used in the preparation of the bid sought to be withdrawn. The bidder shall give notice of a claim to withdraw a bid, in writing, and submit his original work papers, documents and materials used in the preparation of his bid, to the Purchasing Agent within two business days after the conclusion of the opening of bids. §2.2-4330(B)(1) of the Code of Virginia.

Failure of a bidder to give notice and submit his original work papers, documents and materials used in the preparation of his bid on or before the time, date and place required shall constitute a waiver by that bidder of his right to withdraw his bid due to a mistake.

No bid may be withdrawn under this section when the result would be the awarding of the Contract on another bid of the same bidder or of another bidder in which the ownership of the withdrawing bidder is more than five percent (5%).

No bidder who is permitted to withdraw a bid shall, for compensation, supply any material or labor to or perform any subcontract or other work agreement for the person or firm to whom the Contract is awarded

or otherwise benefit, directly or indirectly, from the performance of the project for which the withdrawn bid was submitted. The person or firm to whom the Contract was awarded and the withdrawing bidder are jointly liable to the Owner in an amount equal to any compensation paid to or for the benefit of the withdrawing bidder without such approval.

If a bid is withdrawn under authority of this section, the lowest remaining bid shall be deemed to be the low bidder on the project.

10. REJECTION OF BIDS: The Owner reserves the right to cancel the Invitation for Bids, to reject any and all bids at its sole discretion when such rejection is in the interest of the Owner, or to reject the bid of any bidder who is determined to be not responsive or not responsible. See §2.2-4319, Code of Virginia.

11. DETERMINATION OF RESPONSIBILITY:

Each bidder shall be prepared, if so requested by the Owner, to present evidence of his experience, qualifications and financial ability to carry out the terms of the Contract.

Prior to award of the Contract, an evaluation will be made to determine if the low bidder has the capability, in all respects, to perform fully the contract requirements and the moral and business integrity and reliability which will assure good faith performance, and who has been prequalified, if required. Factors to be evaluated may include, but are not limited to:

(a) sufficient financial ability to perform the contract as evidenced by the bidder's ability to obtain payment and performance bonds from an acceptable surety;
(b) appropriate experience to perform the Work described in the bid documents;
(c) any judgments entered against the bidder, or any officers, directors, partners or owners for breach of a contract for construction;
(d) any substantial noncompliance with the terms and conditions of prior construction contracts with a public body without good cause where the substantial noncompliance is documented; or
(e) a conviction of the bidder or any officer, director, partner, project manager, procurement manager, chief financial officer, or owner in the last five years of a crime relating to governmental or nongovernmental construction or contracting;
(f) any current debarment of the contractor, any officer, director or owner, from bidding or contracting by any public body of any state, any state agency, or any agency of the federal government.

The Owner reserves the right to disqualify or refuse to accept the bid of any bidder who has been convicted, or entered a plea of guilty or nolo contendere, in any federal or state court to any charge involving any unlawful, corrupt or collusive practice involving a public contract whether federal, state, or local, or who has been determined in any judicial proceeding to have violated any antitrust, bid-rigging or collusive practice statute in connection with any public contract, or against whom such formal criminal prosecution or other judicial proceeding has been initiated.

A bidder who, despite being the apparent low bidder, is determined not to be a responsible bidder shall be notified in writing in conformance with the procedures in §2.2-4359 of the Code of Virginia.

12. AWARD OF CONTRACT:

(a) **Basis for Contract Award:** The Contract, if awarded, will be awarded to the lowest responsive and responsible bidder, if any, provided his bid is reasonable and it is in the best interest of the Owner to accept it and subject to the Owner's right to reject any and all bids and to waive informality in the bids and in the bidding. The Bid Form may contain a multi-part Base Bid and may contain Additive Bid Items. Determination of the lowest responsible bidder, if any, will be based on the Total Base Bid amount entered on the Bid Form including any properly submitted bid modifications plus as many Additive Bid Items taken in sequence as the Owner in its discretion chooses to Award. Where the sum of the values entered in the multiple parts do not agree with the Total Base Bid amount, the Total Base Bid amount entered on the Bid Form, including any properly submitted bid modifications, shall take precedence. In the event that the Total Base Bid from the lowest responsible bidder exceeds available funds, the Owner may negotiate the Total Base Bid amount with the apparent low bidder to obtain a contract price within available funds, pursuant to §2.2-4318 of the Code of Virginia and Section 12(c) herein.

(b) **Informalities:** The Owner reserves the right to waive any informality in the bids when such waiver is in the interest of the Owner.

(c) **Negotiation With Lowest Responsible Bidder:** If award of a contract to the lowest responsive and responsible bidder is precluded because of limitations on available funds, under the provisions of §2.2-4318 of the Code of Virginia (the Public Procurement Act), the Owner reserves the right to negotiate the Total Base Bid amount with the lowest responsive, responsible bidder to obtain a contract price within the available funds. This may involve changes in either the features or scope of the work included in the Base Bid. Such negotiations with the apparent low bidder may include reducing the quantity, quality, or other cost saving mechanisms involving items in the Total Base Bid. The Owner shall notify the lowest responsive and responsible bidder that such a situation exists and the Owner and bidder shall then conduct their negotiations in person, by mail, by telephone or by any means they find convenient. If an acceptable contract can be negotiated, the changes to the Invitation for Bid documents agreed upon in the negotiations shall be summarized in a "Post Bid Modification" and included in the contract. If an acceptable contract cannot be negotiated, the Owner shall terminate negotiations and reject all bids.

(d) **Notice of Intent to Award or Notice of Award**: The Notice of Award or the Notice of Intent to Award will be posted on the Albemarle County Purchasing Office web site with the Invitation for Bid procurement documents (www.albemarle.org/purchasing). Any bidder or offeror who desires to protest the award or decision to award a contract shall submit the protest in writing to the Albemarle County Purchasing Agent no later than ten days after the posting of the Notice of Award or Notice of Intent to Award, whichever comes first (§ 2.2-4360).

13. CONTRACT SECURITY: For contracts of more than $100,000, the Standard Performance Bond (Form AC-10) and the Standard Labor and Material Payment Bond (Form AC-10.1) shall be required, as specified in the Invitation for Bids documents. See the General Conditions and §2.2-4337 and §2.2-4338 of the Code of Virginia. The Owner reserves the right to require such bonds for contracts less than $100,000. If the Owner so elects, the requirement shall be set forth in the Invitation for Bids. **The bonds shall identify the name and address of an attorney-in-fact who is appointed to act on behalf of the surety within the Commonwealth of Virginia. The attorney-in-fact shall affix to the bond a certified and current copy of the power of attorney.**

14. **CERTIFICATION:** The bidder, by his signature on the Bid Form, certifies that neither his organization nor any of its officers, directors, partners or owners is currently barred from bidding on contracts by the Commonwealth of Virginia, or any public body or agency of another state, or any agency of the federal government. See the statement "Disqualification of Contractors" in the Bid Form.

15. **ETHICS IN PUBLIC CONTRACTING:** The provisions, requirements and prohibitions as contained in Chapter 43, Article 6, §2.2-4367 et seq, Code of Virginia, pertaining to bidders, offerers, contractors, and subcontractors are applicable to this project.

16. **BUILDING PERMITS:** The Virginia Uniform Statewide Building Code shall apply to the Work and shall be administered by the local Building Official. The Building Permit will be obtained by the Contractor and paid for by the Owner. All other permits, local license fees, business fees, taxes, or similar assessments shall be obtained and paid for by the Contractor. See Section 25 of the General Conditions for utility connection fees and services.

17. **MINORITY UTILIZATION:** The County of Albemarle, Virginia, encourages the participation of minority businesses in public procurement activities. Towards that end, the Owner encourages firms to provide for the participation of minority owned businesses through partnerships, joint ventures, subcontracts, and other contractual opportunities.

18. **BID DOCUMENTS:** Bid Documents are the property of the Owner and are available electronically through the Albemarle County Purchasing Office web site at www.albemarle.org/purchasing. Bidders are responsible to check the Purchasing web site and download any Addenda issued for the bid. A deposit is not required for downloading of electronic documents through the web site. The bidder is responsible for the cost of printing any contract documents necessary for bidding. If awarded a contract, the Owner will provide the contractor with two sets of contract documents (i.e. full sized drawings and specifications) for use in the field and the contractor will be responsible for the cost of printing any additional contract documents that may be needed.

19. **GENERAL CONDITIONS:** The County of Albemarle Construction Contract General Conditions are incorporated in the bid documents. If the General Conditions are incorporated by reference, the bidder may obtain a copy of the current edition of the Construction Contract General Conditions at no cost by request to the County of Albemarle, Facilities & Environmental Services - Project Management Division, 401 McIntire Road, Charlottesville, Virginia 22902 (434-872-4501).

20. **PREBID CONFERENCE:** See the Invitation for Bids for requirements for a prebid conference and whether such conference is mandatory or optional.

21. **INSPECTION OF BID DOCUMENTS:** Copies of the Invitation for Bids documents including Plans and Specifications will, upon request, be made available for inspection at the Albemarle County Facilities & Environmental Services Department - Project Management Division, or the A/E's office.

22. **DRUG-FREE WORKPLACE REQUIRED:** Bidders are reminded that §2.2-4312 of the Code of Virginia requires that during the performance of the contract resulting from this solicitation, the contractor agrees to (i) provide a drug-free workplace for the contractor's employees; (ii) post in conspicuous places, available to employees and applicants for employment, a statement notifying employees that the unlawful manufacture, sale, distribution, dispensation, possession, or use of a controlled substance or marijuana is

prohibited in the contractor's workplace and specifying the actions that will be taken against employees for violations of such prohibition; (iii) state in all solicitations or advertisements for employees placed by or on behalf of the contractor that the contractor maintains a drug-free workplace; and (iv) include the provisions of the foregoing clauses in every subcontract or purchase order of over $10,000, so that the provisions will be binding upon each subcontractor or vendor.

For the purposes of this section, "drug-free workplace" means a site for the performance of work done in connection with a specific contract awarded to a contractor in accordance with this solicitation, the employees of whom are prohibited from engaging in the unlawful manufacture, sale, distribution, dispensation, possession or use of any controlled substance or marijuana during the performance of the contract.

23. CERTIFICATION OF CRIMES AGAINST CHILDREN: Pursuant to Virginia Code §22.1-296.1(C), as a condition of awarding a contract for the provision of services that require the contractor or his employees to have direct contact with students on school property during regular school hours or during school-sponsored activities, the School Board requires the contractor to provide certification that all persons who will provide such services have not been convicted of a felony or any offense involving the sexual molestation or physical or sexual abuse or rape of a child. Any person making a materially false statement regarding any such offense shall be guilty of a Class 1 misdemeanor and, upon conviction, the fact of such conviction shall be grounds for the revocation of the contract to provide such services and, when relevant, the revocation of any license required to provide such services. This requirement does not apply to a contractor or his employees providing services to the School Board in an emergency or exceptional situation, such as when student health or safety is endangered or when repairs are needed on an urgent basis to ensure that school facilities are safe and habitable, when it is reasonably anticipated that the contractor or his employees will have no direct contact with students.

PREBID QUESTION FORM

(Use separate form for each question submitted.)

DATE: _____

PROJECT: New Construction High School Center II
2025-IFB-1007262

The following question concerns Drawing Sheet (number)_____:

_____

_____

_____

_____

_____

_____

The following question concerns Specifications Section (number)_____, page _____, paragraph _____:

_____

_____

_____

_____

_____

_____

All responses to questions will be made by Addendum. Deadline for all Questions shall be October 31, 2024 by 5:00 PM.

Questions submitted by: _____ _____
Name Organization

Email Form To: County of Albemarle Purchasing – Chris Beahm; cbeahm@albemarle.org
Albemarle County Public Schools Project Manager – Kagan Squire; ksquire2@k12albemarle.org
A/E – Quinn Evans – Kylan Shirley; kylan.shirley@quinnevans.com

Or

Mail Form to: County of Albemarle
Purchasing Department
401 McIntire Road
Charlottesville, Virginia 22902-4596

Quinn Evans
1840 West Broad Street, Suite 400
Richmond, Virginia, 23220

BID FORM

DATE: _____

PROJECT TITLE**:** **New Construction High School Center II**
IFB No.: **2025-IFB-1007262**

TO: County of Albemarle, Virginia, and/or
The School Board of Albemarle County, Virginia
Office of Procurement – Room 248
Albemarle County Office Building
401 McIntire Road
Charlottesville**,** VA 22902

In compliance with and subject to your Invitation for Bids and the documents therein specified, all of which are incorporated herein by reference, the undersigned bidder proposes to furnish all labor, equipment, and materials and perform all work necessary for construction of this project, in accordance with the Plans and Specifications dated October 8, 2024, and the Addenda noted below, as prepared by Quinn Evans Architects, Inc.; Richmond, Virginia for the consideration of the following amount:

BASE BID (including the following parts but excluding work in Additive Bid Items):

PART A.

Lump sum price for construction of the building and sitework complete and in accordance with the Plans and Specifications:

PART A = _____ Dollars ($_____)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.)

Base Bids for PARTS B, C, D, E, F, G, H, I, J, K, L, M, N, O, and P shall be based on the estimated quantities indicated in the Bid Form and to be provided complete and in accordance with the applicable portions of the plans and specifications. Payment amounts for each of these items will be based on the actual quantities authorized, provided and approved times the unit prices indicated by the bidder. The final contract amount shall be adjusted upward or downward based on the actual payment amounts versus the bid amounts for PARTS B, C, D, E, F, G, H, I, J, K, L, M, N, O, and P.

PART B. EXCAVATION OF UNSUITABLE MATERIAL

Excavation of unsuitable material, where authorized or directed, below or in addition to the levels required for the Work in Part A, proper disposal off-site of excess material and backfill with structural fill material compacted per specifications. (Price per cubic yard.) Final amount shall be adjusted upward or downward based on actual quantity authorized.

Estimated quantity of (500) cy @ $_____ per cy = _____

PART B = _____ Dollars ($_____)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.)

PART C. EXCAVATION IN TRENCHES

Excavation of material, where authorized or directed, in trenches, where authorized or directed, proper disposal off-site of excess material and backfill with structural fill material complete per specifications. (Price per cubic yard.) Final amount shall be adjusted upward or downward based on actual quantity authorized.

Estimated quantity of (100) cy @ $_____ per cy = _____

PART C = _____ Dollars ($_____)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.)

PART D. EXCAVATION OF ROCK

Excavation of ROCK material, where authorized or directed, proper disposal off-site of excess material and **backfill with compacted trench fill material** complete per specifications. (Price per cubic yard.) Final amount shall be adjusted upward or downward based on actual quantity authorized.

Estimated quantity of (100) cy @ $_____ per cy = _____

PART D = _____ Dollars ($_____)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.)

PART E. TRENCH ROCK EXCAVATION

Excavation of TRENCH ROCK material, where authorized or directed, proper disposal off-site of excess material and backfill with structural fill material complete per specifications. (Price per cubic yard.) Final amount shall be adjusted upward or downward based on actual quantity authorized.

Estimated quantity of (250) cy @ $_____ per cy = _____

PART E = _____ Dollars ($_____)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.)

PART F. SUBSURFACE DRAINS

Subsurface drain equivalent to VDOT Std. UD-4 standard pavement edge drain. (Price per linear foot.) Final amount shall be adjusted upward or downward based on actual quantity authorized.

Estimated quantity of (150) lf @ $_____ per lf = _____

PART F = _____ Dollars ($_____)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.)

PART G. VDOT #1 STONE

VDOT #1 stone in-place, in addition to the levels required for the work. (Price per cubic yard.) Final amount shall be adjusted upward or downward based on actual quantity authorized.

Estimated quantity of (10) cy @ $_____ per cy = _____

PART G = _____ Dollars ($_____)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.)

PART H. VDOT #57 AGGREGATE

VDOT #57 stone in-place, in addition to the levels required for the work. (Price per cubic yard.) Final amount shall be adjusted upward or downward based on actual quantity authorized.

Estimated quantity of (10) cy @ $_____ per cy = _____

PART H = _____ Dollars ($_____)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.)

PART I. GEOTEXTILE FABRIC

Woven geotextile fabric in-place, in addition to the levels required for the work. (Price per square yard.) Final amount shall be adjusted upward or downward based on actual quantity authorized.

Estimated quantity of (200) sy @ $_____ per sy = _____

PART I = _____ Dollars ($_____)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.)

PART J. SMOKE DETECTORS

Additional Smoke Detectors installed at the direction of Owner, Architect or Code Official. (Price per each installed and hooked up to the fire alarm system.) Final amount shall be adjusted upward or downward based on actual quantity authorized.

Estimated quantity of (1) @ $_____ per each = _____

PART J = _____ Dollars ($_____)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.)

PART K. EXIT SIGNS

Additional Exit Signs installed at the direction of Owner, Architect or Code Official. (Price per each sign, installed, and wired.) Final amount shall be adjusted upward or downward based on actual quantity authorized.

Estimated quantity of (1) @ $_____ per each = _____

PART K = _____ Dollars ($_____)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.)

PART L. GEOTHERMAL WELLS

Installation of one geothermal well, inclusive of 40' of casing, in addition to the quantity indicated on the Drawings (Price per each.) Final amount shall be adjusted upward or downward based on actual quantity authorized.

Estimated quantity of (1) @ $_____ per each = _____

PART L = _____ Dollars ($_____)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.)

PART M. GEOTHERMAL WELL CASING

Installation of well casing in addition to amounts indicated on Drawings. (Price per linear foot.) Final amount shall be adjusted upward or downward based on actual quantity authorized.

Estimated quantity of (20) lf @ $_____ per lf = _____

PART M = _____ Dollars ($_____)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.)

PART N. ACM WATERLINE REPLACEMENT

Replacement of existing ACM Waterline as indicated on Civil Drawings. Provide unit price for linear feet of replacement length that is indicated on the Drawings, inclusive of pipe materials, installation labor and excavation and backfill. (Price per linear foot.) Unit price will be used for establishing adjustments to Contract Sum if additional length of water line, beyond that established on Drawings is required.

Quantity as indicated on Drawings $_____ per lf = _____

PART N = _____ Dollars ($_____)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.)

PART O. BUILDING AUTOMATION SYSTEM

The undersigned agrees that it will use as the subcontractor for Work under Section 25 4003, "Building Automation System" and for related Work shown on the drawings, **Siemens**, a subcontractor selected by the Owner, for a subcontract price as noted below, and that this quote has been included in the TOTAL BASE BID AMOUNT. The undersigned agrees that it will be responsible for this subcontractor and its work just as if it had been selected by the undersigned.

PART O = **Six Hundred Thirty Two Thousand One** Hundred Twelve Dollars **($632,112.00)**
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.)

PART P. BUILDING INTRUSION DETECTION SYSTEM

The undersigned agrees that it will use as the subcontractor for Work provided under Section 283111 – Building Intrusion Detection and for related Work shown on the drawings, **Hudson and Payne**, a subcontractor selected by the Owner, for a subcontract price as noted below, and that this quote has been included in the TOTAL BASE BID AMOUNT. The

undersigned agrees that it will be responsible for this subcontractor and its work just as if it had been selected by the undersigned.

PART P = **Twenty-One Thousand Nine-Hundred and 00/100** Dollars ($ 21,900.00)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.)

TOTAL BASE BID AMOUNT (For PARTS A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, & P) IS:

_____**Dollars** ($_____)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.)

ADDITIVE BID ITEMS

ADDITIVE BID ITEM 1 – SECOND ELEVATOR: Lump sum price for one elevator installed installed in the hoistway, complete and in accordance with the drawings and specifications is _____Dollars ($_____)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.)

ADDITIVE BID ITEM 2 – PHOTOVOLTAIC SYSTEM: Lump sum price for all work to design, engineer and install a roof-top photovoltaic power system complete and in accordance with the Drawings and Specifications is _____
Dollars ($_____)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.)

Contract award will be based on the **TOTAL BASE BID AMOUNT shown above** (including any properly submitted bid modifications) plus as many Additive Bid Items in sequence as the Owner in its discretion decides to award.

The undersigned understands that time is of the essence and agrees that the dates for Substantial Completion of the High School Center II Building, inclusive of all building systems shall be on or before May 31, 2026.

The undersigned also understands and agrees that specific individual Sequences of the Work, as defined on Sheet G003, shall be Substantially Complete accordingly. Substantial Completion Dates for individual Sequences are illustrated on **Sheet G003 – Construction Sequencing Plan**. Primary Sequences, as described below and in the Supplementary General Conditions are subject to Liquidated Damages in accordance with the Supplementary General Conditions:

Primary Sequence	Substantial Completion Date	Liquidated Damages
Sequence A	May 31, 2026	$5,000.00
Sequence B	August 7, 2026	$5,000.00
Sequence C	October 1, 2025	$1,000.00
Sequence D	August 7, 2026	$1,000.00

Refer to Sheet G003 for comprehensive Construction Sequencing Plan illustrating all sequences of Work and relevant dates for each.

The dates above are based on a Notice authorizing Work to proceed on or about January 14, 2025. Final Completion shall be achieved within 30 calendar days from the specified Substantial Completion Date. Completion of the Contract, including all maintenance agreements, shall be achieved within one (1) year after the date of Substantial Completion as determined by the A/E.

UNIT PRICES WITHOUT CORRESPONDING QUANTITY ALLOWANCES

UNIT 1. FIRE LANE STRIPING

UNIT 1 = _____Dollars ($_____per 20 linear feet)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.)

UNIT 2. FIRE LANE SIGNAGE

UNIT 2 = _____Dollars ($_____per sign)
(Amount shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.)

*** * * * * * * * * * * * ***

Acknowledgment is made of receipt of the following Addenda:

_____
_____
_____
_____

If notice of acceptance of this bid is given to the undersigned within 60 days after the date of opening of bids, or any time thereafter before this bid is withdrawn, the undersigned will execute and deliver a contract in the prescribed form (County of Albemarle Contract Between Owner and Contractor, Form AC-9) within 10 days after the contract has been presented to him for signature. The required payment and performance bonds, on the forms prescribed, shall be delivered to the owner along with the signed Contract.

Immigration Reform and Control Act of 1986: The undersigned certifies that it does not and will not during the performance of the Contract for this project violate the provisions of the Federal Immigration Reform and Control Act of 1986, which prohibits employment of illegal aliens.

DISQUALIFICATION OF CONTRACTORS: By signing this bid or proposal, the undersigned certifies that this Bidder or any officer, director, partner or owner is not currently barred from bidding on contracts by any Agency of the Commonwealth of Virginia, or any public body or agency of another state, or any agency of the federal government, nor is this Bidder a subsidiary or affiliate of any firm/corporation that is currently barred from bidding on contracts by any of the same. We have attached an explanation of any previous disbarment(s) and copies of notice(s) of reinstatement(s).

CERTIFICATION OF NO COLLUSION: The undersigned does hereby certify in connection with the procurement and bid to which this Certification of No Collusion is incorporated that:

> This bid is not the result of, or affected by, any act of collusion with another person engaged in the same line of business or commerce; nor is this bid the result of, or affected by, any act of fraud punishable under Article 1.1 of Chapter 12 of Title 18.2 of the Code of Virginia, 1950, as amended (18.2-498.1 et seq.).

The undersigned declares that they are fully authorized to sign the proposal on behalf of the firm listed and to all conditions and provisions thereof. The firm name given below is the true and complete name of the bidder and the bidder is legally qualified and licensed by the Commonwealth of Virginia, Department of Commerce, State Board for Contractors, to perform all Work included in the scope of the Contract.

Virginia License No._____

Contractor Class _____

Valid Until _____

FEIN/SSN:_____

If Partnership (List Partner's Names)
_____
_____

Bidder _____
(Name of Firm)

By _____
(Signature)

_____
(Typed Name)

Title _____

If Corporation, affix Corporate Seal & list State of Incorporation
State: _____
(Affix Seal)

Business Address:
_____
_____
_____
_____
Telephone No.: _____
Fax No.: _____
Email: _____

STATE CORPORATION COMMISSION & REGISTERED AGENT FORM

Virginia State Corporation Commission (SCC) registration information.

Code of Virginia § 13.1-757. A foreign corporation may not transact business in the Commonwealth until it obtains a certificate of authority from the Commission.

The bidder:

☐	is a corporation or other business entity with the following Virginia SCC identification number: _____ **-OR-**
☐	is not a corporation, limited liability company, limited partnership, registered limited liability partnership, or business trust **-OR-**
☐	is not required to obtain a certificate of authority from the Virginia SCC, pursuant to *Virginia Code* § 13.1-757(B) because its sole contact(s) with the Commonwealth consist(s) of: 1. ☐ Maintaining, defending, or settling any proceeding; 2. ☐ Holding meetings of the board of directors or shareholders or carrying on other activities concerning internal corporate affairs; 3. ☐ Maintaining bank accounts; 4. ☐ Maintaining offices or agencies for the transfer, exchange, and registration of the corporation's own securities or maintaining trustees or depositories with respect to those securities; 5. ☐ Selling through independent contractors; 6. ☐ Soliciting or obtaining orders, whether by mail or through employees or agents or otherwise, if the orders require acceptance outside this Commonwealth before they become contracts; 7. ☐ Creating or acquiring indebtedness, deeds of trust, and security interests in real or personal property; 8. ☐ Securing or collecting debts or enforcing deeds of trust and security interests in property securing the debts; 9. ☐ Owning, without more, real or personal property; 10. ☐ Conducting an isolated transaction that is completed within 30 days and that is not one in the course of repeated transactions of a like nature; 11. ☐ For a period of less than 90 consecutive days, producing, directing, filming, crewing or acting in motion picture feature films, television series or commercials, or promotional films which are sent outside of the Commonwealth for processing, editing, marketing and distribution. The term "transacting business" as used in this subsection shall have no effect on personal jurisdiction under § 8.01-328.1; or 12. ☐ Serving, without more, as a general partner of, or as a partner in a partnership which is a general partner of, a domestic or foreign limited partnership that does not otherwise transact business in the Commonwealth. 13. ☐Transacting business in interstate commerce.
☐	is an out-of-state business entity that is including with this bid **an opinion of legal counsel** which accurately and completely discloses the undersigned bidder's current contacts with Virginia and describes why those contacts do not constitute the transaction of business in Virginia within the meaning of § 13.1-757 or other similar provisions in Titles 13.1 or 50 of the Code of Virginia. **Attach opinion of legal counsel to this form.**

Registered Agent Information

Please specify the Registered Agent who will accept service of process on your behalf.

Agent Name: _____

Physical Address (no Post Office Boxes):

_____

_____

I certify the accuracy of this information.

Signed:_____Title:_____Date:_____

OFFEROR DATA SHEET

Note: The following information is required as part of your response to this solicitation. Failure to complete and provide this sheet may result in finding your bid nonresponsive.

1. Qualification: The vendor must have the capability and capacity in all respects to satisfy fully all of the contractual requirements.

2. Vendor's Primary Contact:

   Name: _____ Phone: _____

3. Years in Business: Indicate the length of time you have been in business providing this type of good or service:

   _____ Years _____ Months

4. Vendor Information:

   FIN or FEI Number: _____ If Company, Corporation, or Partnership

5. Indicate below a listing of at least four (4) recent projects, either educational or governmental, that your company has successfully completed with similar scope, cost and complexity, include the date of services and the name, address, and email address, and telephone number of the point of contact.

A.	Company:		Contact:	
	Phone:		Email:	
	Dates of Service:		$ Value:	

B.	Company:		Contact:	
	Phone:		Email:	
	Dates of Service:		$ Value:	

C.	Company:		Contact:	
	Phone:		Email:	
	Dates of Service:		$ Value:	

D.	Company:		Contact:	
	Phone:		Email:	
	Dates of Service:		$ Value:	

I certify the accuracy of this information.

Signed: _____ Title: _____ Date: _____

CERTIFICATION OF CRIMES AGAINST CHILDREN AND ACTS OF MORAL TURPITUDE

Contractor acknowledges that the implementation of this contract requires Contractor, Contractor's employees and/or subcontractors to have direct contact with Albemarle County Public Schools' students. Therefore, Contractor hereby certifies that neither Contractor nor, to the best of Contractor's knowledge, its employees and/or subcontractors have been convicted of a felony or any offense involving the sexual molestation or physical or sexual abuse or rape of a child.

Contractor further certifies and shall indicate below whether Contractor and, to the best of Contractor's knowledge, its employees and/or its subcontractors, who will have direct contact with Albemarle County Public School students, have been convicted of a crime of moral turpitude. Crimes of "moral turpitude" are those crimes involving lying, cheating or stealing.

For the purposes of this certification, "direct contact with students" means being in the presence of students during regular school hours or during school sponsored activities.

Contractor understands that, pursuant to Code of Virginia §22.1-296.1(C), making a materially false statement regarding offenses which are required to be included in the certification referenced above is a Class 1 misdemeanor and, upon conviction, the fact of such conviction shall be grounds for the revocation of the contract to provide such services and, when relevant, the revocation of any license required to provide such services. Albemarle County Public Schools shall not be liable for materially false statements regarding the certifications required under this Contract.

Have you or, to the best of your knowledge, any of your employees and/or subcontractors who will have direct contact with students been convicted of a crime of moral turpitude?

□ NO
□YES (please explain)

_____

_____

_____

_____ _____

Contractor **Date**

By: _____

Title: _____

Bid Receipt and Bid Reading Procedures
October 8, 2024
2025-IFB-1007262
New Construction High School Center II

The following Albemarle County Purchasing Procedures shall be in effect:

1. Paper bids shall be prepared as usual and shall be delivered to the County Office Building at 401 McIntire Road, Charlottesville, VA 22902. Bids will be received in a secure manner and will be stored in such manner as to keep them in a secure status.

2. A secure lock box will be available, at the exterior of the County Office Building, at the front Visitors Entrance, and will be labeled **Vendor/Contractor Bids or Proposals Only.** Bids shall be placed in this box, prior to the established due date and time for each solicitation. It is the Offeror's responsibility to ensure that bids are received prior to the established bid due date and time.

3. Bids will be received in the lockbox until **2:00 pm ET on Thursday, November 7, 2024**. Any further bids received will be ruled as late bids and will be retained un-opened. Late bids will not be considered. If you have any difficulty utilizing the lockbox please call the Purchasing Office, at 434- 296-5854.

4. Bid readings will be held at 2:30 pm on **Thursday, November 7, 2024**. At the appointed time as noted below, the bids will be virtually opened and read aloud by Purchasing personnel. Public attendance at the Bid Reading will be by virtual attendance through MS Teams Meeting.

5. The bids shall be examined for conformance of all requirements of the solicitation including a signature, acknowledgement of addenda, and presence of a bid bond, when required. At the conclusion of the reading of the bids, Purchasing staff will complete the due diligence to examine bids for determination of complete responsiveness and vendor responsibility and additional information, including the bid tabulation, will be provided as it becomes available.

6. On **Thursday, November 7, 2024 at 2:30 pm** ET, the Virtual Bid Reading may be attended through the following MS Teams Meeting link:

Microsoft Teams Need help?
Join the meeting now
Meeting ID: 289 067 940 378
Passcode: jscBJJ

COUNTY OF ALBEMARLE

CONSTRUCTION CONTRACT GENERAL CONDITIONS

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1. DEFINITIONS

Whenever used in these Construction Contract General Conditions ("General Conditions") or in the Contract Documents, the following terms have the meanings indicated, which are applicable to both the singular and plural and the male and female gender thereof:

Architect, Engineer, Architect/Engineer or A/E: The term used to designate the Architect and/or the Engineer that contracts with the Owner to provide the Architectural and Engineering services for the Project. The A/E is a separate contractor and not an agent of the Owner. The term includes any associates or consultants employed by the A/E to assist in providing the A/E services.

Beneficial Occupancy: The condition after Substantial Completion but prior to Final Completion of the Project at which time the Project, or portion thereof, is sufficiently complete and systems operational such that the Owner could, after obtaining necessary approvals and certificates, occupy and utilize the space for its intended use. Guarantees and warranties applicable to that portion of the Work begin on the date the Owner accepts the Project, or a portion thereof, for such Beneficial Occupancy, unless otherwise specified in the Supplemental General Conditions or by separate agreement.

Building Permit: See "Permit" below.

Change Order: A document (Form AC-11) issued on or after the effective date of the Contract Between Owner and Contractor (Form AC-9) which is agreed to by the Contractor and approved by the Owner, and which authorizes an addition, deletion or revision in the Work, including any adjustment in the Contract Price and/or the Contract Completion Date. A Change Order once signed by all parties, with the exception of a Unilateral Change Order that is only signed by the Owner, is incorporated into and becomes a part of the Contract.

Claim: A demand or assertion by one of the parties seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. The term "claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. Claims must be made by written notice. The responsibility to substantiate claims shall rest with the party making the claim.

Code of Virginia: 1950 Code of Virginia as amended. Sections of the Code referred to herein are noted by §xx-xx.

Construction: The term used to include new construction, reconstruction, renovation, restoration, major repair, demolition and all similar work upon buildings and ancillary facilities, including any draining, dredging, excavation, grading or similar work upon real property.

Contract: The Contract Between Owner and Contractor, Form AC-9, hereinafter referred to as the Contract.

Contract Completion Date: The date by which the Work must be substantially complete. The Contract Completion Date is customarily established in the Notice To Proceed, based on the Time for Completion. In some instances, however, the Contract contains a mandatory Contract Completion Date, which shall be stated in the Invitation for Bid or Request for Proposal, as applicable.

Contract Documents: The Contract Between Owner and Contractor (Form AC-9) signed by the Owner and the Contractor and any documents expressly incorporated therein. Such incorporated documents customarily include the bid submitted by the Contractor, these General Conditions, any Supplemental General Conditions, any Special Conditions, the plans and the specifications, and all modifications, including addenda and subsequent Change Orders.

Contract Price: The total compensation payable to the Contractor for performing the Work, subject to modification by Change Order.

Contractor: The person with whom the Owner has entered into a contractual agreement to do the Work.

Date of Commencement: The date as indicated in the written Notice to Proceed or a date mutually agreed to between the Owner and Contractor in writing.

Day(s): Calendar day(s) unless otherwise noted.

Defective: An adjective which, when modifying the word Work, refers to Work that is unsatisfactory, faulty, deficient, does not conform to the Contract Documents or does not meet the requirements of inspections, standards, tests or approvals required by the Contract Documents, or Work that has been damaged prior to the A/E's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion or Beneficial Occupancy).

Drawing: A page or sheet of the Plans which presents a graphic representation, usually drawn to scale, showing the technical information, design, location, and dimensions of various elements of the Work. The graphic representations include, but are not limited to, plan views, elevations, transverse and longitudinal sections, large and small scale sections and details, isometrics, diagrams, schedules, tables and/or pictures.

Emergency: Any unforeseen situation, combination of circumstances, or a resulting state that poses imminent danger to health, life or property.

Field Order: A written order issued by the A/E or Owner which clarifies or explains the plans or specifications, or any portion or detail thereof, without changing the design, the Contract Price, the Time for Completion or the Contract Completion Date.

Final Completion Date: The date of the Owner's acceptance of the Work from the Contractor upon confirmation from the Architect/Engineer and the Contractor that the Work is totally complete in accordance with Section 43(b).

Final Payment: The final payment that the Contractor receives pursuant to the applicable provisions of Section 36, except in the event no final payment is made due to termination of the Contract under either Sections 40 or 41. In the event of a termination for cause under Section 40, the Final Payment shall be when the termination became effective. In the event of a termination for convenience under Section 41, the Final Payment shall be either the payment of compensation for termination that the Contractor receives according to the provisions of Subsection 41, or the Owner's determination that no compensation for termination is due the Contractor under Subsection 41, as the case may be.

Float: The excess time included in a construction schedule to accommodate such items as inclement weather and associated delays, equipment failures, and other such unscheduled events. It is the

contingency time associated with a path or chain of activities and represents the amount of time by which the early finish date of an activity may be delayed without impacting the critical path and delaying the overall completion of the Project. Any difference in time between the Contractor's approved early completion date and the Contract Completion Date shall be considered a part of the Project float.

Float, Free: The time (in days) by which an activity may be delayed or lengthened without impacting upon the start day of any activity following in the chain.

Float, Total: The difference (in days) between the maximum time available within which to perform an activity and the duration of an activity. It represents the time by which an activity may be delayed or lengthened without impacting the Time for Completion or the Contract Completion Date.

Notice: All written notices, including demands, instructions, claims, approvals and disapprovals, required or authorized under the Contract Documents. Any written notice by either party to the Contract shall be sufficiently given by any one or combination of the following, whichever shall first occur: (1) delivered by hand to the last known business address of the person to whom the notice is due; (2) delivered by hand to the person's authorized agent, representative or officer wherever they may be found; or (3) enclosed in a postage prepaid envelope addressed to such last known business address and delivered to a United States Postal Service official or mailbox. Notice is effective upon such delivery. All notices to the Owner should be directed to the Project Manager.

Notices transmitted by Facsimile (Fax) or Email are acceptable for the Project. If faxed, Notices shall be transmitted to the Fax number listed in the Contract and shall have a designated space for the Fax Notice recipient to acknowledge his receipt by authorized signature and date. The Fax Notice with authorized signature acknowledging receipt shall be Faxed back to the sender. If emailed, Notices shall be transmitted to the email address listed in the Contract. The Email Notice recipient shall acknowledge receipt by emailing back to the sender and responding to the Emailed Notice. Notice shall be effective upon the date of acknowledgment of the Faxed or Emailed Notice or the date of delivery, whichever occurs first.

Notice to Proceed: A written notice given by the Owner to the Contractor (with a copy to A/E) fixing the date on which the Contract time will commence for the Contractor to begin the prosecution of the Work in accordance with the requirements of the Contract Documents. The Notice to Proceed will customarily identify a Contract Completion Date.

Owner: County of Albemarle, Virginia and/or The County School Board of Albemarle County, Virginia.

Permit: The term "permit" as used herein shall mean any and all permits required to comply with local, state, and federal codes or laws (including but not limited to building permit, erosion and sediment control permit, and any other permit required by state, federal, and local jurisdictions).

Person: This term includes any individual, corporation, partnership, association, company, business, trust, joint venture, or other legal entity.

Plans: The term used to describe the group or set of project-specific drawings and/or Architect/Engineer sketches which are included in the Contract Documents.

Project: The term used instead of the specific or proper assigned title of the entire undertaking which includes, but is not limited to, the "Work" described by the Contract Documents.

Project Inspector: One or more persons and/or firms employed by the Owner to inspect the Work for the Owner and/or to document and maintain records of activities at the Site to the extent required by the Owner. The scope of the Project Inspector's authority with respect to the Contractor is limited to that indicated in Section 16(e) and (f).

Project Manager: The Project Manager as used herein shall be the Owner's designated representative on the Project. The Project Manager shall be the person through whom the Owner generally conveys written decisions and notices. All notices due the Owner and all information required to be conveyed to the Owner shall be conveyed to the Project Manager. The Owner may change the Project Manager from time to time and may, in the event that the Project Manager is absent, disabled or otherwise temporarily unable to fulfill his duties, appoint an interim Project Manager.

Provide: Shall mean furnish and install ready for its intended use.

Schedule of Values: The schedule prepared by the Contractor and acceptable to the Owner which indicates the value of that portion of the Contract Price to be paid for each trade or major component of the Work.

Site: Shall mean the location at which the Work is performed or is to be performed.

Special Conditions: Provisions of a contract that are specific to the project under consideration and do not fall under General Conditions or Supplemental General Conditions.

Specifications: That part of the Contract Documents containing the written administrative requirements and the technical descriptions of materials, equipment, construction systems, standards, and workmanship which describe the proposed Work in sufficient detail and provide sufficient information for the Code Official to determine code compliance and for the Contractor to perform the Work. (The General Conditions, any Supplemental General Conditions, Special Conditions, various bidding information and instructions, and blank copies of various forms to be used during the execution of the Work are usually bound with the Specifications.)

Subcontractor: A person having a direct contract with Contractor or with any other Subcontractor for the performance of the Work. Subcontractor includes any person who provides on-site labor but does not include any person who only furnishes or supplies materials for the Project.

Submittals: All shop, fabrication, setting and installation drawings, diagrams, illustrations, schedules, samples, and other data required by the Contract Documents which are specifically prepared by or for the Contractor to illustrate some portion of the Work and all illustrations, brochures, standard schedules, performance charts, instructions, diagrams and other information prepared by a Supplier and submitted by the Contractor to illustrate material or equipment conformance of some portion of the Work with the requirements of the Contract Documents.

Substantial Completion: The condition when the Owner agrees that the Work, or a specific portion thereof, is sufficiently complete, in accordance with the Contract Documents, so that it can be utilized by the Owner for the purposes for which it was intended. The Owner at its sole discretion may, after

obtaining the necessary approvals and certificates, take Beneficial Occupancy at this time or choose to wait to occupy until after Final Completion is achieved.

Supplemental General Conditions: That part of the Contract Documents which amends or supplements the General Conditions.

Supplier: A manufacturer, fabricator, distributor, materialman or vendor who provides material for the Project but does not provide on-site labor.

Time for Completion: The number of consecutive calendar days following the issuance of the Notice to Proceed which the Contractor has to substantially complete all Work required by the Contract. When the Notice to Proceed is issued, it states a Contract Completion Date, which has been set by the Owner based on the Time for Completion.

Underground Facilities: All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels or other such facilities or attachments, and any encasements containing such facilities which are or have been installed underground to furnish any of the following services or materials: electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, sewage and drainage removal, traffic or other control systems or water.

Unilateral Change Order: A Change Order from the Owner directing the Contractor to proceed with work within the scope of the contract which may be undefined or for which there is no agreement on the cost or time associated with the work.

Work: The services performed under this Contract including, but not limited to, furnishing labor, and furnishing and incorporating materials and equipment into the construction. The Work also includes the entire completed construction, or the various separately identifiable parts thereof, required to be provided under the Contract Documents or which may reasonably be expected to be provided as part of a complete, code compliant and functioning system for those systems depicted in the plans and specifications.

2. CONTRACT DOCUMENTS

(a) The Contract Between Owner and Contractor (AC-9), the Standard Performance Bond (AC-10), the Standard Labor and Material Payment Bond (AC-10.1), the Schedule of Values and Certificate for Payment (AC-12), the Affidavit of Payments of Claims (AC-13), the Contractor's Certificate of Substantial Completion (AC-13.2a), and the Contractor's Certificate of Completion (AC-13.2) issued by the County of Albemarle are forms incorporated in these General Conditions by reference and are made a part hereof to the same extent as though fully set forth herein. They must be used by the Contractor for their respective purposes.

(b) All time limits stated in the Contract Documents, including but not limited to the Time for Completion of the Work, are of the essence of the Contract.

(c) The Contract Between Owner and Contractor shall be signed by the Owner and the Contractor in as many original counterparts as may be mutually agreed upon, each of which shall be considered an original.

(d) Anything called for by one of the Contract Documents and not called for by the others shall be of like effect as if required or called for by all, except that a provision clearly designed to negate or alter a provision contained in one or more of the other Contract Documents shall have the intended effect. In the event of conflicts among the Contract Documents, the Contract Documents shall take precedence in the following order: the Contract Between Owner and Contractor; the Special Conditions; the Supplemental General Conditions; the General Conditions; the specifications with attachments; and the plans.

(e) If any provision of this Contract shall be held invalid by any court of competent jurisdiction, such holding shall not invalidate any other provision.

(f) All correspondence, invoices, memoranda, submittals and other documents related to this Project whether generated by the Owner, the A/E, the Contractor or others should be identified at the beginning of the document with the Project Title shown in the Contract. Additional identification such as a job number, purchase order number or such may also be shown at the Owner's option.

3. LAWS, REGULATIONS AND PERMITS

(a) The Contractor shall comply with all laws, ordinances, rules, regulations and lawful orders of any public authority bearing on the performance of the Work and shall give all notices required thereby. The Contractor shall assure that all Subcontractors and tradesmen who perform Work on the project are properly licensed by the Department of Professional and Occupational Regulation as required by Title 54.1, Chapter 11, Articles 1 and 3, Code of Virginia, and by applicable regulations.

(b) This Contract and all other contracts and subcontracts are subject to the provisions of Articles 3 and 5, Chapter 4, Title 40.1, Code of Virginia, relating to labor unions and the "right to work." The Contractor and its Subcontractors, whether residents or nonresidents of the Commonwealth, who perform any Work related to the Project shall comply with all of the said provisions.

(c) IMMIGRATION REFORM AND CONTROL ACT OF 1986: By signing this Contract, the Contractor certifies that it does not and will not during the performance of this Contract violate the provisions of the Federal Immigration Reform and Control Act of 1986, which prohibits employment of illegal aliens.

(d) The provisions of all rules and regulations governing safety as adopted by the Safety Codes Commission of the Commonwealth of Virginia and as issued by the Department of Labor and Industry under Title 40.1 of the Code of Virginia shall apply to all Work under this Contract. Inspectors from the Department of Labor and Industry shall be granted access to the Work for inspection without first obtaining a search or administrative warrant.

(e) Building Permit: The Virginia Uniform Statewide Building Code applies to the Work and is administered by the local Building Official. The Building Permit will be obtained by the Contractor and paid for by the Owner. All other permits, local license fees, business fees, taxes, or similar assessments shall be obtained and paid for by the Contractor. See Section 25 for utility connection fees and services.

(f) The Contractor shall include in each of its subcontracts a provision requiring each Subcontractor to include or otherwise be subject to the same payment and interest requirements in Subsections (a), (b), and (c) of Section 37 of these General Conditions with respect to each lower-tier Subcontractor and Supplier.

(g) The Contractor, if not licensed as an asbestos abatement contractor in accordance with §54.1-514, Code of Virginia, shall have all asbestos-related Work performed by subcontractors who are duly licensed as asbestos contractors for the Work required.

(h) Lead-Based Paint Activities: If the Contract Documents indicate that lead-based paint is present on existing materials, components, or surfaces, the Contractor shall conform to the following:

(1) The requirements set forth in 59 Federal Register 45,872 (September 2, 1994) Proposed Rule - Lead; Requirements for Lead-based Paint Activities (Proposed Rules) in selecting and performing the means, methods and procedures for performing the Work. This includes, but is not limited to, training of personnel, lead abatement, encapsulation of lead containing materials, removal and handling of lead containing materials, and methods of disposal. When the Final Rule, to be codified at 40 CFR 745, supersedes the Proposed Rule, the Contractor shall be responsible for conforming to the Final Rule, as of the effective date set forth therein.

(2) The requirements for employee protection contained in 29 CFR Part 1926, Subpart D, and the requirements for record-keeping contained in 29 CFR Part 1910.

(3) The Virginia Department of Labor and Industry's (DLI) Emergency Regulation published in the May 27, 1996 Virginia Register, requiring, among other things, that a permit be issued to the lead abatement contractor, or any subsequent regulation issued by DLI.

(i) If the Contractor violates laws or regulations that govern the Project, the Contractor shall take prompt action to correct or abate such violation and shall indemnify and hold the Owner harmless against any fines and/or penalties that result from such violation. To the extent that such violation is the result of negligence or other actionable conduct of the Contractor, the Contractor shall indemnify and hold the Owner harmless against any third party claims, suits, awards, actions, causes of action or judgments, including but not limited to attorney's fees and costs incurred thereunder, that result from such violation.

(j) Land Disturbance Activities: If the Work includes any land disturbing activities, the Contractor shall be responsible for obtaining an Albemarle County Land Disturbance Permit. The Contractor shall have an individual certified by the Department of Conservation and Recreation (DCR) as a Responsible Land Disturber (RLD) on the project site at all times during the construction project where land is being disturbed in accordance with §10.1-563, Code of Virginia.

All construction activities involving land disturbances equal to or exceeding ten thousand (10,000) square feet must be covered by a Virginia Stormwater Management Program (VSMP) permit approved and issued by the County in accordance with the County of Albemarle's Water Protection Ordinance. The Owner is responsible for securing permit coverage for all applicable land disturbing activities performed, including within any easements that directly relate to the construction site activity. The Contractor shall sign a certification statement to comply with all conditions of the

permit, shall accept assignment as the responsible party prior to issuance of the Land Disturbance Permit, and shall sign all Responsible Land Disturber (RLD) forms.

The Contractor shall be responsible for securing permit coverage for support facilities that are not located within the project limits of disturbance. The Contractor shall be responsible for all costs to obtain permit coverage for all support facilities (both on-site and off-site) not included in the construction plans or contract documents for the project. The Owner will not be responsible for any inconvenience, delay, or loss experienced by the Contractor as a result of his failure to gain access to any support facility areas at the time contemplated.

(k) Environmental Permitting: The Contractor shall sign a certification to comply with all conditions of any environmental permits required for the project (e.g. wetland or stream mitigation permit, floodplain development permit, etc.). The Contractor shall adhere to any time-of-year restriction conditions as required by state and federal permitting agencies. No in-stream work shall be permitted during in-stream time-of-year restrictions.

(l) Virginia Department of Transportation (VDOT) Land Use Permit: The Contractor shall be responsible to obtain a VDOT Land Use Permit for projects requiring such permit. The Contractor shall be responsible for all costs associated with obtaining such permit.

(m) The Contractor is responsible for ensuring that all permits required to perform the work are obtained and that all conditions of those permits are met throughout the duration of the project.

4. NONDISCRIMINATION

(a) §2.2-4311 of the Code of Virginia shall be applicable. It provides as follows:

"1. During the performance of this Contract the Contractor agrees as follows:

(a) The Contractor will not discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, age, disability, or other basis prohibited by state law relating to discrimination in employment, except where there is a bona fide occupational qualification reasonably necessary to the normal operation of the Contractor. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this nondiscrimination clause.

(b) The Contractor, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, will state that such Contractor is an equal opportunity employer.

(c) Notices, advertisements and solicitations placed in accordance with federal law, rule or regulation shall be deemed sufficient for the purpose of meeting the requirements of this section.

2. The Contractor will include the provisions of the foregoing paragraphs (a), (b) and c) in every subcontract or purchase order of over ten thousand dollars ($10,000), so that the provisions will be binding upon each Subcontractor or vendor."

(b) Where applicable, the Virginians with Disabilities Act and the Federal Americans with Disabilities Act shall apply to the Contractor and all Subcontractors.

5. PROHIBITION OF ALCOHOL AND OTHER DRUGS

(a) §2.2-4312 of the Code of Virginia shall be applicable. It provides as follows:

"During the performance of this contract, the contractor agrees to (i) provide a drug-free workplace for the contractor's employees; (ii) post in conspicuous places, available to employees and applicants for employment, a statement notifying employees that the unlawful manufacture, sale, distribution, dispensation, possession, or use of a controlled substance or marijuana is prohibited in the contractor's workplace and specifying the actions that will be taken against employees for violations of such prohibition; (iii) state in all solicitations or advertisements for employees placed by or on behalf of the contractor that the contractor maintains a drug-free workplace; and (iv) include the provisions of the foregoing clauses in every subcontract or purchase order of over $10,000, so that the provisions will be binding upon each subcontractor or vendor. For the purposes of this section, "drug-free workplace" means a site for the performance of work done in connection with a specific contract awarded to a contractor in accordance with this chapter, the employees of whom are prohibited from engaging in the unlawful manufacture, sale, distribution, dispensation, possession or use of any controlled substance or marijuana during the performance of the contract."

(b) The Contractor shall also establish, maintain and enforce policies which prohibit the following acts by all Contractor, Subcontractor and Supplier personnel at the Site:

1. the manufacture, distribution, dispensation, possession, or use of alcohol, marijuana or other drugs, except possession and medically prescribed use of prescription drugs; and

2. the impairment of judgment or physical abilities due to the use of alcohol, marijuana or other drugs, including impairment from prescription drugs.

6. TIME FOR COMPLETION

(a) The Time for Completion shall be designated by the Owner on the Invitation for Bids, Request for Proposals or other prebid/proposal documents. In some instances, the Time for Completion may be stated on the Invitation for Bids, Request for Proposals or other prebid/pre-proposal document in the form of a Contract Completion Date. The Work must be substantially completed by the Time for Completion or the Contract Completion Date. Unless otherwise specified, the Contractor shall achieve Final Completion within thirty (30) days after the date of Substantial Completion.

(b) The Time for Completion shall be stated in the Contract Between Owner and Contractor and shall become a binding part of the Contract upon which the Owner may rely in planning the use of the

facilities to be constructed and for all other purposes. If the Contractor fails to substantially complete the Work within the Time for Completion or Contract Completion Date, as set forth in the Contract, he shall be subject to payment of actual damages incurred by the Owner or liquidated damages, if provided for in the Contract.

(c) The Contractor, in submitting his bid, acknowledges that he has taken into consideration normal weather conditions. The listing below defines the monthly anticipated days of adverse weather for each month and is based upon NOAA climatological data for Charlottesville, Virginia. Adverse weather days shall be days of actual precipitation of 0.10 inch or greater.

Jan*	Feb*	Mar*	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec*
6	6	7	6	8	6	8	8	6	5	5	6

* In addition to the anticipated days of adverse weather noted above, the Contractor must include one day of adverse weather impact (snow, ice, mud) for each day of actual adverse weather during the months of January, February, March, and December.

The anticipated days provided above will constitute the baseline for adverse weather time evaluations.

For projects not involving buildings, throughout the portion of the contract from the date of Notice to Proceed until the project is substantially complete, actual adverse weather days are to be recorded by the Contractor and verified by the A/E each month.

For projects involving buildings, throughout the portion of the contract from the date of Notice to Proceed until the building is "dried in", actual adverse weather days are to be recorded by the Contractor and verified by the Architect each month. The building shall be considered "dried in" when the exterior block walls or stud and sheathing walls are in place, and a temporary (or permanent) roof is in place. Upon determination by the Owner and Architect that the building is in fact dried in, requests for additional time due to weather delays will not be accepted for any work within the building footprint.

The total anticipated adverse weather days for the project shall be the sum of all the monthly days for each month from the date of Notice to Proceed until the project is substantially complete, or until the date the building is to be "dried in", according to the Contractor's schedule.

If the total number of actual adverse weather days plus adverse weather impact days exceeds the anticipated adverse weather days determined above, the excess days may be used as a basis to determine whether a Contractor is entitled to a time extension. The adverse weather must have prevented work for fifty percent (50%) or more of the Contractor's work day and delayed work critical to the timely completion of the project.

The Contractor's schedule must indicate the critical (path) work and must reflect the above anticipated adverse weather days for all weather dependent activities.

(1) The extension requested must be supported by a delay in completion of the entire Project shown on the critical path of the accepted CPM Schedule or the approved bar graph schedule

required for the Project. Extensions will be granted only for delays in completion of the Project, not for that portion of any delay which consumes only "float" time.

(2) A request for extension of time based on abnormal weather must be made in writing within ten (10) calendar days of the completion of the calendar month during which abnormal weather is claimed at the Site.

(3) All of the evidence and data supporting the request (including both historical data and the recordings at the Site during the time of delay) must be furnished to the Owner before any consideration will be given to the request. That supporting data shall be submitted by the end of the calendar month following the month for which the request is made. Time extensions for adverse weather related days granted by the Owner will extend the Contract Completion Date but will not include additional compensation to the Contractor. Weather-related time extension(s) shall not be compensable.

(d) The Contractor represents and agrees that he has taken into account in his bid the requirements of the bid documents, local conditions, availability of materials, equipment, and labor, and any other factors which may affect the performance of the Work. The Contractor agrees and warrants that he will achieve Substantial Completion of the Work to allow the Owner to have Beneficial Occupancy not later than the Time for Completion or Contract Completion Date. The Contractor agrees and warrants that he will achieve Final Completion of the Work (the entire completion of all Work, including "punch list" items), not later than the number of days as specified in the Contract Documents after achieving Substantial Completion.

7. CONDITIONS AT SITE

(a) The Contractor and its Subcontractors shall have visited the Site prior to bidding or submitting a bid or proposal and are totally responsible for having ascertained pertinent local conditions such as location, accessibility and general character of the Site, and the character and extent of existing conditions, improvements and work within or adjacent to the Site. It is understood that the Contractor accepts conditions at the site as of the date of its bid or proposal and no allowances will be made after award for any future error or negligence by Contractor or Subcontractors. Claims, which result from the Contractor's failure to do so, will be deemed waived.

(b) If, in the performance of the Contract, hidden physical conditions of a building being modified are exposed revealing unusual or materially different conditions from those ordinarily encountered or inherent in work of this nature, or if subsurface or latent conditions at the Site are found which are materially different from those frequently present in the locality or from those indicated in the Contract Documents, the Contractor must report such conditions to the Owner and to the Architect/Engineer before the conditions are disturbed. Upon such notice, or upon his own observation of such conditions, the Architect/Engineer shall promptly propose such changes in the Contract Documents as he finds necessary to conform to the different conditions. Any change in the cost of the Work or additional time needed for completion must be requested pursuant to Sections 38 and/or 42 of these General Conditions.

(c) If the Contractor, during the course of the Work, observes the existence of any material which he knows, should know, or has reason to believe is hazardous to human health, the Contractor shall promptly notify the Owner. The Owner will provide the Contractor with instructions regarding the disposition of the material. The Contractor shall not perform any Work involving the material or any Work causing the material to be less accessible prior to receipt of special instructions from the Owner.

8. CONTRACT SECURITY

(a) For Contracts with a value exceeding one hundred thousand dollars ($100,000), the Contractor shall deliver to the Owner or its designated representative, a Standard Performance Bond (Form AC-10) and a Standard Labor and Material Payment Bond (Form AC-10.1), each fully executed by the Contractor and one or more surety companies legally licensed to do business in Virginia and each in an amount equal to one hundred percent (100%) of the accepted bid. The bonds shall identify the name and address of an attorney-in-fact who is appointed to act on behalf of the surety within the Commonwealth of Virginia. The attorney-in-fact shall affix to the bond a certified and current copy of the power of attorney. If more than one Surety executes a bond, each shall be jointly and severally liable to the Owner for the entire amount of the bond. Sureties shall be selected by the Contractor, subject to approval by the Owner. No payment on the Contract shall be due and payable to the Contractor until the bonds have been approved by the Owner. The Standard Performance Bond and Standard Labor and Material Payment Bond will be held for one year after final acceptance of the Work or as described in the bond forms.

(b) For the purposes of all Standard Labor and Material Payment Bonds entered into, the term "subcontractors" as used in §2.2-4337(A.2) of the Code of Virginia is interpreted to mean any contractors who participated in the prosecution of the Work undertaken by the Contractor (referred to in §2.2-4337(A.2) of the Code of Virginia as the "prime contractor"), whether such contractor had a direct contract with the Contractor (prime contractor) or whether there were one or more other intervening Subcontractors contractually positioned between it and the Contractor (prime contractor).

(c) See §2.2-4338 of the Code of Virginia, for alternative forms of security for payment and/or performance bonds.

(d) For contracts with a value of less than one hundred thousand dollars ($100,000), the Contractor will not be required to provide a Standard Performance Bond and a Standard Labor and Material Payment Bond as described above unless the Invitation for Bid or Request for Proposal states that such bonds will be required.

9. SUBCONTRACTS

(a) The Contractor shall, as soon as practicable after the signing of the Contract and prior to commencement of Work, notify the Owner and Architect/Engineer in writing of the names of all Subcontractors proposed for the Work and of such others as the Architect/Engineer may direct. Subcontractors whose names do not appear on the list must be approved by the Owner. Where the specifications establish qualifications or criteria for Subcontractors, manufacturers, or individuals

performing Work on the Project, the Contractor shall be responsible for ascertaining that those proposed meet the criteria or qualifications. The Contractor shall not employ any Subcontractor that the Owner may, within a reasonable time, object to as unsuitable. Neither the Owner nor the Architect/Engineer shall direct the Contractor to contract with any particular Subcontractor unless provided in the specifications or Invitation for Bids or Request for Proposal.

(b) The Owner may select a particular Subcontractor for a certain part of the Work and designate on the Invitation for Bids or Request for Proposal that the Subcontractor shall be used for the part of the Work indicated and that the Subcontractor has agreed to perform the Work for the subcontract amount stipulated on the bid or proposal form. The Contractor shall include in his bid the amount stipulated by the Owner in the bid form. In such case, the Contractor shall be responsible for that Subcontractor and its work and all scheduling and coordination associated with the work. The Subcontractor shall be responsible to the Contractor for its work just as if the Contractor had selected the Subcontractor.

(c) The Owner shall, on request, furnish to any Subcontractor, if practicable, the amounts of payments made to the Contractor, the Schedule of Values and Requests for Payment submitted by the Contractor and any other documentation submitted by the Contractor which would tend to show what amounts are due and payable by the Contractor to the Subcontractor.

(d) The Contractor shall be fully responsible to the Owner for all acts and omissions of his agents and employees and all succeeding tiers of Subcontractors and Suppliers performing or furnishing any of the Work. Nothing in the Contract Documents shall create any contractual relationship between Owner or Architect/Engineer and any such Subcontractor, Supplier or other person or organization, nor shall it create any obligation on the part of Owner or Architect/Engineer to pay for or to see to the payment of any moneys due any such Subcontractor, Supplier or other person or organization, except as may otherwise be required by law.

(e) The Contractor shall be fully responsible for his invitees at the Site and for those of his Subcontractors, Suppliers, and their employees, including any acts or omissions of such invitee.

(f) The Contractor agrees that he alone is responsible for all dealings with his Subcontractors and Suppliers, and their subcontractors, employees and invitee, including, but not limited to, the Subcontractors' or Suppliers' claims, demands, actions, disputes and similar matters unless specifically provided otherwise by the Contract or by statute.

10. SEPARATE CONTRACTS

(a) The Owner reserves the right to let other contracts in connection with the Project, the Work under which may proceed simultaneously with the execution of this Contract. The Contractor shall afford other separate contractors reasonable opportunity for the introduction and storage of their materials and the execution of their work. The Contractor shall cooperate with them and shall take all reasonable action to coordinate his Work with theirs. If the Owner has listed other separate contracts in the Invitation for Bids or Request for Proposal which it expects to proceed simultaneously with the Work of the Contractor, and has included the estimated timing of such other Contracts in the Invitation for Bids or Request for Proposal, the Contractor shall integrate the schedule of those separate contracts into his scheduling. The Contractor shall make every reasonable effort to assist

the Owner in maintaining the schedule for all separate contracts. If the work performed by the separate contractor is defective or performed so as to prevent or threaten to prevent the Contractor from carrying out his Work according to the Contract, the Contractor shall immediately notify the Owner and the Architect/Engineer upon discovering such conditions.

(b) If a dispute arises between the Contractor and any separate contractor(s) as to their responsibility for cleaning up as required by Sections 31(c) and 31(d) of these General Conditions, the Owner may clean up and charge the cost thereof to the respective contractors in proportion to their responsibility. If a Contractor disputes the Owner's apportionment of clean-up costs, it shall be that contractor's burden to demonstrate and prove the correct apportionment.

11. CONTRACTOR'S AND SUBCONTRACTOR'S INSURANCE

A. General Requirements:

(a) Certificate of Insurance-General Contractor: Prior to execution of the Contract by the Owner, the Contractor shall provide written evidence (certificates of insurance) that he has obtained all the insurance required hereunder from an insurer authorized to do business in Virginia and such insurance has been approved by the Owner. Insurance providers must have an agent licensed to do business in Virginia. The Owner must be identified on the certificate(s) of insurance as an additional insured for all types of insurance coverage, except for workers' compensation and professional liability, and there shall be a statement provided on the certificate(s) confirming the Owner is named as an additional insured and so endorsed to the policy(ies). In the event of cancellation of this insurance, not less than thirty (30) days prior written notice must be sent to the Owner.

(b) Certificate of Insurance-Subcontractor: The Contractor shall not allow any Subcontractor to commence Work on his subcontract until the same types of insurance in an appropriate amount have been obtained by the Subcontractor and approved by the Contractor. The Owner shall have no responsibility to verify compliance by the Contractor, or its subcontractors or suppliers. Approval of insurance by the Owner shall not relieve or decrease the liability of the Contractor hereunder. In the event of cancellation of this insurance, not less than thirty (30) days prior written notice must be sent to the Owner.

B. Insurance Requirements: By signing and submitting a proposal under this solicitation, the offeror certifies that if awarded the contract, it will purchase and maintain, at its sole expense, and from a company or companies authorized to do business within the Commonwealth of Virginia, insurance policies containing the following types of coverages and minimum limits, protecting from claims which may arise out of or result from the Offerors's performance or non-performance of services under this Contract, or the performance or non-performance of services under this Contract by anyone directly or indirectly employed by the Offeror or for whose acts it may be liable. The Supplemental General Conditions detail the minimum amounts required for this solicitation.

(a) Workers' Compensation to include Employer's Liability of an amount not less that $100,000/$500,000/$100,000. Coverage is compulsory for employers of three or more employees, to include the employer. Businesses who hire subcontractors who will perform the same trade or are hired to fulfill contract requirements must include the subcontractor's employees when determining the total number of employees for workers compensation. A waiver of subrogation in favor of the County of Albemarle and its officers, employees, agents, and volunteers must be endorsed on the workers

compensation policy. Contractors who fail to notify the County of increases in the number of employees that change their workers' compensation requirements under the Code of Virginia during the course of the contract shall be in noncompliance with the contract. This policy shall specifically list Virginia as a covered state.

(b) General Liability – of an amount not less than $1,000,000 per occurrence/$2,000,000 aggregate limit, and a per project aggregate limit of $2,000,000.-CGL form CG 2010 11/85 edition or its equivalent is required to be endorsed to the commercial general liability policy. Commercial General Liability is to include bodily injury and property damage, personal injury, advertising injury, arising out of premises, operations, and products and completed operations. The County of Albemarle and its officers, employees, agents and volunteers must be named as additional insureds on a primary and non-contributory basis and be so endorsed on the policy. A waiver of subrogation in favor of Albemarle County Government is required on the commercial general liability policy.

(c) Automobile Liability – of an amount not less than $1,000,000 per accident. Coverage is to include hired, owned, non-owned, temporary, and leased vehicles. The County of Albemarle and its officers, employees, agents and volunteers must be named as additional insureds on a primary and non-contributory basis and be so endorsed on the auto policy. A waiver of subrogation naming the County of Albemarle and its officers, employees, agents and volunteers is also required on the commercial auto policy.

(d) Umbrella or Excess Liability Coverage- of an amount not less than $1,000,000. Must be follow form and go over the underlying general liability, commercial auto and employers liability policies. The County of Albemarle and its officers, employees, agents and volunteers must be named as additional insureds on a primary and non-contributory basis and be so endorsed on the Umbrella or Excess Liability policy. A waiver of subrogation naming the County of Albemarle and its officers, employees, agents and volunteers is also required on the commercial Umbrella or Excess Liability policy.

(e) Environmental/pollution - of an amount not less than $1,000,000. County of Albemarle and its officers, employees, agents and volunteers must be named as additional insureds on a primary and non-contributory basis and be so endorsed on the Environmental/pollution Liability policy. A waiver of subrogation naming the County of Albemarle and its officers, employees, agents and volunteers is also required on the commercial Environmental/pollution Liability policy.

(f) Professional (E&O) Liability Insurance - of an amount not less than $1,000,000

(g) Cyber Liability - of an amount not less than $1,000,000

All insurance coverage:

1. shall be issued by an insurance carrier authorized to do business within the Commonwealth of Virginia and rated A – VIII or better, by A. M. Best Company or equivalent rating from an alternate recognized ratings agency, and otherwise acceptable to the County;
2. shall be kept in force throughout performance of services;
3. shall be an occurrence based policy; professional liability may be claims made basis;
4. shall include completed operations coverage;
5. shall contain a cross liability or severability of interest clause or endorsement. Insurance covering the specified additional insured shall be primary and non-contributory, and all other insurance carried by the additional insureds shall be excess insurance;
6. where additional insured required, such policy shall not have a restriction on the limits of coverage provided to the County as an additional insured. The County shall be entitled to protection up to the full limits of the offerors's policy regardless of the minimum requirements specified in the Contract.

Proof Of Insurance: Prior to performance of any services or delivery of goods, the Offeror shall (i) have all required insurance coverage in effect; (ii) the Offeror shall deliver to the County certificates of insurance for all lines of coverage. The Offeror shall be responsible that such coverage evidenced thereby shall not be substantially modified or canceled without 30 days prior written notice to the County; and (iii) the Offeror shall deliver to the County endorsements to the policies which require the County and its officials, officers, employees, agents and volunteers be named as "additional insured". Policies which require this endorsement include: Commercial General Liability, Automobile Liability and, umbrella or excess liability coverage as detailed below. Such endorsements must be approved by the County, and (iv) upon the request of the County, provide any other documentation satisfactory to the County in its sole discretion, evidencing the required insurance coverage, including but not limited to a copy of the insurance policy and evidence of payment of policy premiums. The Offeror shall require each of its subcontractors and suppliers to have coverage per the requirements herein in effect, prior to the performance of any services by such subcontractors and suppliers. Further, the Offeror shall ensure that all Required Insurance coverages of its subcontractors and suppliers is and remains in effect during performance of their services on the Project and certifies by commencement of the Work that this insurance and that of subcontractors is in effect and meets the requirements set forth herein. The County shall have no responsibility to verify compliance by the Offeror or its subcontractors and suppliers.

Effect Of Insurance: Compliance with insurance requirements shall not relieve the Offeror of any responsibility to indemnify the County for any liability to the County, as specified in any other provision of this contract, and the County shall be entitled to pursue any remedy in law or equity if the Offeror fails to comply with the contractual provisions of this contract. Indemnity obligations specified elsewhere in this Contract shall not be negated or reduced by virtue of any insurance carrier's denial of insurance coverage for the occurrence or event which is the subject matter of the claim, or by any insurance carrier's refusal to defend any named insured.

Waiver Of Subrogation: The Offeror agrees to release and discharge the County of Albemarle and its officers, employees, agents and volunteers of and from all liability to the Offeror, and to anyone claiming by, through or under the Offeror, by subrogation or otherwise, on account of any loss or damage to tools, machinery, equipment or other property, however caused.

Sovereign Immunity: Nothing contained herein shall affect, or shall be deemed to affect, a waiver of

the County's sovereign immunity under law.

Right to Revise or Reject: The County reserves the right, but not the obligation, to revise any insurance requirement not limited to limits, coverages and endorsements, or reject any insurance policies which fail to meet the criteria stated herein. Additionally, the County reserves the right, but not the obligation, to review and reject any insurer providing coverage due to its poor financial condition or failure to operate legally.

Umbrella or Excess Liability Coverage which includes premises/operations, product/completed operations, and has per-occurrence limits as detailed in the Supplemental General Conditions. This insurance shall name the County and its officials, officers, and employees and agents as "additional insureds" by **endorsement** to the Umbrella or Excess Liability policy. Such policy shall not have a restriction on the limits of coverage provided to the County of Albemarle as an additional insured. The County of Albemarle shall be entitled to protection up to the full limits of the Offeror's policy regardless of the minimum requirements specified in this contract.

Professional Liability Insurance: At its sole expense, and prior to commencing any activities under this Agreement, Offeror shall secure professional liability insurance, covering any damages caused by the negligent or wrongful acts or omissions of the Offeror, its employees and agents in the performance of this Agreement, with coverage in an amount as detailed in the Supplemental General Conditions ("Required Insurance"). Offeror shall maintain the Required Insurance in effect throughout the Term of this Agreement and for a period of three (3) years following final acceptance of the Project by the County. Upon execution of this Agreement, Offeror shall provide the County with a certificate of insurance, or other written documentation satisfactory to the County in its sole discretion, issued by Offeror's insurance company(ies), confirming the Required Insurance and the beginning and ending date(s) of Contractor's policy(ies). Upon receipt of any notice, verbal or written, that the Required Insurance is subject to cancellation, Offeror shall immediately (within one business day) notify the County. Offeror's failure to comply with any of the requirements of this Section shall constitute a material breach of this Agreement entitling the County to terminate this Agreement without notice to Offeror and without penalty to the County.

C. Installation Floater: if applicable, the Contractor is required to purchase an Installation Floater to to cover their own property to be installed into a building. Coverage is provided for equipment and/or machinery being installed, renovated or repaired during the course of construction.

12. BUILDER'S RISK INSURANCE

(a) The Contractor, at his cost, shall obtain and maintain in the names of the Owner and the Contractor builder's risk insurance on a special causes of loss form, including the costs of excavations, backfills, foundations, underground utilities and site work (or fire, extended coverage, vandalism and malicious mischief insurance, if approved by the Owner) upon the entire structure or structures on which the Work of this Contract is to be done, and upon all material in or adjacent thereto which is intended for use thereon, to one hundred percent (100%) of the insurable value thereof. Such insurance may include a deductible provision if the Owner so provides in the Supplemental General Conditions, in which case the Contractor will be liable for such deductions, whenever a claim arises. The loss, if any, is to be made adjustable with and payable to the Owner, in accordance with its interests, as they may appear. The Owner, its officers, employees and its agents, shall be named as

loss payee in any policy of insurance issued. Written evidence of the insurance shall be filed with the Owner prior to execution of the Contract by the Owner. Insurance providers must be authorized to do business in Virginia and have an agent licensed to do business in Virginia. In the event of cancellation of this insurance, not less than thirty (30) days prior written notice must be sent to the Owner. A copy of the policy of insurance shall be given to the Owner upon demand.

(b) Certain projects, such as renovations and interior modifications of existing buildings, may be covered by the Owner's insurance and may be excluded from the Builder's risk policy purchased by the contractor insurance required by this section. In those instances, the Supplemental General Conditions for the project shall expressly exclude the project from the requirements of Subsection 12(a).

(c) Any insurance provided through the County of Albemarle, Virginia, for construction, additions or renovations will not extend to Contractor's nor Subcontractors' buildings, equipment, materials, tools or supplies unless these items are to become property of the Owner upon completion of the Project and the Owner has assumed responsibility for such items at the time of the loss.

13. TAXES, FEES AND ASSESSMENTS

The Contractor shall, without additional expense to the Owner, pay all applicable federal, state, and local taxes, fees, and assessments except the taxes, fees and assessments on the real property comprising the Site of the project. The Owner shall pay inspection fees to the local building official except for reinspection fees resulting from incomplete or defective work.

14. PATENTS

The Contractor shall obtain all licenses necessary to use any invention, article, appliance, process or technique of whatever kind and shall pay all royalties and license fees. The Contractor shall hold the Owner, its officers, agents and employees, harmless against any loss or liability for or on account of the infringement of any patent rights in connection with any invention, process, technique, article or appliance manufactured or used in the performance of the Contract, including its use by the Owner, unless such invention, process, technique, article or appliance is specifically named in the specifications or plans as acceptable for use in carrying out the Work. If, before using any invention, process, technique, article or appliance specifically named in the specifications or plans as acceptable for use in carrying out the Work, the Contractor has or acquires information that the same is covered by letters of patent making it necessary to secure the permission of the patentee, or other, for the use of the same, he shall promptly advise the Owner and the Architect/Engineer. The Owner may direct that some other invention, process, technique, article or appliance be used. Should the Contractor have reason to believe that the invention, process, technique, article or appliance so specified is an infringement of a patent, and fail to inform the Owner and the Architect/Engineer, he shall be responsible for any loss or liability due to the infringement.

15. ARCHITECT/ENGINEER'S STATUS

(a) The Architect/Engineer shall have authority to endeavor to secure the faithful performance by Owner and Contractor of the Work under the Contract. He shall review the Contractor's Submittals for conformance to the requirements of the Contract Documents and return copies to the Contractor with appropriate notations. He shall interpret the requirements of the plans and specifications and issue Field Orders to the Contractor as may be required. He shall recommend to the Owner suspension of the Work (in whole or in part) whenever such suspension may be necessary to ensure the proper execution of the Contract. He shall have authority to reject, in writing, Work, including material, installation or workmanship, which does not conform to the requirements of the plans and specifications. He shall determine the progress and quality of the Work, subject to the right of the Owner to make an overriding decision to the contrary. Upon request by the Contractor, the Architect/Engineer shall confirm, in writing within ten (10) days, any oral order or determination made by him.

(b) The Architect/Engineer shall have no authority to approve or order changes in the Work which alter the design concept or which call for an extension of time or a change in the Contract Price.

(c) The Owner shall have the right, but not the duty, to countermand any decision of the Architect/Engineer and to follow or reject the advice of the Architect/Engineer, including but not limited to acceptance of the Work.

(d) All orders from the Owner to the Contractor shall either be transmitted through the Architect/Engineer or communicated directly to the Contractor and the Architect/Engineer by the Owner.

(e) Should the Owner choose to employ another or different Architect/Engineer, the status of the Architect/Engineer so employed shall be the same as that of the former Architect/Engineer.

(f) The Architect/Engineer will provide to the Owner and the Contractor after each visit to the Site, a written report indicating the date, time of day, weather conditions and the names of the persons representing the Architect/Engineer who participated in the visit. The report will advise the Owner of any problems that were noted and shall compare the Architect/Engineer's observations of the actual progress of the Work with that reported by the Contractor. On the basis of his on-site observations as Architect/Engineer, he will make every reasonable effort to guard the Owner against defects and deficiencies in the Work of the Contractor. He shall have the authority to inspect the Work, to note and report Defective Work and deviations from the Contract Documents to the Owner, to reject same, and to recommend to the Owner the suspension of the Work when necessary to prevent Defective Work from proceeding or being covered.

(g) The Architect/Engineer shall not be responsible for construction means, methods, techniques, sequences or procedures (other than those expressly specified in Contract Documents), or for safety precautions and programs in connection with the Work, and he shall not be responsible for the Contractor's failure to carry out the Contractor's own responsibilities.

(h) The provisions of this section are included as information only to describe the relationship between the Owner, A/E, and Contractor. No failure of the A/E to act in accordance with this section shall relieve the Contractor from his obligations under the Contract or create any rights in favor of the Contractor.

16. INSPECTION

(a) All material and workmanship shall be subject to inspection, examination and testing by the Owner, the Architect/Engineer, the Project Inspector, authorized inspectors and authorized independent testing entities at any and all times during manufacture and/or construction. The Architect/Engineer and the Owner shall have authority to reject defective material and workmanship and require its correction. Rejected workmanship shall be satisfactorily corrected and rejected material shall be satisfactorily replaced with proper material without charge therefor, and the Contractor shall promptly segregate and remove the rejected material from the Site. If the Contractor fails to proceed at once with replacement of rejected material and/or the correction of defective workmanship, the Owner may, by contract or otherwise, replace such material and/or correct such workmanship and charge the cost to the Contractor, or may terminate the right of the Contractor to proceed as provided in Section 40 of these General Conditions, the Contractor and surety being liable for any damage to the same extent as provided in Section 40 for termination thereunder.

(b) Site inspections, tests conducted on Site or tests of materials gathered on Site, which the Contract requires to be performed by independent testing entities, shall be contracted and paid for by the Owner. The Contractor shall schedule all required tests, approvals and inspections of the Work or other work related to the Project. If items/areas to be inspected and/or tested are not ready for inspection when the testing agency/inspector arrives on-site at the pre-arranged time, the Contractor is responsible for all costs associated with inspection delays, including but not limited to reinspection fees. The Contractor shall give proper notice to all required parties of such tests, if feasible, so that the Owner and others may observe the tests at the normal place of testing. Unless otherwise required by the Contract Documents, required certificates of testing, approval or inspection shall be secured by the Contractor and promptly delivered to the Owner. Examples of such tests are the testing of cast-in-place concrete, foundation materials, soil compaction, pile installations, caisson bearings and steel framing connections. The Contractor shall promptly furnish, without additional charge, all reasonable facilities, labor and materials necessary and convenient for making such tests. Except as provided in (d) below, whenever such examination and testing finds defective materials, equipment or workmanship, the Contractor shall reimburse the Owner for the cost of reexamination and retesting. Although conducted by independent testing entities, the Owner will not contract and pay for tests or certifications of materials, manufactured products or assemblies which the Contract, codes, standards, etc., require to be tested and/or certified for compliance with industry standards such as Underwriters Laboratories, Factory Mutual or ASTM. If fees are charged for such tests and certifications, they shall be paid by the Contractor. The Contractor shall also pay for all inspections, tests, and certifications which the Contract specifically requires him to perform or to pay, together with any inspections and tests which he chooses to perform for his own purposes, but are not required by the Contract.

(c) Where Work is related to or dependent on the Defective Work, the Contractor shall stop such related or dependent Work until the Defective Work or deficiency is corrected or an alternative solution is presented that is satisfactory to the Owner. Where Work is rejected because of defective material or workmanship, the Contractor shall stop like Work in other areas or locations on the Project until the matter is resolved and the Owner has approved corrective measures.

(d) Should it be considered necessary or advisable by the Owner at any time before final acceptance of the entire Work to make an examination of any part of the Work already completed, by removing or tearing out portions of the Work, the Contractor shall on request promptly furnish all necessary

facilities, labor and material to expose the Work to be tested to the extent required. If such Work is found to be defective in any respect, due to the fault of the Contractor or his Subcontractors, the Contractor shall defray all the expenses of uncovering the Work, of examination and testing, and of satisfactory reconstruction. If, however, such Work is found to meet the requirements of the Contract, the actual cost of the Contractor's labor and material necessarily involved in uncovering the Work, the cost of examination and testing, and Contractor's cost of material and labor necessary for replacement including a markup of ten percent (10%) for overhead and profit shall be paid to the Contractor and he shall, in addition, if completion of the Work has been delayed thereby, be granted a suitable extension of time. Notwithstanding the foregoing, the Contractor shall be responsible for all costs and expenses in removing and replacing the Work if the Contractor had covered the Work prior to any inspection or test contrary to the instructions of the A/E, Owner or Project Inspector.

(e) The Project Inspector has the right and the authority to:

(1) Inspect all construction materials, equipment, and supplies for quality and for compliance with the Contract Documents and/or approved shop drawings and submittals;

(2) Inspect workmanship for compliance with the standards described in the Contract Documents;

(3) Observe and report on all tests and inspections performed by the Contractor;

(4) Recommend rejection of Work which does not conform to requirements of the Contract Documents;

(5) Keep a record of construction activities, tests, inspections, and reports;

(6) Attend all joint Site construction meetings and inspections held by the Owner and/or the A/E with the Contractor;

(7) Check materials and equipment, together with documentation related thereto, delivered for conformance with approved Submittals and the Contract;

(8) Check installations for proper workmanship and conformance with shop drawing and installation instructions;

(9) Assist in the review and verification of the Schedule of Values & Certificate for Payment, submitted by the Contractor each month;

(10) Do all things for or on behalf of the Owner as the Owner may subsequently direct in writing.

(f) The Project Inspector has no authority to:

(1) Authorize deviations from the Contract Documents;

(2) Enter into the area of responsibility of the Contractor's superintendent;

(3) Issue directions relative to any aspect of construction means, methods, techniques, sequences or procedures, or in regard to safety precautions and programs in connection with the Work;

(4) Authorize or suggest that the Owner occupy the Project, in whole or in part; or

(5) Issue a certificate for payment.

(g) The duties of the Project Inspector are for the benefit of the Owner only and not for the Contractor. The Contractor may not rely upon any act, statement, or failure to act on the part of the Project Inspector, nor shall the failure of the Project Inspector to properly perform his duties in any way excuse Defective Work or otherwise improper performance of the Contract by the Contractor.

17. PROJECT MANAGEMENT AND SUPERVISION BY CONTRACTOR

(a) The Contractor shall have a competent project manager or superintendent, satisfactory to the Architect/Engineer and the Owner, on the Site at all times during the progress of the Work. The Contractor shall submit for approval by the Owner and Architect/Engineer the resumes for the proposed project manager and superintendent within ten (10) days from Notice of Intent to Award Contract. The project manager and superintendent shall be familiar with and be able to read and understand the plans and specifications, and be capable of communicating orally and in writing with the Owner's project manager and/or inspectors and the Contractor's workers. The Contractor shall be responsible for all construction means, methods, techniques, sequences and procedures, for coordinating all portions of the Work under the Contract except where otherwise specified in the Contract Documents, and for all safety and worker health programs and practices. The Contractor shall notify the Owner, in writing, and obtain approval, of any proposed change in project manager or superintendent, including the reason therefor, prior to making such change.

(b) The Contractor shall, at all times, enforce strict discipline and good order among the workers on the Project, and shall not employ on the Work, or contract with, any unfit person, anyone not skilled in the Work assigned to him, or anyone who will not work in harmony with those employed by the Contractor, the Subcontractors, the Owner or the Owner's separate contractors and their subcontractors.

(c) The Owner may, in writing, require the Contractor to remove from the Site any employee or Subcontractor's employee the Owner deems to be incompetent, careless, not working in harmony with others on the Site, or otherwise objectionable, but the Owner shall have no obligation to do so.

18. CONSTRUCTION SUPERVISION, METHODS AND PROCEDURES

(a) The Contractor shall be solely responsible for supervising and directing the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract. The Contractor shall be solely responsible for the means, methods, techniques, sequences and procedures of construction and for coordinating all portions of the Work under the Contract, except where otherwise specified in the Contract Documents. However, the Contractor shall not be responsible for the negligence of others in the design or selection of a specific means, method, technique, sequence or procedure of construction which is indicated in and required by the Contract. The Contractor is solely responsible to the Owner that the finished Work complies with the Contract Documents.

The Contractor shall be solely responsible for health and safety precautions and programs for workers and others in connection with the Work. No inspection by, knowledge on the part of, or acquiescence by the Architect or Engineer, the Project Inspector, the Owner, the Owner's employees and agents, or any other entity whatever shall relieve the Contractor from its sole responsibility for compliance with the requirements of the Contract or its sole responsibility for health and safety programs and precautions.

(b) If a specific means, method, technique, sequence or procedure of construction is indicated in or required by the Contract Documents, the Contractor may furnish or utilize a substitute means, method, sequence, technique or procedure of construction acceptable to Architect/Engineer, subject to the Owner's right to disapprove. The Contractor must submit its written request for the substitution to the Architect/Engineer with sufficient information to allow the Architect/Engineer to determine that the substitute proposed is equivalent to that indicated or required by the Contract.

(c) The divisions and sections of the Specifications and the identification of any drawings shall not control the Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

19. SCHEDULE OF THE WORK

(a) **General:** The Contractor is responsible for the scheduling and sequencing of the Work, for coordinating the Work, for monitoring the progress of the Work, and for taking appropriate action to keep the Work on schedule. The Contractor may attempt to achieve Substantial Completion on or before the Time for Completion or the Contract Completion Date established by the Contract and receive payment in accordance with Section 36 for the Work completed each period. However, the date established by the Contract Documents as the deadline for achieving Substantial Completion must be used in all schedules as the date on which Substantial Completion will be achieved. The time (in days) between the Contractor's planned early completion and the contracted Time for Completion is part of the Project "Total Float" time and will be used as such. Extensions of time pursuant to Sections 38 and 42, damages for delay, and all other matters between the Owner and the Contractor will be determined using the contractually required Substantial Completion date, not an early Substantial Completion date planned by the Contractor.

Within two (2) weeks after the Contractor signs the Contract Between Owner and Contractor, unless otherwise extended by the Owner at the time of the signing, the Contractor shall prepare and submit to the Owner, with a copy to the Architect/Engineer, a preliminary bar graph milestone schedule for accomplishing the Work based upon the Time for Completion stated in the Contract. The preliminary bar graph schedule shall be in sufficient detail to show the sequencing of the various trades for each floor level, wing or work area. The Owner will notify the Contractor of its acceptance of or objections to the preliminary schedule within seven (7) days of receipt by the Owner. A fully complete Project schedule for accomplishing the Work must be submitted and approved by the Owner prior to making application for the first payment.

The Owner's failure to reject or its acceptance of any schedule, graph, chart, recovery schedule, updated schedule, plan of action, etc. shall not constitute a representation or warranty by the Owner, including but not limited to a representation or warranty that the schedule is feasible or practical nor

shall any such acceptance or failure to reject relieve the Contractor from sole responsibility for completing the Work within the time allowed.

No progress payments will be payable to the Contractor until after it has submitted a preliminary schedule which is acceptable to the Owner. Neither the second progress payment nor any subsequent payment shall be payable to the Contractor until it has submitted a fully complete Project schedule accepted by the Owner. Nor shall subsequent progress payments be payable to the Contractor unless and until he maintains the monthly bar graphs or status reports required by Section 19(e) herein or unless and until he provides any recovery schedule pursuant to Section 19(f) herein.

Failure to provide a satisfactory preliminary or fully complete Project schedule within the time limits stated above shall be a breach of contract for which the Owner may terminate the Contract in the manner provided in Section 40 of these General Conditions.

The fully complete Project schedule for accomplishing the Work shall be of the type set forth in subparagraph (1) or (2) below, as appropriate:

(1) For Contracts with a price of $500,000 or less, a bar graph schedule will satisfy the above requirement. The schedule shall indicate the estimated starting and completion dates for each major element of the work. See (b) below.

(2) For Contracts with a price over $500,000, a Critical Path Method (CPM) schedule shall be utilized to control the planning and scheduling of the Work. The CPM schedule shall be the responsibility of the Contractor and shall be paid for by the Contractor. See (c) below.

(b) **Bar Graph Schedule:** Where a bar graph schedule is required, it shall be time-scaled in weekly increments, shall indicate the estimated starting and completion dates for each major element of the Work by trade and by area, level, or zone, and shall schedule dates for all salient features, including but not limited to the placing of orders for materials, submission of shop drawings and other Submittals for approval, approval of shop drawings by Architect/Engineer, the manufacture and delivery of material, the testing and the installation of materials, supplies and equipment, and all Work activities to be performed by the Contractor.

The Contractor shall allow sufficient time in his schedule for adverse weather anticipated in Section 6 and for the A/E to conduct whatever associated reviews or inspections as may be required under the A/E's contract with the Owner. If the A/E and the Contractor are unable to agree as to what constitutes sufficient time, the Owner shall determine the appropriate duration for such Architect/Engineer activities. Each Work activity will be assigned a time estimate by the Contractor. One day shall be the smallest time unit used.

It is the Contractor's responsibility to submit a schedule that shows Substantial Completion of the Work by the Contract Time for Completion or the Contract Completion Date and any interim deadlines established by the Contract.

(c) **CPM Schedule:** Where a CPM schedule is required, it shall be in the time-scaled precedence format using the Contractor's logic and time estimates. The CPM schedule shall be drawn or plotted with activities grouped or zoned by Work area or subcontract as opposed to a random (or scattered) format.

The CPM schedule shall be time-scaled on a weekly basis and shall be drawn or plotted at a level of detail and logic which will schedule all salient features of the Work, including not only the actual construction Work for each trade, but also the submission of shop drawings and other Submittals for approval, approval of shop drawings by Architect/Engineer, placing of orders for materials, the manufacture and delivery of materials, the testing and installation of materials and equipment, and all Work activities to be performed by the Contractor. Failure to include any element of Work required for the performance of this Contract shall not excuse the Contractor from completing all Work required within the Time for Completion, Contract Completion Date and any interim deadlines established by the Contract.

The Contractor shall allow sufficient time in his schedule for adverse weather anticipated in Section 6 and for the A/E to conduct whatever associated reviews or inspections as may be required under the A/E's contract with the Owner. If the A/E and the Contractor are unable to agree as to what constitutes sufficient time, the Owner shall determine the appropriate duration for such Architect/Engineer activities. Each Work activity will be assigned a time estimate by the Contractor. One day shall be the smallest time unit used.

It is the Contractor's responsibility to submit a schedule that shows Substantial Completion of the Work by the Contract Time for Completion or the Contract Completion Date and any interim deadlines established by the Contract.

When completed, the CPM schedule shall be submitted to the Architect/Engineer and the Owner for review. The CPM schedule will identify and describe each activity, state the duration of each activity, the calendar dates for the early and late start and the early and late finish of each activity, and clearly highlight all activities on the critical path. "Total float" and "free float" shall be indicated for all activities. Float time, whether "free float" or "total float" as defined in Section 1, shall not be considered for the exclusive use or benefit of either the Owner or the Contractor, but must be allocated in the best interest of completing the Work within the Time for Completion or the Contract Completion Date. Extensions to the Time for Completion or the Contract Completion Date, when granted by Change Order, will be granted only when equitable time adjustment exceeds the Total Float in the activity or path of activities affected by the change. The CPM schedule shall also show what part of the Contract Price (expressed in U.S. dollars) is attributable to each activity on the schedule, the sum of which for all activities shall equal the total Contract Price. The CPM schedule shall also show the planned workforce (crew size and number of crews) and the major pieces of equipment required for each activity on the schedule. When acceptable to the Owner and Architect/Engineer as to compliance with the requirements of this Section, but not as to logic, the schedule shall become the CPM schedule for the Project. Acceptance of the schedule by the Owner does not indicate agreement with nor responsibility for the proposed or actual duration of any activity shown on the accepted schedule.

(d) **Progress of Work:** The Contractor shall commence and complete the work in accordance with the approved schedule. Contractor acknowledges that it may be required to perform Work out of the sequence originally planned to maintain progress on the project. Contractor acknowledges that it has anticipated certain reasonable delays and disruptions as part of the contract price. No additional reimbursement will be forthcoming for out of sequence work. Time is of the essence. If the Contractor fails to employ sufficient competent personnel as may be required to perform the Work or otherwise causes delays which result in the Contractor's failure to complete the Work in the given time, the Contractor will indemnify and hold the Owner harmless for any additional expenses or

damages (including, but not limited to, liquidated damages) arising out of such delay or inability to proceed with the Work. Liquidated Damages, if any, shall be referenced in the Supplemental General Conditions.

(e) **Monthly Project Reports:** The Contractor shall review progress not less than each month, but as often as necessary to properly manage the Project and stay on schedule. The Contractor shall collect and preserve information on Change Orders, including extensions of time. The Contractor shall evaluate this information and update the latest accepted schedule as often as necessary to finish within the Contract Time for Completion or before the Contract Completion Date. The Contractor shall submit to the A/E along with his monthly request for payment a copy of the bar graph schedule annotated to show the current progress. For projects requiring a CPM schedule, the Contractor shall submit a monthly report of the status of all activities. The bar graph schedule or monthly status report submitted with each periodic request for payment shall show the Work completed to date in comparison with the Work scheduled for completion, including but not limited to the dates for the beginning and completion of the placing of orders; the manufacture, testing and installation of materials, supplies and equipment. The form shall be approved by the A/E and the Owner; however, a bar graph or a CPM schedule marked, colored or annotated to reflect the above will usually satisfy this requirement. If any elements of the Work are behind schedule, regardless of whether they may prevent the Work from being completed on time, the Contractor must indicate in writing in the report what measures he is taking and plans to take to bring each such element back on schedule and to ensure that the Time for Completion or Contract Completion Date is not exceeded.

(f) **Progress Delay:** Should any of the following conditions exist, the Owner may require the Contractor to prepare, at no extra cost to the Owner, a plan of action and a recovery schedule for completing the Work by the Contract Time for Completion or the Contract Completion Date:

(1) The Contractor' monthly progress report indicates delays that are, in the opinion of the A/E or the Owner, of sufficient magnitude that the Contractor's ability to complete the Work by the scheduled Time for Completion or the Contract Completion Date is brought into question;

(2) The CPM schedule sorted by early finish shows the Contractor to be thirty (30) or more days behind the critical path schedule at any time during construction up to thirty (30) days prior to scheduled Substantial Completion date;

(3) The Contractor desires to make changes in the logic (sequencing of Work) or the planned duration of future activities of the CPM schedule which, in the opinion of the Architect/Engineer or the Owner, are of a major nature.

The plan of action and recovery schedule, when required, shall explain and display how the Contractor intends to regain compliance with the current accepted, fully completed, Project CPM schedule, as updated by approved change orders.

The plan of action, when required, shall be submitted to the Owner for review within two (2) business days of the Contractor receiving the Owner's written demand. The recovery schedule, when required, shall be submitted to the Owner within five (5) calendar days of the Contractor's receiving the Owner's written demand.

If, in the opinion of the A/E or Owner, the recovery schedule is deemed insufficient, the Contractor, if directed by the Owner, will be required to remedy the schedule delay, without additional compensation, by one of the following manners:

(1) Increased manpower by Contractor or its subcontractors;
(2) Increased number of shifts, including night and weekend work.

(g) **Early Completion of Project:** The Contractor may attempt to achieve Substantial Completion on or before the Time for Completion or the Contract Completion Date. However, such planned early completion shall be for the Contractor's convenience only and shall not create any additional rights of the Contractor or obligations of the Owner under this Contract, nor shall it change the Time for Completion or the Contract Completion Date. The Contractor shall not be required to pay damages to the Owner because of its failure to achieve Substantial Completion by its planned earlier date. Likewise, the Owner shall not pay the Contractor any additional compensation for achieving Substantial Completion early nor will the Owner owe the Contractor any compensation should the Owner, its officers, employees, or agents cause the Contractor not to achieve Substantial Completion earlier than the date required by the Contract Documents.

If the Contractor seeks to change the Time for Completion or the Contract Completion Date to reflect an earlier completion date, he may request or propose such a change. The Owner may, but is not required to, accept such proposal. However, a change in the Time for Completion or the Contract Completion Date shall be accomplished only by Change Order. If the Contractor's proposal to change the Time for Completion or the Contract Completion Date is accepted, a Change Order will be issued stating that all references in the Contract, including these General Conditions, to the Time for Completion or the Contract Completion Date shall thereafter refer to the date as modified, and all rights and obligations, including the Contractor's liability for actual damages, delay damages and/or liquidated damages, shall be determined in relation to the date, as modified.

20. SCHEDULE OF VALUES AND CERTIFICATE FOR PAYMENT

(a) Before submittal of the first partial payment request under the Contract, the Contractor shall prepare for review and approval of the Architect/Engineer and the Owner, a schedule of the estimated values listed by trades or by specification sections of the Work, totaling the Contract Price. Where the total project has multiple parts or phases, the Contractor shall prepare appropriate schedules of values to facilitate reviews and justifications for payments.

All requests for payment shall be made on the Schedule of Values and Certificate for Payment (Form AC-12) pages 1 and 2. Succeeding pages may be on the Form AC-12 continuation sheets or a computerized spreadsheet which is in the same format and which contains the same information.

(b) If the Contractor requests, or intends to request, payment for materials stored in an approved and secure manner, the Schedule of Values must indicate the amount for labor and the amount for materials, and in a supplement thereto must include an itemized list of materials for that trade or Work section. The material breakdown shall be in sufficient detail to allow verification of the quantities required for the Project, the quantities delivered, the Work completed, and the quantities stored on or off Site. Refer to Section 36 of these General Conditions for additional requirements associated with stored materials and/or equipment.

(c) The "Value of Work Completed" portion of the Form AC-12 shall be completed, the Contractor's certification completed and signed, and the appropriate substantiating material attached to each Certificate for Payment (AC-12). Such substantiating material includes, but is not limited to, invoices for materials, delivery tickets, time sheets, payroll records, daily job logs/records, and similar materials which, in the opinion of the Owner and the A/E, are necessary or sufficient to justify payment of the amount requested.

(d) The labor progress for any task or activity shall be calculated based upon the percentage of Work complete up to fifty percent (50%) of the completion of the task or activity. Thereafter, the evaluation of labor progress will be based upon the effort required to complete that task or activity. The material progress shall be calculated as the invoiced dollar cost of materials used in relationship to the amount estimated as necessary to complete a particular element of Work. When calculating material progress, credit shall be given for installed material as well as that stored on the Site and any material stored off Site which has been certified by the Architect/Engineer in accordance with Section 36 of these General Conditions.

(e) Should Work included in previous Form AC-12 submittals, and for which payment has been made, subsequently be identified, by tests, inspection, or other means, as not acceptable or not conforming to Contract requirements, the "Value of Work Completed" portion of the first Form AC-12 submitted after such identification shall be modified to reduce the "completed" value of that Work by deleting the value of that which has been identified as not acceptable or nonconforming.

(f) The Contractor shall not include Change Order work on the Form AC-12 until such time as the Contractor is in receipt of a fully executed Change Order from the Owner.

21. ACCESS TO WORK

The Architect/Engineer, the Owner, the Project Manager, the Owner's inspectors and other testing personnel, inspectors from the Department of Labor and Industry, and others authorized by the Owner, shall have access to the Work at all times. The Contractor shall provide proper facilities for access and inspection.

22. SURVEYS AND LAYOUT

(a) The Owner shall furnish the Contractor all necessary documents showing property lines and the location of existing buildings and improvements. The Contractor shall provide competent surveying and engineering services to execute the Work in accordance with the Contract and shall be responsible for the accuracy of these surveying and engineering services.

(b) Such general reference points and benchmarks on the Site as will enable the Contractor to proceed with the Work will be established in the plans and specifications. If the Contractor finds that any previously established reference points have been lost or destroyed, he shall promptly notify the Architect/Engineer.

(c) The Contractor shall protect and preserve the established benchmarks and monuments and shall make no changes in locations without written notice to the Architect/Engineer and the written approval from the Owner. Any of these which may be lost or destroyed or which require shifting because of necessary changes in grades or locations shall, subject to prior written approval of the Owner, be replaced and accurately located by the Contractor.

23. PLANS AND SPECIFICATIONS

(a) The general character and scope of the Work are illustrated by the plans and the specifications. If the Contractor deems additional detail or information to be needed, he may request the same in writing from the Architect/Engineer. His request shall precisely state the detail or information needed and shall explain why it is needed. The Contractor shall also indicate a date when the requested information is required. The Architect/Engineer shall provide by Field Order such further detail and information as is necessary by the date required so long as the date indicated is reasonable. Any additional drawings and instructions supplied to the Contractor shall be consistent with the Contract Documents, shall be true developments thereof, and shall be so prepared that they can be reasonably interpreted as a part thereof. The Contractor shall carry out the Work in accordance with the additional detail drawings and instructions.

(b) If the Contractor finds a contract error, or other discrepancy in the plans or specifications, he shall notify the Architect/Engineer in writing as soon as possible, but before proceeding with the affected Work. The Architect/Engineer shall issue a clarification by Field Order to the Contractor stating the correct requirements. If the Contractor deems the Field Order requires additional Work, he shall notify the A/E of such prior to proceeding with that Work and he shall submit a request for Change Order along with a detailed substantiating cost proposal thru the A/E to the Owner within ten (10) calendar days.

(c) In case of differences between small and large scale drawings, the large scale drawings shall govern. Where on any of the drawings a portion of the Work is drawn out and the remainder is indicated in outline, the parts drawn out shall apply also to all other like portions of the Work.

(d) Where the word “similar” appears on the drawings, it shall be interpreted in its general sense and not as meaning identical, and all details shall be worked out in relation to their location and their connection with other parts of the Work.

(e) The specifications may be divided into several parts, or sections, for convenience only, since the entire specifications must be considered as a whole. The divisions of the specifications are not intended to control the Contractor in dividing the Work among Subcontractors or to limit the Work performed by any trade. The Contractor shall be solely responsible for the coordination of the trades, Subcontractors and vendors engaged in the Work.

(f) Measurements or dimensions shown on the drawings for Site features, utilities and structures shall be verified at the Site by the Contractor. The Contractor shall not scale measurements or dimensions from the drawings. If there are discrepancies, the Architect/Engineer shall be consulted. If new Work is to connect to, match with or be provided in existing Work, the Contractor shall verify the actual existing conditions and necessary dimensions prior to ordering or fabrication.

(g) As-Built Drawings: The Contractor shall maintain at the Site for the Owner one copy of all drawings, specifications, addenda, approved shop or setting drawings, Change Orders and other modifications (collectively referred to herein as "As-Built Drawings") in good order and marked to record all changes as they occur during construction. These shall be available to the Architect/Engineer, the Owner, the Project Inspector, the Owner's other inspectors and to the Owner's testing personnel. The drawings shall be neatly and clearly marked in color during construction to record all variations made during construction. The representation of such variations shall include such supplementary notes, symbols, legends, and details as may be necessary to clearly show the as-built construction. These As-Built Drawings are to be a separate set of drawings from the set of drawings used by the Contractor's superintendent or supervisor for every day management of the project.

(h) Record Drawings: Upon completion of the Work and prior to the final inspection, the Contractor shall deliver to the Architect/Engineer, for review and preparation of the Record Drawings, one complete set of "As-Built Drawings" referred to in the preceding subsection.

(i) Close-out and Operations and Maintenance Documents: Upon completion of the Work and prior to final payment, the Contractor shall deliver to the Architect/Engineer, two complete hard copy sets of the Close-out and Operations and Maintenance Documents as specified in the Project Manual Specifications. Additionally, the Contractor will provide two CDs or other acceptably formatted electronic copy of the abovementioned documents to accompany the hard copy versions. The electronic version will be organized with folders and appropriate hierarchy as to represent the hard copy versions. The documentation found on the electronic version will be in PDF format, or other acceptable format as directed by the Owner.

24. SUBMITTALS

(a) The Contractor shall submit a listing of all Submittals required by the Architect/Engineer or which the Contractor identifies as necessary, fixing the dates for the submission of shop or setting drawings, samples and product data. The listing shall be in a format acceptable to the Architect/Engineer. The Contractor shall identify all Submittals with the Owner's Project Title as required by Section 2(f). There will be no payments to the Contractor until a listing of all Submittals is submitted and approved by the Architect/Engineer and Owner.

(b) Submittals shall be forwarded to the Architect/Engineer for approval if required by the specifications or if requested by the Architect/Engineer or the Owner. No part of the Work dealt with by a Submittal shall be fabricated by the Contractor, save at his own risk, until such approval has been given.

(c) The Contractor shall furnish to the Architect/Engineer for approval the name of the manufacturer, the model number, and other identifying data and information respecting the performance, capacity, nature and rating of the machinery and mechanical and other equipment which the Contractor contemplates incorporating in the Work. When Submittals are required by this Contract for materials, the Contractor shall furnish full information concerning the material or articles which he contemplates incorporating in the Work. When required, samples shall be submitted for approval at the Contractor's expense, with all shipping charges prepaid. Machinery, equipment, material and articles installed or used without required approval shall be at the risk of subsequent rejection.

(d) The Owner prefers and encourages the Contractor to submit all shop drawings to the Architect/Engineer electronically. However, shop drawings may be submitted in the form of six (6) blue line or black line prints. Catalog cuts, product data and other non-reproducible literature, except certificates, shall be submitted in six (6) copies minimum, of which three (3) will be retained by the Architect/Engineer and the remainder will be returned to the Contractor.

(e) The Owner prefers and encourages the Contractor to submit all Submittals to the Architect/Engineer electronically. Submittals shall be accompanied by a letter of transmittal which shall list the Project Title, the Submittals included, the specification section number applicable to each, and the date shown on each Submittal. Submittals shall be complete in every respect and bound in sets if not submitted electronically. Each Submittal shall be clearly marked to show each item, component and/or optional feature proposed to be incorporated into the Project. Cross reference to the plans or specifications as needed to identify the use for which the item or component is intended.

(f) The Contractor shall check the Submittals for compliance with the requirements of the Contract Documents. The Contractor shall clearly note in writing any and all items which deviate from the requirements of the Contract Documents. Reasons for deviation shall be included with the Submittal. The Contractor shall be solely responsible for checking all dimensions and coordinating all materials and trades to ensure that the components or products proposed, individually or in combination, will fit in the space available and that they will be compatible with other components or products provided.

(g) After checking each submittal, the Contractor shall stamp each sheet of the Submittal with the Contractor's review stamp. Data submitted in a bound volume or on one sheet printed on two sides, may be stamped on the front of the first sheet only. The Contractor's review stamp shall be worded as follows:

> The equipment and material shown and marked in this submittal is that proposed to be incorporated into this Project, is in compliance with the Contract drawings and specifications unless otherwise shown in bold face type or lettering and listed on a page or pages headed "DEPARTURES FROM DRAWINGS AND SPECIFICATIONS", and can be installed in the allocated spaces.
>
> Reviewed by_____ Date_____

The person signing the review stamp shall be the person designated in writing by the Contractor as having that authority. (A copy of such designation shall be forwarded to the A/E prior to or with the first Submittal.) The signature on the stamped review statement shall be handwritten in ink, or in the case of electronic submittals, electronically signed in accordance with § 59.1-479 et seq. of the Code of Virginia. Stamped signatures are not acceptable.

(h) The Contractor shall forward all Submittals sufficiently in advance of construction requirements to allow reasonable time for checking, correcting, resubmitting and rechecking.

(i) If a Submittal indicates a departure from the Contract requirements, the Architect/Engineer may reject the Submittal or, if he deems it to have merit, may recommend it to the Owner, who shall approve or reject it as the Owner, in its sole discretion, sees fit. The departure from the Contract

requirements shall be further authorized by a Change Order, if a reduction or increase in the Contract Price is appropriate.

(j) The Architect/Engineer is responsible to the Owner, but not to the Contractor, to verify that the Submittals conform to the design concept and functional requirements of the plans and specifications, that the detailed design portrayed in shop drawings and proposed equipment and materials shown in Submittals are of the quality specified and will function properly, and that the Submittals comply with the Contract Documents.

(k) The Work shall be in accordance with approved Submittals. Approval of the Contractor's Submittals by the A/E does not relieve the Contractor from responsibility of complying with the Contract and all drawings and specifications, except as changed by Change Order.

(l) The plans and/or specifications may indicate that the Architect/Engineer designed or detailed a portion of the plans around a particular product (most commonly a piece of equipment). Should a different product be proposed by the Contractor and accepted, all modifications, rerouting, relocations and variations required for proper installation and coordination to comply with the design concept and requirements of the Contract Documents shall be the responsibility of the Contractor and shall be made at no extra cost to the Owner. If the plans were noted as designed or detailed around a particular product and/or if a product is named when a "brand name or equal" specification has been used, this is not intended to favor or preclude the use of other products pursuant to Section 26 of these General Conditions. Rather such design merely acknowledges the reality that in many instances the Architect/Engineer must have a basis to design and detail around for dimensions and characteristics of a product or system.

(m) Additional Submittal requirements may be shown in the specifications.

25. FEES, SERVICES AND FACILITIES

(a) The Contractor shall obtain all permits and pay for all fees and charges necessary for temporary access and public right-of-way blockage or use, for temporary connections to utilities and for the use of property (other than the Site) for storage of materials and other purposes unless otherwise specifically stated in the Contract Documents.

(b) Certain projects such as renovations and interior modifications of existing buildings will usually have water and electric service to the building. In those instances, water and electric power, if required for the Work under the Contract, will be furnished by the Owner subject to reasonable use by the Contractor, only to the extent and capacity of present services. The Contractor shall be responsible for providing required connections, temporary wiring, piping, etc. to these services in a safe manner and in accordance with applicable codes. All temporary wire, pipe, etc. shall be removed before the Substantial Completion inspection. Acceptance by the Contractor of the use of Owner's water and electricity constitutes a release to the Owner of all claims and of all liability to the Contractor for whatever damages which may result from power and water outages or voltage variations.

(c) The Owner shall pay any connection charges for permanent utility connections directly to the utility Supplier. The Contractor shall coordinate such connections with the utility Supplier.

(d) It is understood that, except as otherwise specifically stated in the Contract Documents, the Contractor, either directly or through his Subcontractors, shall provide and pay for all material, labor, tools, equipment, water, light, power, telephone and other services or facilities of every nature whatsoever necessary to execute completely and deliver the Work within the Contract Time for Completion or before the Contract Completion Date.

26. EQUALS

(a) **Brand names:** Unless otherwise stated in the specifications, the name of a certain brand, make or manufacturer denotes the characteristics, quality, workmanship, economy of operation and suitability for the intended purpose of the article desired, but does not restrict the Contractor to the specific brand, make, or manufacturer; it is set forth to convey to the Contractor the general style, type, character and quality of the article specified.

(b) **Equal materials, equipment or assemblies:** Whenever in these Contract Documents, a particular brand, make of material, device or equipment is shown or specified, such brand, make of material, device or equipment shall be regarded merely as a standard. Any other brand, make or manufacturer of a product, assembly or equipment which in the opinion of the Architect/Engineer is the equal of that specified, considering quality, capabilities, workmanship, configuration, economy of operation, useful life, compatibility with design of the Work, and suitability for the intended purpose, will be accepted unless rejected by the Owner as not being equal.

(c) **Substitute materials, equipment or assemblies:** The Contractor may propose to substitute a material, product, equipment, or assembly which deviates from the requirements of the Contract Documents but which the Contractor deems will perform the same function and have equal capabilities, service life, economy of operations, and suitability for the intended purpose. The proposal must include any cost differentials proposed. The Owner will have the A/E provide an initial evaluation of such proposed substitutes and provide a recommendation on acceptability and indicate the A/E's redesign fee to incorporate the substitution in the design. If the proposed substitute is acceptable to the Owner, a Change Order will be proposed to the Contractor to accept the substitute and to deduct the cost of the A/E redesign fee and the proposed cost savings from the Contract Price. The Owner shall have the right to limit or reject substitutions at its sole discretion.

(d) The Contractor shall be responsible for making all changes in the Work necessary to adapt and accommodate any equal or substitute product which it uses. The necessary changes shall be made at the Contractor's expense.

27. AVAILABILITY OF MATERIALS

If a brand name, product, or model number included in the Contract Documents is not available on the present market, alternate equal products or model numbers may be proposed by the Contractor through the Architect/Engineer for approval by the Owner. A letter from the manufacturer or representative of the manufacturer that states the specified brand name product or model number is no longer available is required.

28. CONTRACTOR'S TITLE TO MATERIALS

No materials or supplies for the Work shall be purchased by the Contractor, or by any Subcontractor or Supplier, subject to any security interest, installment or sales contract or any other agreement or lien by which an interest is retained by the seller or is given to a secured party. The Contractor warrants that he has clear and good title to all materials and supplies which he uses in the Work or for which he accepts payment in whole or in part.

29. STANDARDS FOR MATERIALS INSTALLATION & WORKMANSHIP

(a) Unless otherwise specifically provided in the Contract, all equipment, material, and accessories incorporated in the Work are to be new and in first class condition.

(b) Unless specifically approved by the Owner or required by the Contract, the Contractor shall not incorporate into the Work any materials known by the industry to be hazardous to the health of building construction workers, maintenance workers, or occupants (for example asbestos or lead paint). If the Contractor becomes aware that a material required by the Contract contains asbestos or other hazardous materials, he shall notify the Owner and the Architect/Engineer immediately and shall take no further steps to acquire or install any such material without first obtaining Owner approval.

(c) All workmanship shall be of the highest quality found in the building industry in every respect. All items of Work shall be done by craftsmen or tradesmen skilled in the particular task or activity to which they are assigned. In the acceptance or rejection of Work, no allowance will be made for lack of skill on the part of workmen. Poor or inferior workmanship (as determined by the Architect/Engineer, the Owner or other inspecting authorities) shall be removed and replaced at Contractor's expense such that the Work conforms to the highest quality standards of the trades concerned, or otherwise corrected to the satisfaction of the Architect/Engineer, the Owner, or other inspecting authority, as applicable.

(d) Under the various sections of the plans or specifications, where specified items are supplied with the manufacturer's printed instructions, recommendations, or directions for installation, or where such instructions, recommendations, or directions are available, installation of the specified items shall be in strict accordance with the manufacturer's printed instructions unless those instructions contradict the plans or specifications, in which case the Architect/Engineer will be notified for an interpretation and decision.

(e) Under the various sections of the plans or specifications, where reference is made to specific codes or standards governing the installation of specified items, installation shall in all cases be in strict accordance with the referenced codes and standards. Where no reference is made to specific codes or standards, installation shall conform to the generally recognized applicable standards for first-class installation of the specific item to be installed. Contractors are expected to be proficient and skilled in their respective trades and knowledgeable of the Codes and Standards of the National Fire Protection Association (NFiPA), National Electric Code (NEC), Occupational Safety and Health Act (OSHA) and other codes and standards applicable to installations and associated work by his trade.

(f) Where the manufacturer's printed instructions are not available for installation of specific items, where specific codes or standards are not referenced to govern the installation or specific items, or where there is uncertainty on the part of the Contractor concerning the installation procedures to be followed or the quality of workmanship to be maintained in the installation of specific items, the Contractor shall consult the Architect/Engineer for approval of the installation procedures or the specific standards governing the quality of workmanship the Contractor proposes to follow or maintain during the installation of the items in question.

(g) During and/or at the completion of installation of any items, the tests designated in the plans or specifications necessary to assure proper and satisfactory functioning for its intended purpose shall be performed by the Contractor or by its Subcontractor responsible for the completed installation. All costs for such testing are to be included in the Contract Price. If required by the Contract Documents, the Contractor shall furnish prior to final inspection the manufacturers' certificates evidencing that products meet or exceed applicable performance, warranty and other requirements, and certificates that products have been properly installed and tested.

30. WARRANTY OF MATERIALS AND WORKMANSHIP

(a) The Contractor warrants that, unless otherwise specified, all materials and equipment incorporated in the Work under the Contract shall be new, in first class condition, and in accordance with the Contract Documents. The Contractor further warrants that all workmanship shall be of the highest quality and in accordance with the Contract Documents and shall be performed by persons qualified at their respective trades.

(b) Work not conforming to these warranties shall be considered defective.

(c) This warranty of materials and workmanship is separate and independent from and in addition to any of the Contractor's other guarantees or obligations in the Contract or under Virginia law.

31. USE OF SITE AND REMOVAL OF DEBRIS

(a) The Contractor shall:

(1) Perform the Work in such a manner as not to interrupt or interfere with the operation of any existing activity on, or in proximity to, the Site or with the Work of any other separate contractor;

(2) Store his apparatus, materials, supplies and equipment in such orderly fashion at the Site of the Work as will not unduly interfere with the progress of his Work or the work of any other separate contractor; and

(3) Place upon the Work or any part thereof only such loads as are consistent with the safety of that portion of the Work.

(b) The Contractor expressly undertakes, either directly or through his Subcontractor(s), to effect all cutting, filling or patching of the Work required to make the same conform to the plans and specifications, and, except with the consent of the Architect/Engineer, not to cut or otherwise alter the Work of any other separate contractor. The Contractor shall not damage or endanger any portion of the Work or Site, including existing improvements, unless called for by the Contract.

(c) The Contractor expressly undertakes, either directly or through his Subcontractor(s), to clean up frequently all refuse, rubbish, scrap materials and debris caused by his operations, to the end that at all times the Site shall present a neat, orderly and workmanlike appearance. No such refuse, rubbish, scrap material and debris shall be left within the completed Work nor buried on the building Site, but shall be removed from the Site and properly disposed of in a licensed landfill or otherwise as required by law.

(d) The Contractor expressly undertakes, either directly or through his Subcontractor(s), before final payment or such prior time as the Owner may require, to remove all surplus material, false Work, temporary structures, including foundations thereof, plants of any description and debris of every nature resulting from his operations and to put the Site in a neat, orderly condition; to thoroughly clean and leave reasonably dust free all finished surfaces including all equipment, piping, etc., on the interior of all buildings included in the Contract; and to clean thoroughly all glass installed under the

Contract, including the removal of all paint and mortar splatters and other defacements. If the Contractor fails to clean up at the time required herein, the Owner may do so and charge the costs incurred thereby to the Contractor in accordance with Section 10(b) of these General Conditions.

(e) The Contractor shall have, on-site, an employee certified by the Department of Conservation and Recreation as a Responsible Land Disturber who shall be responsible for the installation, inspection and maintenance of erosion control and stormwater management measures and devices. The Contractor shall prevent Site soil erosion, the runoff of silt and/or debris carrying water from the Site, and the blowing of debris off the Site in accordance with the applicable requirements and standards of the Contract, the County of Albemarle's Water Protection Ordinance, and any Virginia water protection ordinances/codes and/or stormwater regulations. This would include covering of dumpsters during periods of precipitation to prevent any runoff to the stormwater system.

32. TEMPORARY ROADS

Temporary roads, if required, shall be established and maintained until permanent roads are accepted, then removed and the area restored to the conditions required by the Contract Documents. Crushed rock, paving and other road materials from temporary roads shall not be left on the Site unless permission is received from the Owner to bury the same at a location and depth approved by the Owner or leave in place as installed.

33. SIGNS

The Contractor may, at his option and without cost to the Owner, erect signs acceptable to the Owner on the Site for the purpose of identifying and giving directions to the job. No signs shall be erected without prior approval of the Owner as to design and location. The Contractor shall pay all fees required by Albemarle County.

34. PROTECTION OF PERSONS AND PROPERTY

(a) The Contractor expressly undertakes, both directly and through his Subcontractors, to take every reasonable precaution at all times for the protection of all persons and property which may come on the Site or be affected by the Contractor's Work.

(b) The Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Any violation of these requirements or duties or any potential safety hazard that is brought to the attention of the Contractor by the Architect/Engineer, the Owner, or any other persons shall be immediately abated.

(c) The provisions of all rules and regulations governing health and safety as adopted by the Safety Codes Commission of the Commonwealth of Virginia, issued by the Department of Labor and Industry under Title 40.1 of the Code of Virginia, shall apply to all Work under this Contract.

(d) The Contractor shall continuously maintain adequate protection of all his Work from damage and shall protect the Owner's property from injury or loss arising in connection with this Contract. He shall make good any such damage, injury or loss, except as may be directly and solely due to errors in the Contract Documents or caused by agents or employees of the Owner. The Contractor shall adequately protect adjacent property to prevent any damage to it or loss of use and enjoyment by its owners. The Contractor shall provide and maintain all passageways, guard fences, lights and other facilities for protection as required by public authority, local conditions, or the Contract.

(e) In an emergency affecting the health, safety or life of persons or of the Work, or of the adjoining property, the Contractor, without special instruction or authorization from the Architect/Engineer or the Owner, shall act, at his discretion, to prevent such threatened loss or injury. Also, should he, to prevent threatened loss or injury, be instructed or authorized to act by the Architect/Engineer or the Owner, he shall so act immediately, without appeal. Any additional compensation or extension of time claimed by the Contractor on account of any emergency work shall be determined as provided by Section 38 of these General Conditions.

(f) When necessary for the proper protection of the Work, temporary heating, cooling, humidification, or de-humidification of a type approved by the Architect/Engineer must be provided by the Contractor, at the Contractor's expense, unless otherwise specified.

35. CLIMATIC CONDITIONS

The Contractor shall suspend activity on and protect any portion of the Work that may be subject to damage by climatic conditions, including but not limited to, protection from precipitation, wind (including securing material and equipment that could become airborne), and extreme temperatures.

36. PAYMENTS TO CONTRACTOR

(a) Unless otherwise provided in the Contract, the Owner will make partial payments to the Contractor on the basis of a duly certified and approved Schedule of Values and Certificate for Payment, Form AC-12, showing the estimate of the Work performed during the preceding calendar month or work period, as recommended by the Architect/Engineer. When evaluating the Contractor's Form AC-12, the Architect/Engineer will consider the value of the Work in place, the value of approved and properly stored materials, the status of the Work on the critical path with regard to the Time for Completion, and the estimated value of the Work necessary to achieve Final Completion. The Architect/Engineer will schedule a monthly pay meeting. The Contractor will submit his monthly estimate of Work completed on Form AC-12 so that it is received by the Architect/Engineer and the Owner's Project Manager at least two work days prior to the date scheduled by the Architect/Engineer for the monthly pay meeting. The Owner will review the estimate with the Architect/Engineer and the Contractor at the monthly pay meeting, which shall be considered the receipt date, and may approve any or all of the estimate of Work for payment. In preparing estimates, the material delivered to the Site and preparatory Work done shall be taken into consideration, if properly documented as required by Section 20 of these General Conditions, or as may be required by the Architect/Engineer so that quantities may be verified. In addition to material delivered to the Site, material such as large pieces of equipment and items purchased specifically for the Project, but stored off the Site within the Commonwealth of Virginia, may be considered for payment, provided

all of the following are accomplished prior to the submission of the monthly payment request in which payment for such materials is requested:

(1) The Contractor must notify the Owner in writing, at least ten (10) days prior to the submission of the payment request, through the Architect/Engineer, that specific items will be stored off Site in a designated, secured place within the Commonwealth of Virginia. The Schedule of Values must be detailed to indicate separately both the value of the material and the labor/installation for trades requesting payment for stored materials. By giving such notification and by requesting payment for material stored off Site, the Contractor warrants that the storage location is safe and suitable for the type of material stored and that the materials are identified as being the property of the Contractor, and agrees that loss of materials stored off the Site shall not relieve the Contractor of the obligation to timely furnish these types and quantities of materials for the Project and meet the Time for Completion or Contract Completion Date, subject to Section 42(b) of these General Conditions. If the storage location is more than 20 miles from the Site, the Contractor may be required to reimburse the Owner for the cost incurred for travel to the storage location to verify the Contractor's request for payment for materials stored off Site.

(2) Such notification, as well as the payment request, shall:

(a) itemize the quantity of such materials and document with invoices showing the cost of said materials;

(b) indicate the identification markings used on the materials, which shall clearly reference the materials to the particular project;

(c) identify the specific location of the materials, which must be within reasonable proximity to the Site and within the Commonwealth of Virginia;

(d) include a letter from the Contractor's Surety which confirms that the Surety on the Performance Bond and the Labor and Material Payment Bond has been notified of the request for payment of materials stored off the Site and agrees that the materials are covered by the bond; and

(e) include a certificate of all-risk builder's risk insurance in an amount not less than the fair market value of the materials, which shall name the Owner and the Contractor as co-insured.

(3) The Architect/Engineer shall indicate, in writing, to the Owner that Submittals for such materials have been reviewed and meet the requirements of the Contract Documents, that the stored materials meet the requirement of the plans and specifications, and that such materials conform to the approved Submittals. Should the A/E deem it necessary to visit the storage site to make such review, the Contractor shall bear the costs incurred therewith.

(4) The Owner, through the Architect/Engineer, shall notify the Contractor in writing of its agreement to prepayment for materials.

(5) The Contractor shall notify the Owner in writing, through the Architect/Engineer, when the materials are to be transferred to the Site and when the materials are received at the Site.

(b) Payment will not be made for materials or equipment stored on or off the Site which are not scheduled for incorporation into the Work within the six months following submission of the request for payment, unless the Contractor has the prior consent of the Owner, which consent may be granted or withheld by the Owner in its discretion if, in the opinion of the Owner, it is not necessary to procure the materials more than six months in advance of use to assure their availability when needed.

(c) In making such partial payments, five percent (5%) of each payment to the Contractor shall be retained until Final Completion and acceptance of all Work covered by the Contract, unless otherwise provided by any law, regulation or program of the federal government. Such retainage shall be held to assure faithful performance of the Contract and may also be used as a fund to deduct amounts due to or claimed by the Owner, including, but not limited to, payment to the Owner of all monies due for deductive change orders, credits, uncorrected Defective Work, interest, damages, and the like. (§2.2-4333 of the Code of Virginia)

(d) All material and Work for which partial payments are made shall thereupon become the sole property of the Owner, but this provision shall not relieve the Contractor from the sole responsibility for all materials and Work, including those for which payment has been made, or for the restoration of any damaged materials or Work. Nor shall this provision serve as a waiver of the right of the Owner to require the fulfillment of all of the terms and conditions of the Contract.

(e) The final payment, which shall include the retainage, less any amounts due to or claimed by the Owner, shall not become due until the Architect/Engineer and the Owner agree that Final Completion has been achieved and until the Contractor shall deliver to the Owner through the Architect/Engineer a Certificate of Completion by the Contractor (Form AC-13.2) and an Affidavit of Payment of Claims (Form AC-13), stating that all Subcontractors and Suppliers of either labor or materials have been paid all sums claimed by them for Work performed or materials furnished in connection with this Project less retainage. Amounts due the Owner which may be withheld from the final payment may include, but are not limited to, amounts due pursuant to Section 3(i), Section 16(a)-(d), Section 31(d), costs incurred to repair or replace Defective Work, costs incurred as a result of the Contractor's negligent acts or omissions or omissions of those for whom the Contractor is responsible, delay damages under Section 42(h), and any liquidated or actual damages. If all Subcontractors and Suppliers of labor and materials have not been paid the full amount claimed by them, the Contractor shall list each to which an agreed amount of money is due or which has a claim in dispute. With respect to all such Subcontractors and Suppliers, the Contractor shall provide to the Owner, along with the Affidavit of Payment of Claims (Form AC-13), an affidavit from each such Subcontractor and Supplier stating the amount of their subcontract or supply contract, the percentage of completion, the amounts paid to them by the Contractor and the dates of payment, the amount of money still due if any, any interest due the Subcontractor or Supplier pursuant to Section 37(b) below, and whether satisfactory arrangements have been made for the payment of said amounts. If no agreement can be reached between the Contractor and one or more Subcontractors or Suppliers as to the amounts owed to the Subcontractors or Suppliers, the Owner may, in its discretion, pay such portion of the monies due to the Contractor which is claimed by the Subcontractor or Supplier into a Virginia Court or Federal Court sitting in Virginia, in the manner provided by law. Said payment into court shall be deemed a payment to the Contractor. Nothing in this Section shall be construed as creating any obligation or contractor relationship between the Owner and any Subcontractor or Supplier, and the

Owner shall not be liable to any Subcontractor or Supplier on account of any failure or delay of the Owner in complying with the terms hereof.

(f) Upon successful completion of the final inspection and all Work required by the Contract, including but not limited to the delivery of As-Built drawings, equipment manuals, written warranties, acceptance of the Work by the Owner and the delivery of the affidavits required in Section 36(e) of these General Conditions, the Architect/Engineer shall deliver the written Certificate of Completion by the Architect/Engineer (Form AC-13.1) to the Owner, with a copy to the Contractor, stating the entire amount of Work performed and compensation earned by the Contractor, including extra work and compensation therefor. The Owner may accept the Work for occupancy or use while asserting claims against the Contractor; disputing the amount of compensation due to the Contractor; disputing the quality of the Work, its completion, or its compliance with the Contract Documents; or any other reason.

(g) Unless there is a dispute about the compensation due to the Contractor, Defective Work, quality of the Work, compliance with the Contract Documents, completion itself, claims by the Owner, other matters in contention between the parties, or unless monies are withheld pursuant to Albemarle County's Debt Setoff Program, within thirty (30) days after receipt and acceptance of the Schedule of Values and Certificate for Payment (Form AC-12) in proper form by the Architect/Engineer at the monthly pay meeting, which shall be considered the receipt date, the Owner shall pay to the Contractor the amount approved by the Architect/Engineer, less all prior payments and advances whatsoever to or for the account of the Contractor. In the case of final payment, the completed Affidavit of Payment of Claims (Form AC-13), the Certificate of Completion by the Contractor (Form AC-13.2) and the Certificate of Completion by the Architect/Engineer (Form AC-13.1) shall accompany the final Schedule of Values and Certificate for Payment (Form AC-12) which is forwarded to the Owner for payment. The date on which payment is due shall be referred to as the Payment Date. In the event of disputes, payment shall be mailed on or before the Payment Date for amounts and Work not in dispute, subject to any set offs claimed by the Owner, provided however, in instances where further appropriations are required by the County of Albemarle or where the issuance of further bonds is required, in which case, payment shall be made within thirty (30) days after the effective date of such appropriation or within thirty (30) days after the receipt of bond proceeds by the Owner. All prior estimates and payments including those relating to extra Work may be connected and adjusted in any payment and shall be corrected and adjusted in the final payment. In the event that any request for payment by the Contractor contains a defect or impropriety, the Owner shall notify the Contractor of any defect or impropriety which would prevent payment by the Payment Date, within five (5) days after receipt of the Schedule of Values and Certificate for Payment (Form AC-12) by the Owner from the Architect/Engineer.

(h) Interest shall accrue on all amounts owed by the Owner to the Contractor which remain unpaid seven (7) days following the Payment Date. Said interest shall accrue at the discounted ninety-day U.S. Treasury bill rate as established by the Weekly Auction and as reported in the publication entitled The Wall Street Journal on the weekday following each such Weekly Auction. During the period of time when the amounts due to the Contractor remain unpaid following the seventh (7th) day after the Payment Date, the interest accruing shall fluctuate on a weekly basis and shall be that established by the immediately prior Weekly Auction. It shall be the responsibility of the Contractor to gather and substantiate the applicable weekly interest rates to the satisfaction of the Owner and to calculate to the satisfaction of the Owner the interest due. In no event shall the rate of interest charge exceed the rate of interest charged pursuant to §58.1-1812 of the Code of Virginia. No interest shall accrue on

retainage or when payment is delayed because of disagreement between the Owner and the Contractor regarding the quantity, quality or timeliness of the Work, including, but not limited to, compliance with Contract Documents or the accuracy of any Request for Payment received. This exception to the accrual of interest stated in the preceding sentence shall apply only to that portion of a delayed payment which is actually the subject of such a disagreement and shall apply only for the duration of such disagreement. Nothing contained herein shall be interpreted, however, to prevent the withholding of retainage to assure faithful performance of the Contract. These same provisions relating to payment of interest to the Contractor shall apply also to the computation and accrual of interest on any amounts due from the Contractor to the Owner for deductive change orders and to amounts due on any claims by the Owner. The date of mailing of any payment by the U.S. Mail is deemed to be the date of payment to the addressee.

(i) The acceptance by the Contractor of the final payment shall be and operate as a release to the Owner of all claims by the Contractor, its Subcontractors and Suppliers, and of all liability to the Contractor whatever, including liability for all things done or furnished in connection with this Work, except for things done or furnished which are the subject of unresolved claims for which the Contractor has filed a timely written notice of intent, provided a claim is submitted no later than sixty (60) days after final payment. Acceptance of any interest payment by the Contractor shall be a release of the Owner from claims by the Contractor for late payment.

(j) No certificate for payment issued by the Architect/Engineer, and no payment, final or otherwise, no certificate of completion, nor partial or entire use or occupancy of the Work by the Owner, shall be an acceptance of any Work or materials not in accordance with the Contract, nor shall the same relieve the Contractor of responsibility for faulty materials or Defective Work or operate to release the Contractor or his Surety from any obligation under the Contract, the Standard Performance Bond and the Standard Labor and Material Payment Bond.

37. PAYMENTS BY CONTRACTOR (§2.2-4354, Code of Virginia)

Under §2.2-4354, Code of Virginia, the Contractor is obligated to:

a. This is a construction contract under the VPPA. Therefore, Contractor shall pay all subcontractors in the manner provided in Virginia Code Section 2.2-4354(1).

b. Contractor shall pay all subcontractors in the manner provided in Virginia Code Section 2.2-4354(2-5).

38. CHANGES IN THE WORK

(a) The Owner may at any time, by written order utilizing the County of Albemarle Change Order Form AC-11, and without notice to the sureties, make changes in the Work which are within the general scope of the contract except that no change will be made which will increase the total Contract Price to an amount more than twenty-five percent (25%) in excess of the original Contract Price without notice to sureties. The Owner, at its discretion, may require the Contractor to provide evidence of current surety coverage based on approved changes in the work that result in a change in the total contract amount. At the time of the Preconstruction Meeting described in Section 49(b), the Contractor and the Owner shall advise each other of their designees authorized to accept and/or

approve changes to the Contract Price and of any limits to each designee's authority. Should any designee or limits of authority change during the time this Contract is in effect, the Contractor or Owner shall give written notice to the other within seven (7) calendar days, utilizing the procedures set forth in these General Conditions. The Contractor agrees and understands that the authority of the Owner's designee is limited by Virginia Code §2.2-4309 and any other applicable statute.

If the Contractor claims that any instructions given to him by the Architect/Engineer or by the Owner, by drawings or otherwise, involve extra Work which increases the scope of the Contract, then, except in emergencies endangering life or property, he shall give the Architect/Engineer and the Owner written notice thereof before proceeding to execute the Work. Said notice shall be given promptly enough to avoid delaying the Work and in no instance later than fourteen (14) days after the receipt of such instructions. Should it not be immediately clear to the Contractor that the change involves extra Work outside the scope of the Contract, written notice shall be sufficient if given as soon as possible after such realization, but in no event later than fourteen (14) days after the start of such Work. If the Owner agrees, a Change Order shall be issued as provided herein, and any additional compensation shall be determined by one of the four (4) methods provided herein, as selected by the Owner. Except as otherwise specifically provided, no claims for extra Work shall be allowed unless timely notice, as required by this Section, is given by the Contractor and unless such Work is performed pursuant to written Change Order. In making any change, the charge or credit for the change shall be determined by one of the following methods as selected by the Owner:

(1) **Fixed Price:** By a mutually agreed fixed amount change to the Contract Price and/or time allowed for completion of the Work. By using the Estimate for Change Order Forms GC-1, SC-1, and SS-1, respectively, the Change Order shall be substantiated by documentation itemizing the estimated quantities and actual costs of all labor, materials and equipment required as well as any markup used. The price change shall include the Contractor's overhead and profit. See Subsections (d) and (e) below.

(2) **Unit Price:** By using unit prices and calculating the number of net units of Work in each part of the Work which is changed, either as the Work progresses or before Work on the change commences, and by then multiplying the calculated number of units by the applicable unit price set forth in the Contract or multiplying by a mutually agreed unit price if none was provided in the Contract. No additional percentage markup for overhead or profit shall be added to the unit prices.

(3) **Unilateral:** If the Owner and Contractor are unable to agree that an item of Work or service constitutes a change, or that Contractor is entitled to additional compensation and/or an extension of time for such item of Work or service, the Contractor, upon receipt of a Unilateral Change Order, signed by the Owner, will promptly proceed with and expeditiously perform and/or supply the item of Work or service. If the parties are unable to agree on the amount of adjustment or schedule, the Owner will provide written notification to the Contractor of the adjustment the Owner considers appropriate. Such adjustment will be effective subject to Contractor's right to submit a claim as provided in Section 46. Any claim for an adjustment of compensation or schedule, or in opposition to an adjustment imposed by the Owner, will be submitted to the Owner in writing within seven (7) days of commencement of the event giving rise to such claim. The Contractor will submit to the Owner, in writing, the amount of the claim with supporting data within thirty (30) days of completion of the services or termination of the event for which it claims an adjustment.

(4) **Cost Reimbursement (Time and Materials):** In order to allow performance of services to proceed in a timely manner, the Owner may issue a written order for the Contractor to proceed with a change for additional work or service in anticipation of subsequently negotiating an agreeable adjustment of the Contractor's compensation and/or schedule. Upon completion of the Work, the Contractor, by using Estimate for Change Order Forms GC-1, SC-1, and SS-1, respectively, will present to the Owner, an accurate, itemized account of the cost of the change in the Work, including, but not limited to, the costs of labor, materials, equipment, and supplies; and to annotate a copy of the Project schedule to accurately show the status of the Work at the time this initial written order is issued, to show the start and finish of the changed Work, and the status of the Work when the changed Work is completed.

Except as otherwise may be agreed to in writing by the Owner, such costs shall not exceed those prevailing for the trades or crafts, materials, and equipment in the locality of the Project, may include only those items listed as allowable in Subsection 38(e), and shall not include any of the costs listed as not allowable in Subsection 38(f). The Owner shall be permitted, on a daily basis, to verify such records and may require such additional records as are necessary to determine the cost of the change to the Work.

Within fourteen (14) days of the conclusion of such ordered Work, the Contractor and the Owner shall arrive at a cost for the Change Order Request, based on the records kept and the Contractor's allowance for overhead and profit as set forth in Subsections (d), (e) and (f) below, and such costs shall be incorporated into a Change Order. If agreement on the cost of the changed Work cannot be reached within the fourteen (14) days allotted, the Contractor may file a claim for the disputed amount as provided for in Section 46.

(b) The Contractor shall review any Owner requested or directed change and shall respond in writing within fourteen (14) calendar days after receipt of the proposed change (or such other reasonable time as the Owner may direct), stating the effect of the proposed change upon his Work, including any increase or decrease in the Contract time and Price. The Contractor shall furnish to the Owner an itemized breakdown of the quantities and prices used in computing the proposed change in Contract Price.

The Owner shall review the Contractor's proposal and respond to the Contractor within thirty (30) days of receipt. If a change to the Contract Price and time for performance are agreed upon, both parties shall sign the Change Order. If the price and time are not agreed upon, the Owner may direct the Contractor to proceed under Subsection 38(a)(3) or 38(a)(4). Changes to the Contract time and/or Price shall be effective when signed by both parties, with the exception of a Unilateral Change Order that is only signed by the Owner.

(c) In figuring changes, any instructions for measurement of quantities set forth in the Contract shall be followed.

(d) The percentage for overhead and profit to be used in calculating both additive and deductive changes in the Work (other than changes covered by unit prices) shall not exceed the percentages for each category listed below. Said percentages for overhead and profit shall he applied only on the cost of the changed Work (i.e. difference in cost between original and revised Work):

(1) If a Subcontractor does all or part of the changed Work, the Subcontractor's markup for overhead and profit on the Work it performs shall be a maximum of ten percent (10%). The Contractor's markup on the subcontractor's price shall be a maximum of ten percent (10%).

(2) If the Contractor does all or part of the changed Work, its markup for overhead and profit on the changed Work it performs shall be a maximum of ten percent (10%).

(3) If a Sub-subcontractor at any tier does all or part of the changed Work, the Sub-subcontractor's markup on that Work shall be a maximum of ten percent (10%). The markup of a sub-subcontractor's Work by the Contractor and all intervening tiers of Subcontractors shall not exceed a total of ten percent (10%).

(4) Where Work is deleted from the Contract prior to commencement of that Work without substitution of other similar Work, one hundred percent (100%) of the Contract Price attributable to that Work shall be deducted from the Contract Price including applicable overhead costs and profit. However, in the event that material Submittals have been approved and orders placed for said materials, a lesser amount, but in no case less than eighty percent (80%) of the Contract Price attributable to that Work, shall be deducted from the Contract Price. The credit to the Owner for reduced premiums on labor and material bonds and performance bonds shall in all cases be one hundred percent (100%).

(e) Allowable costs for changes in the Work may include the following:

(1) Labor costs for employees directly employed in the change in the Work, including actual salaries and wages plus the cost of payroll charges and fringe benefits and overtime premiums, if such premiums are explicitly authorized by the Owner. "Billable" or "loaded" labor or wage rates will not be accepted.

(2) Materials incorporated into the change to the Work, including costs of transportation and storage, if applicable. If applicable, all cash discounts shall accrue to the Contractor, unless the Owner deposits funds with the Contractor to make such payments, and all trade discounts, rebates, refunds, and returns from the sale of surplus materials shall accrue to the Owner.

(3) Equipment incorporated in the changed Work or equipment used directly in accomplishing the Work. If rented expressly for accomplishing the change in the Work, the cost shall be the rental rate according to the terms of the rental agreement, which the Owner shall have the right to approve. If owned by the Contractor, the costs shall be a reasonable price based upon the life expectancy of the equipment and the purchase price of the equipment. If applicable, transportation costs may be included.

(4) Costs of increases in premiums for the Standard Labor and Material Payment Bond and the Standard Performance Bond, provided coverage for the cost of the change in the Work results in such increased costs. At the Owner's request, the Contractor shall provide proof of his notification to the Surety of the change in the Work and of the Surety's agreement to include such change in its coverage. The cost of the increase in premium shall be an allowable cost but shall not be marked up.

(5) Contractor and Subcontractor overhead costs as set forth in Subsection (d) markups above.

(6) If the change in the Work also changes the Time for Completion or Contract Completion Date by adding days to perform the Work, an itemized accounting of the following Site direct overhead expenses for the change to the time may be considered as allowable costs for compensation in addition to those shown above: The Site superintendent's prorata salary, temporary Site office trailer expense, and temporary Site utilities including basic telephone service, electricity, heat, water, and sanitary/toilet facilities. All other direct and indirect overhead expenses are considered covered by and included in the Subsection (d) markups above.

(7) Any other costs directly attributable to the change in the Work with the exception of those set forth below.

(f) Allowable costs for changes in the Work shall not include the following:

(1) Costs due to the negligence of the Contractor, any Subcontractor, Supplier, their employees or other persons for whom the Contractor is responsible, including, but not limited to, costs for the correction of Defective Work, for improper disposal of material, for equipment wrongly supplied, for delay in performing the Work, or for delay in obtaining materials or equipment.

(2) Home office expenses including payroll costs for the Contractor's officers, executives, administrators, project managers, accountants, counsel, engineers, timekeepers, estimators, clerks, and other similar administrative personnel employed by the Contractor, whether at the Site or in the Contractor's principal or branch office for general administration of the Work. These costs are deemed overhead included in the percentage markups allowable in Subsection (d) above.

(3) Home and field office expenses not itemized in Subsection 38(e)(6) above. Such items include, but are not limited to, expenses of Contractor's home and branch offices, Contractor's capital expenses, interest on Contractor's capital used for the Work, charges for delinquent payments, small tools, incidental job costs, meals, rent, utilities, telephone and office equipment, and other general overhead expenses.

(g) All Change Orders must state that the Contract Time for Completion or Contract Completion Date is not changed or is either increased or decreased by a specific number of days. The old Time for Completion and, if changed, the new Time for Completion must be stated.

If the Contractor requests an extension to the Time for Completion or a later Contract Completion Date, he must provide written justification for the extension to the Architect/Engineer and to the Owner. The written justification must demonstrate an anticipated actual increase in the time required to complete the Work beyond that allowed by the Contract as adjusted by prior change orders or amendments to the Contract, not just an increase or decrease in the time needed to complete some portion of the total Work. When a CPM schedule is required by the Contract, no extension to the Time for Completion or Contract Completion Date shall be allowed unless, and then only to the extent that, the additional or changed Work increases the length of the critical path beyond the Time for Completion or Contract Completion Date. If approved, the increase in time required to complete the Work shall be added to the Time for Completion or Contract Completion Date.

The Owner may decrease, by Change Order, the Time for Completion or Contract Completion Date when an Owner-requested deletion from the Work results in a decrease in the actual time required to complete the Work as demonstrable on the Bar Graph Schedule or on the CPM Schedule, whichever is appropriate. The Contractor may submit a request to decrease, by Change Order, the Time for Completion or Contract Completion Date under the procedures and subject to the considerations set forth in Section 19(g). No request for such decrease shall be considered for approval unless the proposed shorter schedule is otherwise acceptable under Sections 19(b) or (c), whichever is applicable. The Change Order decreasing the Time for Completion or changing the Contract Completion Date must be signed by both the Owner and the Contractor.

With the exception of Change Orders under Subsection 38(a)(4), which shall arrive at a change to the Contract Price and any change to time using the procedures set forth therein, each Change Order shall include all time and monetary impacts of the change, whether the Change Order is considered alone or with all other changes during the course of the Project. Failure to include a change to time and Contract Price in Section 38(a)(1) or (2) Change Orders shall waive any change to the time and Contract Price unless the parties mutually agree in writing to postpone a determination of the change to time and price resulting from the Change Order. Such a determination may be postponed not more than forty-five (45) days to give the Contractor an opportunity to demonstrate a change in the time and price needed to complete the Work. During any such postponement, the Work shall proceed, unless the Owner agrees otherwise.
If at any time there is a delay in the critical path of the Work due to postponement, due to the Contractor's efforts to justify an extension of the time or an increase in the Contract Price, or due to the Contractor's refusal to proceed with any of the Work, pending agreement on a change in time or price, such delay and any Contractor costs resulting from it shall not serve as the basis for the extension of the Time for Completion or Contract Completion Date or for an increase in the Contract Price.

(h) The acceptance by the Contractor of any payment made by the Owner under a Change Order shall be and operate as a release to the Owner of all claims by the Contractor and of all liability owing to the Contractor for all things done or furnished in connection with the Work described in the Change Order. The execution of any Change Order by the Owner shall not be an acceptance of any Work or materials not in accordance with the Contract Documents, nor shall it relieve the Contractor of responsibility for faulty materials or workmanship or operate to release the Contractor or his surety from any obligation arising under the Contract or the Standard Performance Bond or Standard Labor and Material Payment Bond.

(i) Payments will not be made for any Work, labor or materials on a fixed price, unit price or Subsection 38(a)(4) basis until the Contractor has furnished the Owner documents, certified as true and correct by an authorized officer or agent of the Contractor, evidencing the cost of such Work, labor and materials. The Owner may require any or all of the following documentation to be provided by the Contractor:

(1) certified payroll records showing the name, classification, date, daily hours, total hours, rate, and extension for each laborer, foreman, supervisor or other worker;

(2) equipment type & model, dates, daily hours, total hours, rental rate or other specified rate, and extension for each unit of equipment;

(3) invoices for materials showing quantities, prices, and extensions;

(4) daily records of waste materials removed from the Site and/or fill materials imported to the Site;

(5) certified measurements of over excavations, piling installed and similar work; and/or

(6) transportation records for materials, including prices, loads, and extensions.

Requests for payment shall be accompanied and supported by invoices for all materials used and for all transportation charges claimed. If materials come from the Contractor's own stock, then an affidavit may be furnished, in lieu of invoices, certifying quantifies, prices, etc. to support the actual cost.

39. CONTRACTOR'S RIGHT TO STOP WORK OR TERMINATE THE CONTRACT

If the Work should be stopped under an order of any court or other public authority for a period of ninety (90) days through no fault of the Contractor or anyone employed by him, or if the Owner should fail to pay to the Contractor within sixty (60) days any sum certified by the Architect/Engineer when no dispute exists as to the sum due or any provision of the Contract, then the Contractor may, upon ten (10) calendar days written notice to the Owner and the Architect/Engineer, stop Work or terminate the contract and recover from the Owner payment for the cost of the Work actually performed, together with overhead and profit thereon, but profit on the Work performed shall be recovered only to the extent that the Contractor can demonstrate that he would have had profit on the entire Contract if he had completed the Work. The Contractor may not receive profit or any other type of compensation for parts of the Work not performed. The Contractor may recover the reasonable cost of physically closing down the Site, but no other costs of termination. The Owner may offset any claims it may have against the Contractor against the amounts due to the Contractor. In no event shall termination of the Contract by the Contractor terminate the obligations of the Contractor's surety on its payment and performance bonds.

40. OWNER'S RIGHT TO STOP WORK OR TERMINATE THE CONTRACT FOR CAUSE

(a) If the Contractor should be adjudged as bankrupt, or if he should make a general assignment for the benefit of his creditors, or if a receiver should be appointed on account of his insolvency, the Owner may stop work or terminate the Contract. If the Contractor should refuse or should repeatedly fail, except in cases for which extension of time is provided, to supply enough properly skilled workmen or proper materials and equipment, or if he should fail to make prompt payment to Subcontractors or Suppliers of material or labor, or if he should disregard laws, ordinances or the written instructions of the Architect/Engineer or the Owner, or otherwise be in substantial violation of any provision of the Contract, then the Owner may stop work or terminate the Contract.

(b) Prior to termination of the Contract, the Owner shall give the Contractor and his surety ten (10) calendar days written notice pursuant to Section 1 ("Notice") of these General Conditions, during which the Contractor and/or his surety may rectify the basis for the notice. If rectified to the satisfaction of the Owner within said ten (10) days, the Owner may rescind its notice of termination. If not, the termination for cause shall become effective at the end of the ten (10) day notice period.

In the alternative, the Owner may, in writing, postpone the effective date of the termination for cause, at its sole discretion, if it should receive reassurances from the Contractor and/or its surety that the basis for the termination will be remedied in a time and manner which the Owner finds acceptable. If at any time after such postponement, the Owner determines that Contractor and/or its surety has not or is not likely to rectify the causes of termination in an acceptable manner or within the time allowed, then the Owner may immediately terminate the Contract for cause, without the necessity of further ten (10) day notice, by notifying the Contractor and his surety in writing of the termination. In no event shall termination for cause terminate the obligations of the Contractor's surety on its payment and performance bonds.

(c) Upon termination of the Contract, the Owner shall take possession of the Site and of all materials, tools and equipment thereon and finish the Work by whatever method he may deem expedient. In such case the Contractor shall not be entitled to receive any further payment. If the expense of finishing the Work, including compensation for additional managerial and administrative services, shall exceed the unpaid balance of the Contract Price, the Contractor shall pay the difference to the Owner, together with any other expenses of terminating the Contract and having it completed by others.

(d) If it should be judicially determined that the Owner improperly terminated this Contract for cause, then the termination shall be deemed to be a termination for the convenience of the Owner.

(e) Termination of the Contract under this Section is in addition to and without prejudice to any other right or remedy of the Owner. Any actions by the Owner permitted herein shall not be deemed a waiver of any other right or remedy of the Owner under the Contract or under the law. The Owner may offset any claims it may have against the Contractor against the amounts due to the Contractor. The provisions of this Section shall survive termination of the Contract.

41. TERMINATION BY OWNER FOR CONVENIENCE

(a) Owner may terminate this Contract, in whole or in part, at any time without cause upon giving the Contractor written notice of such termination pursuant to Section 1 ("Notice") of these General Conditions. Upon such termination, the Contractor shall immediately cease Work and remove from the Site all of its labor forces and such of its materials as Owner elects not to purchase or to assume in the manner hereinafter provided. Upon such termination, the Contractor shall take such steps as Owner may require to assign to the Owner the Contractor's interest in all Subcontracts and purchase orders designated by Owner. After all such steps have been taken to Owner's satisfaction, the Contractor shall receive as full compensation for termination and assignment the following:

(1) All amounts then otherwise due under the terms of this Contract;

(2) Amounts due for Work performed in accordance with the Contract subsequent to the latest approved Schedule of Values and Certificate for Payment (Form AC-12) through the date of termination;

(3) Reasonable compensation for the actual cost of demobilization incurred by the Contractor as a direct result of such termination. The Contractor shall not be entitled to any compensation or damages for lost profits or for any other type of contractual compensation or damages other

than those provided by the preceding sentence. Upon payment of the foregoing, Owner shall have no further obligations to Contractor of any nature.

(b) In no event shall termination for the convenience of the Owner terminate the obligations of the Contractor's surety on its payment and performance bonds.

42. DAMAGES FOR DELAYS; EXTENSION OF TIME

(a) If the Contractor is delayed at any time in the progress of the Work by any act or omission of the Owner, its agents or employees or any separate independent contractor of the Owner, and the act or omission is the result of or is necessitated by causes outside the Owner's control; or if the Contractor is delayed by strikes, fires, unusual delays in transportation or unavoidable casualties, or other causes outside the Owner's or Contractor's control, the Contractor shall give the Owner and Architect/Engineer written notice within five (5) days of the inception of the delay. The Owner shall extend the time for Substantial Completion or Final Completion, as the case may be, for the length of time that the Substantial Completion or Final Completion of the Work was actually delayed thereby, and the Contractor shall not be charged with liquidated or actual damages for delay during the period of such extension nor shall the Contractor be due compensation or damages of any kind, under any theory of law, as a result of such delay, the impact of such delay, or acceleration of Work as a result of such delay. In the event a CPM schedule is required by the Contract, no extension of the time allowed for Substantial Completion shall be granted unless the Contractor demonstrates a delay in the critical path of the approved CPM schedule or approved bar graph schedule.

(b) If the Contractor is delayed at any time in the progress of the Work by any act or omission of the Owner, its agents or employees, due to causes within their control, or delayed by the Owner's separate, independent contractors, when such delay results from causes within the Owner's control, and the Contractor intends to seek additional compensation for damages, if any, caused by the delay, the Contractor shall inform the Owner and the Architect/Engineer immediately at the time of the occurrence giving rise to the delay by the fastest means available and shall give written notice no later than five (5) days after inception of the delay. The Contractor's notice to the Owner shall specify the nature of the delay claimed by the Contractor, the cause of the delay and the impact of the delay on the Contractor's Work schedule. The Owner shall then have five (5) days to respond to the Contractor's notice with a resolution, remedy or direction to alleviate the delay or with a notice rejecting the claim for delay alleged to be caused by the Owner or parties for whom the Owner is responsible. If the issue is not then resolved, the Contractor may submit a request for Change Order in accordance with Section 38 or submit a claim as provided for in Section 46. The Contractor shall only be entitled to additional compensation if the delay was unreasonable and was caused solely by acts or omissions of the Owner, its agents or employees, due to causes within their control, or was caused by the Owner's separate, independent contractor, when such delay resulted solely from causes within the Owner's control.

(c) The Contractor shall not be entitled to an extension of the Time for Completion or Contract Completion Date or to any additional compensation for delays caused by acts or omissions of the Contractor due to causes within his control, including, but not limited to, delays resulting from Defective Work including workmanship and/or materials, from rejected work which must be corrected before dependent work can proceed, from Defective Work or rejected work for which

corrective action must be determined before like work can proceed, or from incomplete, incorrect or unacceptable submittals or samples.

(d) No extension of time or additional compensation, if applicable, will be granted for any delay unless the claimed delay directly affects the critical path of the approved CPM schedule or the schedule shown on the approved bar graph schedule, whichever is applicable, and any float has been consumed. No extension of time or additional compensation shall be given for a delay if the Contractor failed to give notice in the manner and within the time prescribed in Subsections (a) or (b) above, whichever applies. Furthermore, no extension of time or additional compensation shall be given for any delay unless a claim therefor is made in writing to the Owner, with a copy to the Architect/Engineer, within twenty (20) days of the end of the delay. The claim shall state the cause of the delay, the number of days of extension requested and any compensation requested by the Contractor. The Contractor shall report the termination of the delay to the Owner and Architect/Engineer not less than ten (10) days after such termination. Failure to give notice of either the inception or the termination of the cause of delay or failure to present a claim for extension of time and/or monetary compensation within the times prescribed shall constitute a waiver of any claim for extension or additional compensation based upon that cause.

(e) Requests for compensation for delays pursuant to Subsection (b) above must be substantiated by itemized data and records clearly showing that the Work delayed was on the critical path of the **approved** CPM schedule or on the sequence of Work on the **approved** bar graph schedule, as modified, and that the additional costs incurred by the Contractor are directly attributable to the delay in the Work claimed. Furthermore, compensation for delay shall be calculated from the contractual Time for Completion or Contract Completion Date, as adjusted by Change Order, and shall not be calculated based on any early completion planned or scheduled by the Contractor, unless a Change Order has been executed pursuant to Section 19(g) changing the Time for Completion or the Contract Completion Date to reflect such early completion. See Section 19 for procedures for the Contractor to follow if he plans early completion of the Work and wishes to request a Change Order reflecting the early completion date.

If there is an extension in the Time for Completion or the Contract Completion Date and if the Contractor is entitled to compensation under Subsection 42(b), and where there is no change in the Work, an itemized accounting of the following direct Site overhead expenses will be considered as allowable costs to be used in determining the compensation due the Contractor:

> Site superintendent prorata salary, temporary Site office expense, temporary Site facilities, and temporary Site utilities including basic telephone service, electricity, heat, water, and sanitary/toilets. A ten percent (10%) markup of these expenses will be allowed to compensate the Contractor for home office and other direct or indirect overhead expenses.

(f) If the Contractor submits a claim for delay damages pursuant to Subsection 42(b) above, the Contractor shall be liable to the Owner for a percentage of all costs incurred by the Owner in investigating, analyzing, negotiating and litigating the claim, which percentage shall be equal to the percentage of the Contractor's total delay claim that is determined through litigation to be false or to have no basis in law or in fact. (§2.2-4335(C), Code of Virginia.)

(g) Any change in the Contract Time for Completion or Contract Completion Date shall be accomplished only by issuance of a Change Order.

(h) If the Contractor fails to complete the Work within the Time for Completion or the Contract Completion Date, the Contractor shall be liable to the Owner in the amounts set forth in the Supplemental General Conditions, if any, not as a penalty, but as fixed, agreed and liquidated damages for delay until the Work is substantially or finally completed as the case may be. If liquidated damages are not so fixed in the Supplemental General Conditions, the Contractor shall be liable for any and all actual damages sustained as a result of delay. In addition to damages for delay, whether liquidated or actual, the Contractor shall also be liable for any and all actual damages sustained by the Owner as a result of any other breach of the Contract, including, but not limited to, Defective Work and abandonment of the Contract.

(i) If liquidated damages are provided by the Supplemental General Conditions, the following provisions apply:

(1) If the Work is not substantially complete by the Time for Completion or Contract Completion Date, the Contractor shall owe to the Owner, not as a penalty but as Step One liquidated damages, the sum stated in the Supplemental General Conditions for Step One liquidated damages for each and every partial or total calendar day of delay in Substantial Completion.

(2) Once the Work is substantially complete, the accrual of Step One liquidated damages shall cease and the Contractor shall have thirty (30) calendar days, unless otherwise specified in the Contract Documents, in which to achieve Final Completion of the Work.

(3) If Final Completion of the Work is not achieved on or before the thirtieth (30th) calendar day, or the date specified in the Contract Documents, after Substantial Completion, and if the Owner has not granted any extension of time, the Contractor shall owe to the Owner, not as a penalty but as Step Two liquidated damages, the sum stated in the Supplemental General Conditions as Step Two liquidated damages for each and every partial or total calendar day of delay in Final Completion.

43. INSPECTION FOR SUBSTANTIAL COMPLETION & FINAL COMPLETION

(a) The Contractor shall notify the Owner, in writing on the Certificate of Partial or Substantial Completion by the Contractor (Form AC-13.2a), of the date when the Work or designated portion thereof, will be, in his opinion, substantially complete and ready for inspection and testing to determine if it has reached Substantial Completion. The notice shall be given at least ten (10) days in advance of said date and shall be forwarded through the Architect/Engineer, who will attach his written endorsement as to whether or not he concurs with the Contractor's statement that the Work will be ready for inspection and testing on the date given. The Architect/Engineer's endorsement is a convenience to the Owner only and shall not relieve the Contractor of his responsibility in the matter nor shall the Architect/Engineer's endorsement be deemed to be evidence that the Work was substantially complete and ready for inspection and testing. Inspection and testing shall take place at a time(s) mutually agreeable to the Contractor, Owner and Architect/Engineer.

The inspection shall include a demonstration by the Contractor that all equipment, systems and operable components of the project function properly and in accordance with the Contract Documents. The Contractor shall furnish access for the inspection and testing as provided in Section 21 of these General Conditions. The inspection and testing shall determine whether Substantial Completion has been accomplished and shall result in a written list of unfinished Work and Defective Work, commonly referred to as a "punch list", which must be finished and corrected to obtain Final Completion.

After successful completion of the testing and the Architect/Engineer determines that, in its opinion, the Work, either in whole or in part, is substantially complete, the Architect/Engineer shall notify the Owner, in writing on the Certificate of Partial or Substantial Completion by the Architect/Engineer (Form AC-13.1a), that the Work, or a specified portion thereof, is recommended to be declared substantially complete. The Owner shall notify the Contractor, in writing, of the date the Owner accepts the Work, or the specified portion thereof, as substantially complete or the Owner shall notify the Contractor of the deficiencies to be corrected or completed before such Work will be accepted as substantially complete.

(b) The Contractor shall notify the Owner, in writing on the Certificate of Completion by the Contractor (Form AC-13.2), of the date when the Work has reached or will reach Final Completion and will be ready for final inspection and testing. The notice shall be given at least five (5) days in advance of said date and shall be forwarded through the Architect/Engineer, who will attach his endorsement as to whether or not he concurs in the Contractor's statement that the Work will be ready for inspection and testing on the date given. That inspection and any necessary testing shall be conducted in the same manner as the inspection for Substantial Completion. When the Work is finally and totally complete, including the elimination of all defects, and the Owner has received all project close-out deliverables, the Work shall be finally accepted by the Owner and final payment shall be made in accordance with Section 36 of these General Conditions.

(c) The Architect/Engineer shall conduct the inspections. The Owner may elect to have other persons of its choosing also participate in the inspections. If one or more Substantial or Final Completion reinspections are required, the Contractor shall reimburse the Owner for all costs of reinspection or, at the Owner's option, the costs may be deducted from payments due to the Contractor.

(d) A representative of the local Building Official will either be present at the Substantial and Final Completion inspections or otherwise inspect the completed Work and advise the Owner whether the Work meets the requirements of the applicable building code(s).

(e) Approval of Work at or as a result of any inspection required herein shall not release the Contractor or his surety from responsibility for complying with the Contract.

44. GUARANTEE OF WORK

(a) Except as otherwise specified, all Work shall be, and is hereby, guaranteed by the Contractor against defects resulting from the use of materials, equipment or workmanship, which are defective, inferior, or not in accordance with the terms of the Contract, for one (1) year from the date of Final Completion of the entire Project by the Owner. Equipment and facilities which have seasonal limitations on their operation (e.g. heating or air conditioning units) shall be guaranteed for one (1) full year from the

date of seasonally appropriate tests and acceptance, in writing, by the Owner. Where the Owner agrees to take Beneficial Occupancy of a portion or phase of the Work which has been determined to be substantially complete before the entire Work is finally completed, the guarantees for the materials, equipment and workmanship in that portion or phase shall begin on the date that the Owner takes Beneficial Occupancy, unless otherwise specified in the Supplemental General Conditions, Special Conditions, or by separate agreement.

(b) Unless the Owner approves otherwise, the warranty period for new equipment shall begin with the contract substantial completion date, regardless of whether the Contractor has used said equipment in the performance, installation, or application of the Work.

(c) If, within any guarantee period, Work which is not in accordance with the Contract, Defective Work, or inferior material, equipment or workmanship is noted by the Owner or Architect/Engineer which requires or renders necessary repairs or changes in connection with the guaranteed Work, the Contractor shall, promptly upon receipt of notice from the Owner, such notice being given not later than two weeks after the guarantee period expires, and without expense to the Owner:

(1) Place in satisfactory condition in every particular all of such guaranteed Work and correct all defects, inferior materials, equipment or workmanship therein;

(2) Make good all damage to the structure or Site or equipment or contents thereof, which, in the opinion of the Owner or the Architect/Engineer, is the result of the use of materials, equipment or workmanship which are inferior, defective or not in accordance with the terms of the Contract; and

(3) Make good any Work or materials or the equipment and contents of structures and/or Site disturbance that results from fulfilling the provisions of this Section.

(d) In any case, when in fulfilling the requirements of the Contract and this guarantee or any other guaranty or warranty, the Contractor disturbs any work performed by a separate contractor, he shall restore such work to a condition satisfactory to the Architect/Engineer and Owner and guarantee such restored work to the same extent as if it was guaranteed under this Contract.

(e) If the Contractor, after notice, fails to proceed promptly to comply with the terms of the guarantee as set forth in this Section, the Owner may have the defects or inferior materials, equipment or workmanship corrected and the Contractor and his surety shall be liable for all expense incurred.

(f) All special warranties and guarantees applicable to definite parts of the Work that may be stipulated in or required by the Contract Documents shall be subject to the terms of this Section during the first year of the life of such special warranty or guarantee.

(g) The guarantee of this Section shall be in addition to and not in lieu of all other warranties, express or implied, applicable to or arising from this Contract or by law.

(h) Nothing contained in this Section shall be construed to establish a period of limitation with respect to any other obligation which the Contractor might have under the Contract Documents, including liability for Detective Work under Section 30. This Section relates only to the specific obligation of the Contractor as set forth in this Section to correct the Work and does not limit the time within which

his obligation to comply with the Contract Documents may be sought to be enforced, nor the time within which proceedings may be commenced to establish the Contractor's liability with respect to his other obligations under the Contract Documents.

(i) In the event the Work of the Contractor is to be modified by another contractor, either before or after the Final Inspection provided by Section 43 of the General Conditions, the first Contractor shall remain responsible in all respects under this Section's Guarantee of Work and under any other warranties or guarantees, express or implied, applicable to or arising from this Contract or by law. However, the Contractor shall not be responsible for any defects in material or workmanship introduced by the contractor modifying his Work. The first Contractor and the contractor making the modifications shall each be solely responsible for his respective work. The contractor modifying the earlier Work shall be responsible for any damage to or defect introduced into the Work by his modification. If the first contractor claims that a subsequent contractor has introduced defects of materials and/or workmanship into his Work, it shall be the burden of the contractor making the claim to demonstrate clearly the nature and extent of such introduced defects and the other contractor's responsibility for those defects. Any contractor modifying the work of another shall have the same burden if he asserts that defects in his work were caused by the contractor whose work he is modifying.

45. ASSIGNMENTS OF CONTRACTUAL OBLIGATIONS

Neither party to the Contract shall assign the Contract in whole or any part without the written consent of the other, nor shall the Contractor assign any monies due or to become due to him hereunder, without the prior written consent of the Owner. No assignment shall relieve any party from its obligations under the Contract.

46. CONTRACTUAL DISPUTES (§2.2-4363, Code of Virginia)

Contractual claims, whether for money or for other relief, shall be submitted, in writing, no later than sixty (60) days after final payment; however, written notice of the Contractor's intention to file such claim must be given at the time of the occurrence or beginning of the Work upon which the claim is based. The filing of a timely notice is a prerequisite to recovery under this Section. Although the Contractor may be required to submit certain classes of claims prior to final payment, and the Contractor is not prevented from filing claims during the pendency of the Work, the Owner shall not be obligated to render a final written decision on any claim until after final payment. All claims shall be submitted along with all practically available supporting evidence and documentation.

No written decision denying a claim or addressing issues related to the claim, if rendered prior to final payment, shall be considered a denial pursuant to this Section unless the written decision makes express reference to this Section and is signed by the Owner or his designee. The Contractor may not institute legal action prior to receipt of the Owner's final written decision on the claim unless the Owner fails to render such a decision within ninety (90) days of submission of the claim or within ninety (90) days of final payment, whichever is later.

The decision of the Owner shall be final and conclusive unless the Contractor within six (6) months of the date of the final decision on a claim, initiates legal action as provided in §2.2-4364 of the Code of Virginia. Failure of the Owner to render a decision within 90 days shall not result in the Contractor being awarded the relief claimed nor shall it result in any other relief or penalty. The sole result of the Owner's failure to render a decision within 90 days shall be the Contractor's right to immediately institute legal action. No administrative appeals procedure pursuant to §2.2-4365 of the Code of Virginia has been established for contractual claims under this Contract. Venue for any litigation arising hereunder shall be in the Circuit Court for the County of Albemarle, Virginia.

47. ASBESTOS

(a) This subsection applies to projects involving existing buildings where asbestos abatement is not a part of the Work, when the scope of the project has been reviewed and a comprehensive survey conducted by an individual licensed by the Virginia Department of Professional and Occupational Regulation to conduct building inspections for asbestos containing materials in buildings, and where the Owner has attempted to remove or encapsulate all asbestos containing material that may become friable or damaged during this Project.

Prior to commencement of Work, the results of the comprehensive survey or any other asbestos survey shall be made available to the Contractor, who shall be responsible for performing his Work

so as not to disturb any remaining asbestos, encapsulated or otherwise, identified in such survey or surveys.

If the Contractor discovers or inadvertently disturbs any material that he knows, should have known or has reason to believe, may contain asbestos that has not been previously identified, was overlooked during the removal, was deemed not to be friable or was encapsulated, the Contractor shall stop Work in the area containing or suspected to contain the asbestos, secure the area, and notify the Owner and the Architect/Engineer immediately by telephone or in person with written notice as soon as possible. The Owner will have the suspect material sampled.

If the sample is positive and must be disturbed in the course of the Work, the Owner shall have the material repaired or removed and shall pay for the bulk sample analysis.

Except as provided in §11-4.1 of the Code of Virginia, if the material disturbed is not within the Contractor's authorized Work and/or Work area or under this Contract, the Contractor shall pay for all associated sampling and abatement Costs.

(b) If asbestos abatement is included as a part of the Work, the Contractor shall assure that the asbestos abatement work is accomplished by those duly licensed as described in Section 3 of these General Conditions and in accordance with the specific requirements of the Contract and all applicable laws and regulations.

(c) If asbestos abatement is included as part of the Work, the licensed asbestos Subcontractor shall obtain the insurance required under Section 11(e) of these General Conditions.

48. TRAINING, OPERATION AND MAINTENANCE OF EQUIPMENT

(a) As a part of the Work, the Contractor in conjunction with his Subcontractors and Suppliers shall provide the Owner's operations and maintenance personnel with adequate instruction and training in the proper operation and maintenance of any equipment, systems, and related controls provided or altered in the Work. The training requirements may be further defined in the specifications.

(b) The Contractor shall provide the Owner with a minimum of two (2) copies of operating, maintenance and parts manuals for all equipment and systems provided in the Work. Further specific requirements may be indicated in the specifications.

49. PROJECT MEETINGS

(a) The intention of this Section is that the Contractor, the Owner and the A/E have timely exchange of information and cooperate to accomplish the Work as required by the Contract Documents. The Contractor is responsible for managing the Work, obtaining approvals and requesting clarifications on a timely, reasonable basis. The Owner and its A/E are responsible for making a reasonable effort to provide timely responses to the Contractor.

(b) **Preconstruction Meeting:**

Prior to the start of construction and no later than 15 calendar days after the Notice to Proceed, a "Preconstruction" meeting shall be held with attendees to include the Owner's Project Manager and Project Inspector, the Architect/Engineer's project manager and representatives of each design discipline involved in the Project, the Contractor's project manager and superintendent (and scheduler, if Contractor desires), and representatives of the Contractor's major Subcontractors. The purpose of the meeting is to clarify and discuss the specifics related to, but not limited to, the following:

(1) Persons involved from each entity and their chain of authority including the names of persons authorized to sign Change Orders and any limits to their authority.

(2) Names, addresses, telephone numbers, FAX numbers, and email addresses to be used for Requests for Information (RFI), Requests for Clarification (RFC), Requests for Proposals (RFP), shop drawings, submittals, and notices.

(3) Contractor's proposed construction schedule and Owner's sequencing requirements, if any.

(4) Schedule of Values and Certificate for Payment (Form AC-12) requirements and procedures.

(5) Procedures for shop drawings, product data and Submittals.

(6) Procedures for handling Field Orders and Change Order Form AC-11.

(7) Procedures for Contractor's request for time extension, if any.

(8) Construction Site requirements, procedures and clarifications to include:
- Manner of conducting the Work presentation to be done by members of the project team, preferably Contractor's superintendent and project manager.
- Site specialties such as dust and erosion control, stormwater management, project signs, clean up and housekeeping, temporary facilities, utilities, security, and traffic.
- Safety.
- Layout of the Work.
- Quality control, testing, inspections and notices required.
- Site visits by the A/E and others.
- Owner's Project Inspector duties.
- Running Punch List.
- As-Built Drawings.

(9) Procedures and documentation of differing or unforeseen Site conditions.

(10) Monthly Pay Meeting.

(11) Project Close-Out requirements and procedures.

(12) Project records.

(c) **Monthly Pay Meeting:**

Section 36 establishes the requirement for a monthly pay meeting which will usually be held at or near the Site. In addition to Owner, A/E and Contractor representatives, the following representatives, at a minimum, should be available to attend portions of the meeting, as applicable or necessary:

- Owner's Project Inspector.
- Contractor's project superintendent.
- A/E representative of each discipline where Work was performed for the current pay request or where Work is projected to be performed in the coming month.
- A representative of each subcontractor who performed work included in the current pay request.
- A representative of each subcontractor who is projected to perform work in the coming month.

The following topics should be included, as a minimum, in the monthly pay meeting:

(1) Observations of status, quality and workmanship of Work in progress.

(2) Validation of the Schedule of Values and Certificate for payment.

(3) Conformance with proposed construction schedule.

(4) Outstanding Requests for Information, Requests for Clarification and Requests for Proposal.

(5) Submittals with action pending.

(6) Status of pending Change Orders.

(7) Status of Running Punch List items.

(8) Work proposed for coming pay period.

(9) Discussions of any problems or potential problems which need attention.

(d) **Other Meetings:**
Requirements for other meetings, such as progress meetings, coordination meetings, preinstallation meetings and/or partnering meetings, may be included in the Contract Documents.

***** END OF GENERAL CONDITIONS *****

SPECIAL CONDITIONS
ALBEMARLE COUNTY PUBLIC SCHOOLS

1. Worker Standards of Conduct/Dress – Hard hats, safety shoes, appropriate shirts and pants are required at all times. Smoking is prohibited on school property. There is to be no contact or harassment of any kind between workers, teachers and students. Only the project superintendent may contact the school staff if necessary. Violence, Swearing, Drugs, Alcohol, Firearms and Weapons are prohibited on school property. Any workers violating these standards of conduct shall be ordered off the site and not allowed to return.

2. Workers shall wear identification indicating the company that employs them while working on an occupied school's property, even during summer months.

3. Drawings and/or Specifications – Any Additional Instructions by Architect/Owner to explain drawing and specifications shall be binding on Contractor.

4. The Contractor (or his designated sub-contractor) shall obtain and pay the fees for all permits necessary for the construction of the project, unless specifically stated otherwise. The Owner will pay for the County Building Permit fees, and the Contractor shall obtain the permits. The Owner will pay for water and sewer connection fees, and the contractor shall obtain the permit. The Contractor shall pay for the tapping fee whether done by himself or pay the Service Authority to make tap. Fees for all bonds (excluding erosion control bonds) will be the sole responsibility of the Contractor. It is the responsibility of the Contractor to determine which permits are necessary. The Owner will pay for the permanent connection to franchised utility companies, electric service, and gas service. The Contractor shall coordinate and schedule all permanent utility service work.

5. Regarding asbestos work, the general contractor shall be responsible for submitting any required notices to all appropriate regulatory agencies, and shall do so within the required timeframe.

6. Contractor's staging area, protective barriers and safety fencing, employee parking, loading access and stockpiling of soils *(where applicable)* shall be as shown on the plans or as approved by Owner.

7. Contractor's staging area and general construction site shall be kept neat and clean so that grass is cut and debris and trash is removed on a weekly basis if not more frequently.

8. Safe access to the designated areas adjacent to the construction areas as indicated on the Construction Sequencing Plan must be maintained at all times for pedestrians and maintenance vehicles.

9. Liquidated Damages: Shall be in accordance with the Supplementary General Conditions.

10. Section 01200 Project Meetings and Section 01300 Submittals are to include the following:
    1) Bi-Weekly Job-Site meetings
    2) The Contractor's project superintendent shall provide the Architect and Owner with copies of his daily report on a weekly basis including manpower per trade, job progress, weather and activities.

11. Application for Payment and payments shall be delayed when project is not in compliance with Erosion Control Plan, permits, or any related instructions given by Owner. Lack of Project Cleanliness may also delay payment. Weekly broom cleaning required for interior renovations.

12. The Contractor shall coordinate all construction operations and deliveries with the school activity schedule. If school is in session while construction is underway, deliveries to the construction site shall not be allowed between the hours **8:30-9:30a.m**. and **3:30-4:30p.m.**

    Contractor shall postpone or reschedule work to a later shift and/or weekends and holidays whenever such work would disrupt or interfere with student testing. If school is in session while construction is underway, the Contractor shall allow for 5 days when work will be prohibited or interrupted for student special testing between August – December, and 15 days between January and May. These dates will be confirmed at the Pre-Construction meeting.

13. Contractors Work within the Existing and Functioning School Area shall be limited as indicated in the Drawings. Excessively noisy work or work producing noxious fumes adjacent to classrooms in session may also be subject to work after regular hours.

14. Hours of work will be limited for projects with exterior work areas, noisy loading or unloading, and work with close neighbors who could be adversely affected. *Contractor must adhere to Albemarle County, Virginia Code Ordinance Sec. 7-105, prohibiting construction, demolition, or maintenance activities between the hours of 10:00pm and 7:00am.*

15. At the completion of the project and before the Final Application for Payment will be approved, Contractor shall provide the Owner written statement certifying that the work is asbestos free.

16. UL Labels are required on all electrical and mechanical equipment. If unlabeled equipment is delivered to the job site, Contractors shall remove and replace with properly labeled equipment or shall pay for UL field testing to properly label prior to payment being made such equipment.

17. Testing/Special Inspections - Owner shall obtain and pay for testing and special inspections services. The Contractor shall pay for any required re-testing due to failed initial tests. Special Inspectors instructions shall be binding on the Contractor. Contractor shall call the testing company designated by the Owner and coordinate any special inspections. Contractor shall provide the Special Inspector with any necessary equipment, such as ladders, scaffolding, etc. for inspection purposes. At the completion of the project and before the Final Application for Payment will be approved, all deficiencies on any special inspection reports, shall be remedied.

18. Building Inspections Department – The Contractor shall call for inspections (*by no later than 12 p.m. the day prior the inspection is requested)*). Requests for fire alarm inspections require several days advance notice. Fire alarm inspection requests shall be made and coordinated by the Contractor with assistance of all related trades such as fire alarm, mechanical and automatic control system subcontractors. A successful dry run test must be made and witnessed by the Owner's representative before calling a County Inspection.

19. Community Development Department Inspections- may include Zoning Inspections; WPO, among others.

20. Retainage shall be 5%, and will not be reduced until the HVAC Testing and Balancing report is approved by Architect and Owner. This may require a delay to provide appropriate outside air temperatures for both heating and cooling tests. All Owner training, Owner manuals, spare parts and warranties are also to be received and approved by Architect and Owner and before retainage is released.

21. Building and site security is the responsibility of the Contractor until final acceptance.

22. The Contractor shall provide approved, framed, operating and maintenance instruction, wiring diagrams and control diagrams as applicable:

Sprinkler System	Fire Alarm System	Telecommunication System
Heating	Ventilating System	Sound System
Fans	Pumps	Motors
Generator	Energy Management	Other Alarms

Any other items or systems required but not specifically listed.

23. Constructor to provide comprehensive training and equipment demonstration for the Owner's designated representatives and the Contractor shall schedule at least 2 weeks in advance for Owner's coordination review and approval.

24. Fire Protection System (Fire Sprinkler) shop drawings and hydraulic calculations shall be prepared, certified and stamped by a professional engineer, licensed in the state of Virginia, at the Contractor's expense.

25. Cleaning during construction: Areas of work shall be cleaned broom clean at least weekly to minimize tracking dirt; Owners existing equipment and facility shall be protected from dust, splash or splatter and cleaned or replaced to return to pre-construction conditions.

26. Final Cleaning to be performed to the Owner's satisfaction. If unsatisfactory cleaning is not remedied within 24 hour written notice to Contractor from Owner, Owner shall complete and deduct from Contractor's final payment.

27. Weather Days: shall be counted cumulatively for the project duration and agreed upon monthly in the pay meeting notes or bi-monthly meetings, never to shorten the duration.

28. Hazardous Materials:
Contractor to notify Owner if suspicious material is found on site to plan and discuss appropriate removal plan. Refer to ACM Testing Report - Existing Building Services facility, contained herein.

29. Contractor will complete and submit documentation necessary for input into Owner's facilities and maintenance asset management system, FMX. Owner will provide a template document for contractor to submit the required information on. Necessary documentation includes key information such as manufacturer, model numbers, serial numbers, expected life, and other key components for all major equipment that is installed. Other documentation may include paint colors, flooring manufacturers, and room-specific interior upgrades for all new construction and renovation projects.

*** END OF SPECIAL CONDITIONS ***

SUPPLEMENTAL GENERAL CONDITIONS

The COUNTY OF ALBEMARLE CONSTRUCTION CONTRACT GENERAL CONDITIONS (Revised January 2023) are modified and supplemented as hereinafter described.

1. Section 11(B) Contractor's and Subcontractor's Insurance: Insurance Requirements
   (a) Worker's Compensation: requires a minimum of **$1,000,000**
   (b) General Liability: requires a minimum of **$2,000,000**
   (c) Automobile Liability: requires a minimum of **$1,000,000**
   (d) Umbrella Liability: requires a minimum of **$10,000,000**

   (e) Environmental Pollution **$1,000,000**

   (f) Professional Liability **$1,000,000**.

   (g) Cyber Liability **$1,000,000**.

2. Section 12 – BUILDER'S RISK INSURANCE

   (a) The requirements of this section of the General Conditions for builders risk insurance on the full value of the entire building are waived for this project. The Owner maintains insurance on the existing building (including fire, vandalism and extended coverage). **However, the Contractor shall provide builders risk insurance for the Work in an amount equal to one hundred percent (100%) of the Contract Price for the Work.** The loss, if any, is to be made adjustable with and payable to the Owner, in accordance with its interests, as they may appear. The Owner, its officers, employees and its agents, shall be named as loss payee in any policy of insurance issued. Written evidence of the insurance shall be filed with the Owner prior to execution of the Contract. In the event of cancellation of this insurance, not less than thirty (30) days prior written notice must be sent to the Owner. A copy of the policy of insurance shall be given to the Owner upon demand.

   (b) Not used

   (c) The Contractor is responsible for providing any desired coverage for Contractor's or Subcontractors' buildings, equipment, materials, tools or supplies that are on-site.

3. Section 42 - DAMAGES FOR DELAY, EXTENSION OF TIME
   Add the following paragraphs:

   (j) It is imperative that the Work in this contract be substantially completed as follows:

Primary Sequence	Substantial Completion Date	Liquidated Damages
Sequence A	May 31, 2026	$5,000.00
Sequence B	August 7, 2026	$5,000.00
Sequence C	October 1, 2025	$1,000.00
Sequence D	August 7, 2026	$1,000.00

The dates above are to give time for the Owner to furnish and equip the facility and meet other

contractual obligations. The Contractor represents and agrees that he has taken into account in his bid the requirements of the bid documents, the location, the time allowed for the Work, local conditions, availability of materials, equipment, and labor, and any other factors which may affect performance of the Work. The Contractor agrees and warrants that he will achieve substantial completion of the Work as outlined below:

(1) Assuming timely execution of the Contract with applicable Bonds, Notice to Proceed will be given to the Contractor on or about **1/14/2025**.

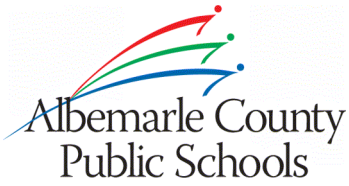
(k) Subject to the provisions of the General Conditions allowing for extension of time allowed for completion of the Work, if the work is not substantially completed by the specified date, the Contractor shall owe to the Owner, not as a penalty but as liquidated damages, the sum of **five-thousand dollars ($5,000)** per day for each and every calendar day for delay in substantial completion of the Work related to each Primary Sequence beyond the dates outlined below:

Primary Sequence	Substantial Completion Date	Liquidated Damages
Sequence A	May 31, 2026	$5,000.00
Sequence B	August 7, 2026	$5,000.00
Sequence C	October 1, 2025	$1,000.00
Sequence D	August 7, 2026	$1,000.00

Likewise, if **All** the Work is not finally completed (Final Completion) 30 days from the specified Substantial Completion Date, the Contractor shall owe to the Owner, not as a penalty but as liquidated damages, the sum of **two-thousand dollars ($2,000)** per day for each and every calendar day of delay in final completion of the Work.

(l) The Owner may withhold from the monthly Progress Payment, the current value of the liquidated damages. Failure of the Owner to withhold liquidated damages during ongoing operations that have exceeded the Contract Completion Date is not a waiver of the Owner's entitlement to damages as set forth in the Contract Documents.

(m) Final accounting of liquidated damages will be administered through a deduction in the final amount owed the Contractor.



CONTRACT #«number»
«Company»
«Address1»
«Address2»
«City», «State» «PostalCode»
«corporate status, as confirmed by SCC»
(Contractor)

Project name: _____
_____
A/E, if applicable: _____
_____
A/E contract #: _____
Project Mgr: _____

SCHOOL BOARD OF ALBEMARLE COUNTY, VIRGINIA,
401 McIntire Rd.
Charlottesville, Virginia 22902
a body corporate under the laws of the Commonwealth of Virginia,
(School Board or Owner)

This Agreement ("Agreement" or "Contract") made and entered into on this ____ day of _____, 20XX, between the Contractor as identified above and the School Board (collectively, the Parties), hereby agree, in consideration of the mutual covenants and stipulations set forth below:

1. Scope of Work: The Contractor shall furnish all labor, equipment, and materials and perform all work for the project as described in the Invitation to Bid (IFB) #_____, p. ____ and the Owner's plans and specifications, including all work described in the Bid Form as Base Bid plus additives, (collectively, the Work) in strict accordance with the Contract Documents. In brief, the Contractor shall _____.

2. Incorporation of documents and Order of Precedence: To the extent that they do not conflict with the terms of this Agreement, the following documents are incorporated by reference in their entirety:

   - the Invitation to Bid, #_____;
   - the Bid Form submitted by the Contractor; (with Post Bid Modification if applicable)
   - the County of Albemarle Construction Contract General Conditions, as included in the IFB;
   - the Supplemental General Conditions, if any;
   - the Special Conditions attached to the Owner's Invitation for Bids;
   - the Owner's Project Plans and Specifications dated _____; and modifications shown as Addenda _____; and
   - the Project Manual dated _____ (which may include some or all of the above documents).

   In the event that a conflict or ambiguity exists or is created between this Agreement, the IFB, and/or the Contractor's submitted Bid Form, the terms of this Agreement first and the IFB second, if necessary, shall govern and supersede any such conflicting or ambiguous terms. The Supplemental General Conditions shall thereafter take precedence over the General Conditions.

3. Payment/Consideration Schedule: In consideration of the Work to be performed by Contractor, as set forth in the section entitled, "Scope of Work," the School Board agrees to pay Contractor for completed and accepted work the total sum of _____ _____ dollars ($_____) as calculated below:

Base bid:	$_____	
Additive 1:	$_____	for _____
Additive 2:	$_____	for _____
Total:	**$_____**	

4. Term: The Work shall be commenced on a date to be specified in a written order of the Owner and shall be Substantially Completed within ____ calendar days. The Work shall be finally completed within ____ days after the date of Substantial Completion of the Work or no later than the date of Final Completion of _____, whichever is sooner. Time is of the essence.

5. Non-Appropriation: The continuation of the terms, conditions, and provisions of this Agreement beyond June 30 (the end of the School Board's fiscal year) of any year, is subject to its approval and ratification by the School Board and appropriation by them of the necessary money to fund said contract for each succeeding year. If sufficient funds are not appropriated and budgeted in any fiscal year for payments due under this Agreement, the School Board shall immediately notify Contractor, and this Agreement shall terminate on the last day of the fiscal year for which appropriations were received without penalty or expense to the School Board of any kind whatsoever.

6. Preconditions to Obligation: The School Board shall not be obligated to purchase or pay for goods, services, or materials under this Agreement unless the School Board has ordered such goods, services, and/or materials and until the Contractor has delivered any ordered goods, services, and/or materials. The School Board may increase or decrease quantities of ordered goods, services, and materials as required and in its discretion.

7. Faith-based Organizations: The School Board does not discriminate against faith-based organizations in accordance with Code of Virginia §2.2-4343.1.

8. Nondiscrimination: Pursuant to Virginia Code §§ 2.2-4201 and 2.2-4311, during the performance of this Contract, Contractor agrees as follows:

   A. Contractor will not discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin, age, disability, or any other basis prohibited by state law relating to discrimination in employment, except where there is a bona fide occupational qualification reasonably necessary to the normal operation of Contractor. Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provisions of this Nondiscrimination clause, including the names of all contracting agencies with which the Contractor has contracts over $10,000;
   B. Contractor will, in all solicitations or advertisements for employees placed by or on behalf of Contractor, state that Contractor is an equal opportunity employer;
   C. Notices, advertisements and solicitations placed in accordance with federal law, rule or regulation shall be deemed sufficient for the purpose of meeting the requirements of this section; and
   D. Contractor shall include the provisions of the foregoing paragraphs A, B, and C in every subcontract or purchase order of over $10,000, so that the provisions will be binding upon each subcontractor or vendor.

9. Drug-Free Workplace: Pursuant to Virginia Code Section § 2.2-4312, during the performance of this Contract, Contractor agrees to:

   A. Provide a drug-free workplace for Contractor's employees.
   B. Post in conspicuous places, available to employees and applicants for employment, a statement notifying employees that the unlawful manufacture, sale, distribution, dispensation, possession, or use of a controlled substance or marijuana is prohibited in Contractor's workplace and specifying the actions that will be taken against employees for violations of such prohibition.
   C. State in all solicitations or advertisements for employees placed by or on behalf of Contractor that Contractor maintains a drug-free workplace.
   D. Include the provisions of the foregoing clauses in every subcontract or purchase order over $10,000, so that the provisions will be binding upon each subcontractor or vendor.

10. Compliance with Immigration Laws: Contractor does not and shall not during the performance of this Agreement knowingly employ an unauthorized alien as defined in the federal Immigration Reform and Control Act of 1986, pursuant to Virginia Code §2.2-4311.1.

11. Compliance with All Laws: Contractor shall comply with all federal, state, and local statutes, ordinances, and regulations now in effect or hereafter adopted, in the performance of scope of work set forth herein. Contractor represents that it possesses all necessary licenses and permits required to conduct its business and will acquire any additional licenses and permits necessary for performance of this Agreement prior to the initiation of work.

12. Business Entity Registration. Pursuant to Virginia Code § 2.2-4311.2, Contractor shall be registered and authorized to transact business in the Commonwealth as a domestic or foreign business entity if so required by Title 13.1 or Title 50 or as otherwise required by law. Contractor shall submit proof of a required registration to the School Board. Additionally, if required, Contractor shall not allow its existence to lapse or its certificate of authority or registration to transact business in the Commonwealth, if so required under Title 13.1 or Title 50 of the Code of Virginia, to be revoked or canceled at any time during the term of the Agreement.

13. Business License Requirement: If Contractor is a business located in Albemarle County, Virginia or at any time during the performance of this Agreement obtains situs for purposes of business license taxes, it shall be unlawful for such business to conduct or engage in such business, trade, or occupation without having first obtained the proper license from the Albemarle County Department of Finance. Contractor covenants that it has a business license where one is required to perform this Agreement.

14. Non-Assignment: All of the conditions and provisions in this Agreement shall extend to and bind the legal representatives, successors and assigns of the respective parties. Neither party to the Agreement shall assign or transfer their interest in the contract without the prior written consent of the other, which shall not be unreasonably withheld.

15. Audit: The Contractor shall maintain full and accurate records with respect to all matters covered under the Agreement including, without limitation, accounting records, written policies and procedures, time records, telephone records, reproduction cost records, travel and living expense records and any other supporting evidence necessary to substantiate charges related to the Agreement. Contractor's records shall be open to inspection and subject to audit and/or reproduction, during normal working hours by the School Board and its employees, agents or authorized representatives to the extent necessary to adequately permit evaluation and verification of any invoices, payments, or claims submitted by Contractor pursuant to this Agreement. Such records subject to examination shall also include, without limitation, those allocations as they may apply to costs associated with the contract. The School Board's employees, agents, or authorized representatives shall have access to the Contractor's facilities, shall have access to all necessary records, and shall be provided adequate and appropriate workspace, in order to conduct audits in compliance with this paragraph.

16. Termination with Cause: In the event that Contractor shall for any reason or through any cause be in default of the terms of this Agreement, the School Board may give Contractor written notice of such default by certified mail/return receipt requested at the address set forth in Section 20 herein**.** Unless otherwise provided, Contractor shall have ten (10) days from the date such notice is mailed in which to cure the default. Upon failure of Contractor to cure the default, the School Board may immediately cancel and terminate this Agreement as of the mailing date of the default notice. Upon termination, Contractor shall withdraw its personnel and equipment, cease performance of any further work under the Agreement, and turn over to the School Board any work in process for which payment has been made. In the event of violations of law, safety or health standards and regulations, this Agreement may be immediately cancelled and terminated by the School Board, and provisions herein with respect to opportunity to cure default shall not be applicable.

17. Termination without Cause: The School Board may at any time, and for any reason, terminate this Agreement by written notice to Contractor specifying the termination date, which shall be not less than thirty (30) days from the date such notice is mailed. In the event of such termination, Contractor shall be paid such amount as shall compensate Contractor for the work satisfactorily completed, and accepted by the School Board, at the time of termination. If the School Board terminates this Agreement without cause, Contractor shall withdraw its personnel and equipment, cease performance of any further work under this Agreement, and turn over to the School Board any work completed or in process for which payment has been made.

18. Choice of Laws and Venue: This Agreement shall be governed by the provisions hereof and by the laws of the Commonwealth of Virginia, excepting the law governing conflicts of laws. Disputes arising out of this Agreement shall be resolved in the courts of the Commonwealth of Virginia in and for Albemarle County.

19. Indemnification and Hold Harmless: Contractor hereby assumes the entire responsibility and liability for any and all damages to persons or property caused by or resulting from or arising out of any act or omission on the part of Contractor, its subcontractors, agents, or employees under or in connection with this Agreement or the performance or failure to perform any work required by this Agreement. Contractor shall indemnify and hold harmless the School Board and its agents, volunteers, servants, employees, and officials from and against any and all claims, losses, or expenses, including reasonable attorney's fees and litigation expenses suffered by any indemnified party or entity as the result of claims or suits due to, arising out of or in connection with (a) any and all such damages, real or alleged, (b) the violation of any law applicable to this Agreement, and (c) the performance of the work by Contractor or those for whom Contractor is legally liable. Upon written demand by the School Board, Contractor shall assume and defend at Contractor's sole expense any and all such suits or defense of claims made against the School Board, its agents, volunteers, servants, employees, or officials.

20. Notices: All notices and requests required or permitted hereunder shall be sent by United States certified mail, return receipt requested, and to be effective, shall be postmarked not later than the final date for giving of such notice, or such notices may be sent by commercial messenger service, in which event, to be effective, such notices shall be delivered to a commercial messenger service not later than the final date for giving such notice. Alternatively, notice can be sent electronically to the parties and email addresses listed below.

Notices for the School Board shall be addressed as follows:

_____
_____
_____
Charlottesville, VA 22902

With a copy to:
Allison McNally
Chief Procurement Officer
401 McIntire Rd., Room 248
Charlottesville, VA 22902
amcnally@albemarle.org

Notices for Contractor shall be addressed as follows:

_____
_____
_____
_____

Such addresses may be changed at any time and from time to time by like written notice given by either party to the other.

21. Entire Agreement: This Agreement and the documents incorporated by reference and included expressly as Exhibits to this Agreement constitute the entire agreement between the Parties. This Agreement supersedes all prior written or oral agreements or proposals between the parties, regarding the subject matter of this Agreement. This Agreement may not be modified except in a writing signed by both parties that is expressly stated to be an amendment hereto.

22. Independent Contractor: Contractor shall be at all times an independent contractor and, as such, shall have and maintain complete control over all of its employees and operations. Neither Contractor nor anyone employed by it shall be, represent, act, purport to act, or be deemed to be an agent, representative, employee or servant of the School Board. Nothing in this section shall be deemed to absolve or otherwise limit the Contractor's liability and responsibility to safely and correctly perform its duties under this Agreement.

23. Waiver: No failure of the School Board to exercise any right or power given to it by law or by this Agreement or to insist upon strict compliance by Contractor with any of the provisions of this Agreement, and no custom or practice of the parties at variance with the terms hereof, shall constitute a waiver of the School Board's right to demand strict compliance with the terms of this Agreement.

24. Interpretation: Whenever the context hereof shall require, the singular shall include the plural, the plural the singular, and the use of any gender shall be applicable to all genders.

25. Severability: The provisions of this Agreement shall be deemed to be severable, and should any one or more of such provisions be declared or adjudged to be invalid or unenforceable, the remaining provisions shall be unaffected thereby and shall remain in full force and effect.

26. Contract Claims by Contractor: Prompt knowledge by the School Board of an existing or impending claim for damages or other relief may alter the plans, scheduling, or other action of the School Board and/or result in mitigation or elimination of the effects of the claim. Therefore, a written statement providing the School Board with notice of the Contractor's intention to file a claim which (i) describes the act or omission by the School Board or its agents that the Contractor contends caused it damages or entitles it to other relief; and (ii) provides a description of the nature and amount of the claim. Such written statement shall be submitted to the Purchasing Office of the Albemarle County Department of Finance within 20 days of the time of the occurrence or beginning of the work upon which the claim is based; provided, however, if such damage is deemed certain in the opinion of the Contractor to result from its acting on an order from the School Board, it shall immediately take written exception to the order. For purposes of this provision, "claim" shall include, without limitation, any request for an increase in the Agreement price or time and any request for equitable adjustment. Submission of a notice of claim as specified shall be mandatory, and failure to submit such notice shall be a conclusive waiver to such claim for damages or other relief by the Contractor. Neither an oral notice or statement, nor an untimely notice or statement will be sufficient to satisfy the requirements herein. The School Board will review the claim and render a final decision in writing within thirty (30) days of receipt of Contractor's written request for a final decision. Such decision shall be final and binding to the fullest extent allowed by law.

27. Claims for Extra Compensation: If Contractor encounters work and services not included in this Agreement or any supplement thereto but which in the opinion of Contractor is necessary for the successful completion of the Agreement and requires extra compensation, Contractor shall, before it begins the work on which it bases its claim, promptly notify the Purchasing Office of the Albemarle County Department of Finance in writing of its intention to perform the work and to make claim for extra compensation. Notification by Contractor under the terms of this paragraph shall not be construed as proving the validity of the claim. No claim for extra compensation will be filed or considered unless notification is given as herein set forth. Upon notification, the School Board shall promptly review any claim for extra compensation. If a claim is accepted by the School Board, it shall be paid as extra work under the terms of a supplemental agreement executed by the parties *before such work is begun*. The amounts claimed as extra compensation by Contractor shall be separately itemized, become a part of the claim, and serve as documentation thereto. The amounts

itemized shall be in sufficient detail to enable the School Board to analyze the need for the extra work and the costs claimed for the work.

28. Payments to Subcontractors:

a. This is a construction contract under the VPPA. Therefore, Contractor shall pay all subcontractors in the manner provided in Virginia Code Section 2.2-4354(1).
b. Contractor shall pay all subcontractors in the manner provided in Virginia Code Section 2.2-4354(2-5).

29. Insurance: Contractor shall purchase and maintain, at its sole expense, and from a company or companies authorized to do business within the Commonwealth of Virginia, insurance policies protecting from claims which may arise out of or result from Contractor's performance or non-performance of services under this Contract or the performance or non-performance of services under this Contract by anyone directly or indirectly employed by Contractor or for whose acts it may be liable. Such policies shall remain in full force and effect at all times during the term of this Agreement and shall contain the types of coverages and minimum limits which are required by the Supplemental General Conditions, Special General Conditions, or General Conditions, which shall, for this provision "Insurance" only, take precedence (in order of precedence as listed here) over this Agreement and other documents incorporated by reference. A certificate of insurance conforming to the requirements of the Supplemental, Special, and General Conditions shall be submitted prior to the execution of this Agreement.

30. Payment/Performance Bonds: Contractor shall furnish to the School Board a payment bond and a performance bond on forms provided by the School Board in conformity with Virginia Code §§ 2.2-4337 and 2.2-4339 each payable to the School Board and each in the sum of the Agreement amount. The performance bond shall be conditioned upon the faithful performance of the Agreement in strict conformity with the terms and conditions of the Agreement, and the payment bond shall be conditioned upon the prompt payment for all such material furnished or labor supplied or performed in the prosecution of the Work. Each of the bonds shall be executed by one or more surety companies selected by Contractor which are licensed and legally authorized to conduct the business of insurance, including surety, within the Commonwealth of Virginia. The performance and payment bonds shall be amended if necessary, as determined by the School Board, to reflect changes to the scope of the Work created by Change Orders and any amendments to this Agreement.

31. School Contractor Certification: Pursuant to Virginia Code § 22.1-296.1, Contractor certifies by his signature below that any and all persons who will provide services for or on behalf of the Contractor on public school property have not been convicted of a felony; any offense involving the sexual molestation, physical or sexual abuse or rape of a child; or any offense for which registration is required as defined in Virginia Code § 9.1-902. This Certification shall be binding throughout the contract term and that it will provide immediate notice to the School Board of any event that renders this certification untrue.

Contractor hereby acknowledges that any person making a materially false statement regarding any such offense shall be guilty of a class 1 misdemeanor and, upon conviction, the fact of such conviction shall be grounds for the revocation of this Agreement and, when relevant, the revocation of any license required to provide such services.

[Signature Page Follows]

SCHOOL BOARD ACCEPTANCE
The School Board of Albemarle County, Virginia

SIGNATURE_____

NAME (type/print)_Allison McNally_____

TITLE____Chief Procurement Officer _____

DATE_____

CONTRACTOR'S ACCEPTANCE
[Contractor]

SIGNATURE_____

NAME (type/print)_____

TITLE_____

DATE_____

POST BID MODIFICATION

DATE:

PROJECT TITLE: NEW CONSTRUCTION HIGH SCHOOL CENTER II

IFB NO.: 2025-IFB-1007262

OWNER: ALBEMARLE COUNTY PUBLIC SCHOOLS

CONTRACTOR:

As allowed by Section 12(c) of the Instructions to Bidders and by §2.2-4318, Code of Virginia, negotiations were conducted with the lowest responsive and responsible bidder, , hereinafter called the Contractor. The following clarifications, amendments, deletions, revisions, substitutions, and/or modifications to the Contract Documents were made along with corresponding adjustments in the Contractor's bid amount for furnishing all labor and materials and performing all work necessary for construction of this project in accordance with the modified contract documents:

Item	AMOUNT
TOTAL	

END OF POST BID MODIFICATION

STANDARD PERFORMANCE BOND
FOR CONSTRUCTION CONTRACTS

KNOW ALL BY THESE PRESENT: That _____, the Contractor ("Principal") whose principal place of business is located at _____and _____ _____ ("Surety") are held and firmly bound unto the County of Albemarle, Virginia, and/or The School Board of Albemarle County, Virginia, the Owner ("Obligee") in the amount of _____ for the payment whereof Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS,

Principal has by written agreement dated_____, entered into a contract with Obligee for _____ which contract (the "Contract") is by reference expressly made a part hereof;

NOW THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if the Principal shall promptly and faithfully perform said Contract in strict conformity with the plans, specifications and conditions of the Contract, then this obligation shall be null and void; otherwise it shall remain in full force and effect.

Provided, that any alterations which may be made in the terms of the Contract, or in the Work to be done under it, or the giving by the Obligee of any extension of the time for the performance of the Contract, or any other alterations, extensions or forbearance on the part of either or both of the Obligee or the Principal to the other shall not in any way release the Principal and the Surety, or either of them, their heirs, executors, administrators, successors or assigns from their liability hereunder, notice to the Surety of any such alterations, extension, or forbearance being hereby waived.

No action shall be brought on this bond unless brought within one year after: (a) completion of the Contract and all Work thereunder, including expiration of all warranties and guarantees, or (b) discovery of the defect or breach of warranty or guarantee if the action be for such.

The Surety represents to the Principal and to the Obligee that it is legally authorized to do business in the Commonwealth of Virginia.

Signed and sealed this _____ day of _____, _____.

PRINCIPAL

_____

BY: _____
(Please sign above and print name below)

_____

TITLE: _____

ADDRESS: _____

_____

_____

PHONE: _____

SURETY

BY: _____
(Please sign above and print name below)

_____

ADDRESS: _____

_____

_____

PHONE: _____

BOND NO.: _____

ADDRESS OF SURETY'S HOME OFFICE:

_____

_____

_____

STANDARD LABOR AND MATERIAL PAYMENT BOND

KNOW ALL BY THESE PRESENT: That _____, the Contractor ("Principal") whose principal place of business is located at _____and _____ _____ ("Surety") are held and firmly bound unto the County of Albemarle, Virginia, and/or The School Board of Albemarle County, Virginia, the Owner ("Obligee") in the amount of _____for the payment whereof Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS,

Principal has by written agreement dated_____, entered into a contract with Obligee for _____ which contract (the "Contract") is by reference expressly made a part hereof;

NOW THEREFORE, THE CONDITION OF THIS OBLIGATION is such that, if the Principal shall promptly make payment to all claimants as hereinafter defined, for labor performed and material furnished in the prosecution of the Work provided for in the Contract, then this obligation shall be void; otherwise it shall remain in full force and effect, subject, however, to the following conditions.

The Principal and Surety, jointly and severally, hereby agree with Obligee as follows:

1. A claimant is defined as one having a direct contract with the Principal or with a subcontractor of the Principal for labor, material, or both for use in the performance of the Contract. A "subcontractor" of the Principal, for the purposes of this bond only, includes not only those subcontractors having a direct contractual relationship with the Principal, but also any other contractor who undertakes to participate in the Work which the Principal is to perform under the aforesaid Contract, whether there are one or more intervening subcontractors contractually positioned between it and the Principal (for example, a subcontractor). "Labor" and "material" shall include, but not be limited to, public utility services and reasonable rentals of equipment, but only for periods when the equipment rented is actually used at the work site.

2. Subject to the provisions of paragraph 3, any claimant who has performed labor or furnished material in accordance with the Contract documents in the prosecution of the Work provided in the Contract, who has not been paid in full therefor before the expiration of ninety (90) days after the day on which such claimant performed the last of such labor or furnished the last of such materials for which he claims payment, may bring an action on this bond to recover any amount due him for such labor or material, and may prosecute such action to final judgment

and have execution on the judgment. The Obligee need not be a party to such action and shall not be liable for the payment of any costs, fees or expenses of any such suit.

3. Any claimant who has a direct contractual relationship with any subcontractor of the Principal from whom the Principal has not required a subcontractor payment bond, but who has no contractual relationship, express or implied, with the Principal, may bring an action on this bond only if he has given written notice to the Principal within one hundred eighty (180) days from the day on which the claimant performed the last of the labor or furnished the last of the materials for which he claims payment, stating with substantial accuracy the amount claimed and the name of the person for whom the Work was performed or to whom the material was furnished. Notice to the Principal shall be served by registered or certified mail, postage prepaid, in an envelope addressed to the Principal at any place where his office is regularly maintained for the transaction of business. Claims for sums withheld as retainages with respect to labor performed or materials furnished shall not be subject to the time limitations stated in this paragraph 3.

4. No suit or action shall be commenced hereunder by any claimant;

   a. Unless brought within one year after the day on which the person bringing such action last performed labor or last furnished or supplied materials, it being understood, however, that if any limitation embodied in this bond is prohibited by any law controlling the construction hereof, the limitation embodied within this bond shall be deemed to be amended so as to be equal to the minimum period of limitation permitted by such law.

   b. Other than in a Virginia court of competent jurisdiction, with venue as provided by statute, or in the United States District Court for the district in which the project, or any part thereof is situated.

5. The amount of this bond shall be reduced by and to the extent of any payment or payments made in good faith hereunder.

Signed and sealed this _____ day of _____, _____.

PRINCIPAL

_____

BY: _____
(Please sign above and print name below)

_____

TITLE: _____

ADDRESS: _____

_____

_____

PHONE: _____

SURETY

BY: _____
(Please sign above and print name below)

_____

ADDRESS: _____

_____

_____

PHONE: _____

BOND NO.: _____

ADDRESS OF SURETY'S HOME OFFICE:

_____

_____

_____

Project Title:	
Contract Number:	
Contract Date:	

Original Contract:	
Additive Changes:	$0.00
Deductive Changes:	$0.00
Total Changes:	$0.00
Revised Contract:	$0.00
Original Contract Completion Date:	
Cumulative Schedule Extensions:	0.00
Revised Contract Completion Date:	1/0/1900

Change Order Log

CO #	PCO#	Date	Additions	Deductions	Schedule Extention (Days)	Description	Funding Source
Totals			**$0.00**	**$0.00**	**0**		

Form AC-11 (New) Sept 2023

CHANGE ORDER- (Construction or A/E Contract Modification)	
COUNTY OF ALBEMARLE, VIRGINIA	
CONTRACT NO.:	**CONTRACTOR:**
0	
CHANGE ORDER NO.:	
PROJECT TITLE:	**PURCHASE ORDER NO.:**
0	
FULL ACCOUNT CODE:	**PROJECT MANAGER:**
DESCRIPTION/JUSTIFICATION OF CHANGE ORDER:	**AMOUNT:**
Total Amount of PCOs	**$0.00**
Contractor Proposal including Itemized Costs must be fully documented and attached to this form.	
Original Contract Value	$0.00
Net change by previously authorized Change Orders	$0.00
Contract Sum prior to this Change Order	$0.00
Contract Sum will be decreased/increased by this Change Order in the amount of	$0.00
New Contract Sum including this Change Order will be	$0.00
Percent of all Change Orders to Original Contract Value:	#DIV/0!
Does the sum of Change Orders exceed 25 % of the Original Contract Value and/or exceeds $50,000.00? If yes, attach Executive approval	
Is a portion of this change caused by AE error and/or omission?	
Description of AE error and/or omission (if applicable):	
Failure to include a change for time shall waive any change to the time allowed by the Contract for completion of the Work unless the parties mutually agree in writing to postpone a determination of the change to time resulting from the Change Order. Such determination may not be postponed more than 45 days from the approval of this Change Order by the Owner.	
Contract Time will be increased by (Calendar Days):	
Date of Contract Completion as of the date of this Change Order therefore is:	1/0/1900
By signing this Change Order, the Contractor agrees to release and waive any and all claims related to this Change Order.	
(1) Architect/Engineer	Date:
(2) Contractor (If applicable)	Date:
(3) Department Approval	Date:
(4) Chief of Procurement	Date:

Form AC-11 (New) Sept 2023

GENERAL CONTRACTOR ESTIMATE FOR CHANGE ORDER

GC-1

IFB Number: | **General Contractor:**
Project: | **Change Description:**
Owner: | **COR/PCO #:**

GENERAL CONTRACTOR DIRECT COSTS

Scope Description				Direct Labor				Direct Material		Direct Equipment	
Item No.	Description	Quantity	Qty Units	Direct Labor Hours Per Unit	Total Direct Labor Hours	Hourly Wage Rate, Excl. Taxes & Ins.	Total Labor Cost	Material Cost Per Unit	Total Material Cost	Equipment Cost Per Unit	Total Equipment Cost
A	B	C	D	E	F = C x E	G	H = F x G	I	J = C x I	K	L = C x K
1.01					0.00		$0.00		$0.00		$0.00
1.02					0.00		$0.00		$0.00		$0.00
1.03					0.00		$0.00		$0.00		$0.00
1.04					0.00		$0.00		$0.00		$0.00
1.05					0.00		$0.00		$0.00		$0.00
1.06					0.00		$0.00		$0.00		$0.00
1.07					0.00		$0.00		$0.00		$0.00
1.08					0.00		$0.00		$0.00		$0.00
1.09	**Subtotal from Estimate Continuation Sheets**						$0.00		$0.00		$0.00
1.97	**Subtotal (S/T) Direct Costs:**					**Subtotal Labor**	**$0.00**	**Subtotal Mat'l**	**$0.00**	**Subtotal Equip.**	**$0.00**
1.98	**Taxes/Insurance:**	**FICA, FUI, SUI, & Workmens' Comp. at**				% of Item 1.97H =	$0.00	Sales Tax @ 5.3%	$0.00	Sales Tax @ 5.3%	$0.00
1.99	**Total Direct Costs**					**Total Labor**	$0.00	**Total Mat'l**	$0.00	**Total Equip.**	$0.00

SUBCONTRACT COSTS

Item No.	Subcontractor Name (List totals from attached SC-1 forms)	Total Cost
A	B	C
2.01		
2.02		
2.03		
2.04		
2.05		
2.06		
2.07		
2.08		
2.09		
2.99	**Total Subcontract Costs**	$0.00

SUMMARY

Item No.	Description		Total Cost
3.01	Total Direct Labor Cost	Item 1.99H	$0.00
3.02	Total Direct Material Cost	Item 1.99J	$0.00
3.03	Total Equipment Cost	Item 1.99L	$0.00
3.04	Subtotal	3.01+3.02+3.03	$0.00
3.05	Overhead and Profit	* 10% x Item 3.04	$0.00
3.06	Subtotal	3.04+3.05	$0.00
3.07	Subcontractor Cost	Item 2.99	$0.00
3.08	GC Markup on Subcontractors	** 10% x Item 3.07	$0.00
3.09	Subtotal	3.06+3.07+3.08	$0.00
3.10	Additional Bond Cost		
3.99	**Total Change Order Cost**	(3.09+3.10)	$0.00

Submitted By

Name: _____

Signature: _____

Title: _____

Date: _____

I have reviewed the costs proposed and find them to be reasonable (as proposed) (as marked).

A/E Signature: _____

Note: Mark-up is capped in conformance with the provisions of Section 38(d) of the Construction Contract General Conditions.
*Limited to 10% on self-performed work.
**Limited to a total of 10%, shared (cumulative total) if multiple tier subs, on subcontracted work.

SUBCONTRACTOR ESTIMATE FOR CHANGE ORDER

SC-1

IFB Number:
Project:
Owner:

General Contractor:
Subcontractor:
Subcontractor Trade:
COR/PCO #:

Change Description:

SUBCONTRACTOR DIRECT COSTS

Scope Description				Direct Labor				Direct Material		Direct Equipment	
Item No.	Description	Quantity	Qty Units	Direct Labor Hours Per Unit	Total Direct Labor Labor Hours	Hourly Wage Rate, Excl. Taxes & Ins.	Total Labor Cost	Material Cost Per Unit	Total Material Cost	Equipment Cost Per Unit	Total Equipment Cost
A	B	C	D	E	F = C x E	G	H = F x G	I	J = C x I	K	L = C x K
1.01					0.00		$0.00		$0.00		$0.00
1.02					0.00		$0.00		$0.00		$0.00
1.03					0.00		$0.00		$0.00		$0.00
1.04					0.00		$0.00		$0.00		$0.00
1.05					0.00		$0.00		$0.00		$0.00
1.06					0.00		$0.00		$0.00		$0.00
1.07					0.00		$0.00		$0.00		$0.00
1.08					0.00		$0.00		$0.00		$0.00
1.09	**Subtotal from Estimate Continuation Sheets**						$0.00		$0.00		$0.00
1.97	**Subtotal (S/T) Direct Costs:**					**Subtotal Labor**	**$0.00**	**Subtotal Mat'l**	**$0.00**	**Subtotal Equip.**	**$0.00**
1.98	**Taxes/Insurance:**	**FICA, FUI, SUI, & Workmens' Comp. at**				% of Item 1.97H =	$0.00	Sales Tax @ 5.3%	$0.00	Sales Tax @ 5.3%	$0.00
1.99	**Total Direct Costs**					**Total Labor**	$0.00	**Total Mat'l**	$0.00	**Total Equip.**	$0.00

SUB-SUBCONTRACT COSTS

Item No.	Sub-Subcontractor Name (List totals from attached SS-1 forms)	Total Cost
A	B	C
2.01		
2.02		
2.03		
2.04		
2.05		
2.06		
2.99	**Total Sub-Subcontract Costs**	$0.00

SUMMARY

Item No.	Description		Total Cost
3.01	Total Direct Labor Cost	Item 1.99H	$0.00
3.02	Total Direct Material Cost	Item 1.99J	$0.00
3.03	Total Equipment Cost	Item 1.99L	$0.00
3.04	Subtotal	3.01+3.02+3.03	$0.00
3.05	Overhead and Profit	* 10% x Item 3.04	$0.00
3.06	Total Subcontractor Cost	3.04+3.05	$0.00
3.07	Sub-Subcontractor Cost **	Item 2.99	$0.00
3.99	**S/C Cost Report'd to GC *** **	3.06+3.07	$0.00

Submitted By

Name: _____

Signature: _____

Title: _____

Date: _____

Note: Mark-up is capped in conformance with the provisions of Section 38(d) of the Construction Contract General Conditions.

* Limited to 10% on self-performed work.

** Limited to a total of 10%, shared (cumulative total) if multiple tier subs, on subcontracted work. Total mark-up on subcontracted work is calculated on the GC-1 form.

*** The subcontractor cost carried forward to GC-1 form does not include mark-up on sub-subcontractor costs. This mark-up is calculated on the GC-1 form. The GC and its subcontractors shall establish how the mark-up is to be distributed among the various subcontractors involved in the work.

ESTIMATE CONTINUATION SHEET

(Attach to Form GC-1, SC-1, or SS-1 as necessary for continuation of the direct cost estimates.)

IFB Number: 0
Project: 0
Owner: 0

Performing Contractor: 0

Change Description: 0

PERFORMING CONTRACTOR DIRECT COSTS

Scope Description				Direct Labor				Direct Material		Direct Equipment	
Item No.	Description	Quantity	Qty Units	Direct Labor Hours Per Unit	Total Direct Labor Labor Hours	Hourly Wage Rate, Excl. Taxes & Ins.	Total Labor Cost	Material Cost Per Unit	Total Material Cost	Equipment Cost Per Unit	Total Equipment Cost
A	B	C	D	E	F = C x E	G	H = F x G	I	J = C x I	K	L = C x K
					0.00		$0.00		$0.00		$0.00

SUB-SUBCONTRACTOR ESTIMATE FOR CHANGE ORDER

SS-1

IFB Number:
Project:
Owner:
Change Description:

General Contractor:
Subcontractor:
Sub-Subcontractor:
Sub-Subcontractor Trade:
COR/PCO #:

SUB-SUBCONTRACTOR DIRECT COSTS

Scope Description				Direct Labor				Direct Material		Direct Equipment	
Item No.	Description	Quantity	Qty Units	Direct Labor Hours Per Unit	Total Direct Labor Labor Hours	Hourly Wage Rate, Excl. Taxes & Ins.	Total Labor Cost	Material Cost Per Unit	Total Material Cost	Equipment Cost Per Unit	Total Equipment Cost
A	B	C	D	E	F = C x E	G	H = F x G	I	J = C x I	K	L = C x K
1.01					0.00		$0.00		$0.00		$0.00
1.02					0.00		$0.00		$0.00		$0.00
1.03					0.00		$0.00		$0.00		$0.00
1.04					0.00		$0.00		$0.00		$0.00
1.05					0.00		$0.00		$0.00		$0.00
1.06					0.00		$0.00		$0.00		$0.00
1.07					0.00		$0.00		$0.00		$0.00
1.08					0.00		$0.00		$0.00		$0.00
1.09	**Subtotal from Estimate Continuation Sheets**						$0.00		$0.00		$0.00
1.97	**Subtotal (S/T) Direct Costs:**					**Subtotal Labor**	**$0.00**	**Subtotal Mat'l**	**$0.00**	**Subtotal Equip.**	**$0.00**
1.98	**Taxes/Insurance:**	**FICA, FUI, SUI, & Workmens' Comp. at**				% of Item 1.97H	$0.00	Sales Tax @ 5.3%	$0.00	Sales Tax @ 5.3%	$0.00
1.99	**Total Direct Costs**					**Total Labor**	$0.00	**Total Mat'l**	$0.00	**Total Equip.**	$0.00

SUMMARY

Item No.	Description		Total Cost
3.01	Total Direct Labor Cost	Item 1.99H	$0.00
3.02	Total Direct Material Cost	Item 1.99J	$0.00
3.03	Total Equipment Cost	Item 1.99L	$0.00
3.04	Subtotal	3.01+3.02+3.03	$0.00
3.05	Overhead and Profit	* 10% x Item 3.04	$0.00
3.99	**Total Sub-Subcontractor**		$0.00

Submitted By

Name: _____

Signature: _____

Title: _____

Date: _____

Note: Mark-up is capped in conformance with the provisions of Section 38(d) of the Construction Contract General Conditions.
*Limited to 10% on self-performed work.

FORM AC-12	SCHEDULE OF VALUES and CERTIFICATE FOR PAYMENT	PAYMENT REQUEST NO.	1
PART A SUMMARY AND CERTIFICATION		PERIOD BEGINNING DATE:	01/00/1900
		PERIOD ENDING DATE:	01/00/1900

IFB NUMBER: 0
OWNER NAME: County of Albemarle, Virginia and/or The County School Board of Albemarle County, Virginia
PROJECT TITLE: 0

	TOTAL VALUE	VALUE OF WORK COMPLETED			PERCENT COMPLETE
		PREVIOUS VALUE TO DATE	VALUE THIS REPORT	CURRENT VALUE TO DATE	
	A	B	C	D = B + C	E = D / A
Original Contract Line Items (from AC-12, PART B)	$ -	$ -	$ -	$ -	0%
Approved Change Orders (from AC-12, PART C)	$ -	$ -	$ -	$ -	0%
ADJUSTED CONTRACT TOTAL	**$ -**	**$ -**	**$ -**	**$ -**	0%
Retainage *Retainage Percentage:* 5.0%		$ -	$ -	$ -	
NET REQUISTION AMOUNT		**$ -**	**$ -**	**$ -**	
			Amount Requested		

CONTRACTOR CERTIFICATION

The undersigned Contractor requests payment of that portion of the contract price shown on the last line of the foregoing Schedule of Values, and represents and warrants to the Owner that: (1) the data shown on the Schedule of Values is accurate and correct; (2) the Work covered by this Certificate has been completed in accordance with the Contract Documents; (3) all previous progress payments received from Owner on account of Work done under this Contract have been applied to discharge in full (except for allowable retainage) all obligations of Contractor incurred in connection with Work covered by prior Certificates for Payment (N/A for Payment No. 1) ; (4) title to all materials and equipment for which payment is requested in this Certificate, whether or not incorporated in said Work, will pass to Owner at time of payment free and clear of all liens, claims, security interests and encumbrances (except such materials and equipment which are covered by a Bond previously accepted by Owner).

FEIN #: 0 **Contractor:** 0

Date: January 0, 1900 **By:** _____
signature

Typed Name: 0

ARCHITECT/ENGINEER CERTIFICATION

This is to certify that, in accordance with the terms of a contract for IFB/Contract Number executed the day of , , by and between, the Contractor, and the County of Albemarle, Virginia and/or The County School Board of Albemarle County, Virginia, the Owner, for work at , there is due to the Contractor the amount of No Dollars and No Cents $.00

Architect/Engineer:

By: _____ _____ _____
signature *printed name* *date*

OWNER ACTION

Recommended for Payment: _____ _____
Project Manager Date

FORM AC-12	SCHEDULE OF VALUES AND CERTIFICATE FOR PAYMENT	PAYMENT REQUEST NO.	1
PART B	RFQ NUMBER: 0		
ORIGINAL CONTRACT LINE ITEMS	OWNER NAME: County of Albemarle, Virginia and/or The County School Board of Albemarle County, Virginia	PERIOD BEGINNING DATE:	01/00/1900
	PROJECT TITLE: 0	PERIOD ENDING DATE:	01/00/1900

ITEM NO.	ITEM DESCRIPTION	TOTAL VALUE	VALUE OF WORK COMPLETED			PERCENT COMPLETE	NOTES / COMMENTS
			PREVIOUS VALUE TO DATE	VALUE THIS REPORT	CURRENT VALUE TO DATE		
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	

ITEM NO.	ITEM DESCRIPTION	TOTAL VALUE	VALUE OF WORK COMPLETED			PERCENT COMPLETE	NOTES / COMMENTS
			PREVIOUS VALUE TO DATE	VALUE THIS REPORT	CURRENT VALUE TO DATE		
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
	Do not insert rows below this point !	$ -	$ -	$ -	$ -	0%	
TOTAL ORIGINAL CONTRACT		**$ -**	**$ -**	**$ -**	**$ -**	**0%**	

FORM AC-12	SCHEDULE OF VALUES AND CERTIFICATE FOR PAYMENT	PAYMENT REQUEST NO.	1
PART C CONSTRUCTION CHANGE ORDERS	PROJECT CODE: 0 AGENCY NAME: County of Albemarle, Virginia and/or The County School Board of Albemarle County, Virginia PROJECT TITLE: 0	PERIOD BEGINNING DATE: PERIOD ENDING DATE:	01/00/1900 01/00/1900

CHNG ORD. NO.	ITEM DESCRIPTION	TOTAL VALUE	VALUE OF WORK COMPLETED			PERCENT COMPLETE	NOTES / COMMENTS
			PREVIOUS VALUE TO DATE	VALUE THIS REPORT	CURRENT VALUE TO DATE		
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	

CHNG ORD. NO.	ITEM DESCRIPTION	TOTAL VALUE	VALUE OF WORK COMPLETED			PERCENT COMPLETE	NOTES / COMMENTS
			PREVIOUS VALUE TO DATE	VALUE THIS REPORT	CURRENT VALUE TO DATE		
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
		$ -	$ -	$ -	$ -	0%	
	Do not insert rows below this point !	$ -	$ -	$ -	$ -	0%	
TOTAL APPROVED CHANGE ORDERS		**$ -**	**$ -**	**$ -**	**$ -**	**0%**	

AFFIDAVIT OF PAYMENT OF CLAIMS

By:

This day _____ personally appeared before me, _____, a Notary Public in and for the City/County of _____, _____ and, being by me first duly sworn, states that all subcontractors and suppliers of labor and materials have been paid all sums due them for work performed or materials furnished in the performance of the Contract between the County of Albemarle, Virginia, and/or The School Board of Albemarle County, Virginia, Owner, and _____, Contractor, dated _____, 20____, for the construction of _____ _____, or arrangements have been made by the Contractor satisfactory to such subcontractors and suppliers with respect to payments of such sums as may be due them by the Contractor.

_____
(Contractor Name)

By: _____

Print Name: _____

Title: _____

ARCHITECT/ENGINEER'S CERTIFICATE OF SUBSTANTIAL COMPLETION

Date: _____

County of Albemarle, Virginia, and/or
The School Board of Albemarle County, Virginia
c/o Facilities & Environmental Services – Facilities Planning & Construction Division
401 McIntire Road
Charlottesville, Virginia 22902-4596

Project Title: _____
RFQ/Contract No.: _____

In accordance with the requirements of the Contract Between Owner and Architect/Engineer and based upon the knowledge gained in the performance of the architectural/engineering services provided in said Contract and the reports of the Owner's Inspection and Testing entities, the undersigned Architect/Engineer states that the following portions of the project named above are substantially complete in accordance with the requirements of the Contract Documents and are recommended for use of their intended purpose (*indicate portions which are ready for use and, if applicable, occupancy)*:

_____
_____
_____
_____
_____

All applicable tests, certificates and regulatory inspections required by the Contract Documents and any local, state or federal regulations have been performed with respect to the substantially completed portions of the project and the Owner has been provided with a copy of each report, except for the following:

_____
_____
_____
_____

A tentative list of unfinished Work and defective Work, referred to as the "punch list," is attached hereto. The list may not be all-inclusive, and the failure to include an item in it does not alter the responsibility of the Contractor to complete all the Work in accordance with the Contract Documents. The items in the tentative list shall be completed or corrected by the Contractor within _____ days of the above date of Substantial Completion.

_____
(A/E Firm Name)

By: _____

Print Name: _____

Title: _____

Attachment: Punch List

CERTIFICATE OF FINAL COMPLETION BY ARCHITECT/ENGINEER

Date: _____

County of Albemarle, Virginia, and/or
The School Board of Albemarle County, Virginia
c/o Facilities & Environmental Services – Facilities Planning & Construction Division
401 McIntire Road
Charlottesville, Virginia 22902-4596

Project Title: _____
RFQ/Contract No.: _____

In accordance with the requirements of the Contract Between the Owner and the Architect/Engineer for Professional Services and based upon the knowledge gained in the performance of the services required in said Agreement, the undersigned hereby states that the above named project was fully completed in accordance with the requirements of the Contract Documents on _____ _____, _____.
(Month) (Day) (Year)

All applicable tests, certificates and regulatory inspections required by the Contract Documents and any local, state or federal regulations have been performed and the Owner has been provided with a copy of each report.

Final as-built drawings have been prepared by the Architect/Engineer and submitted to the Owner in accordance with the requirements of the Contract Documents. The Owner has been provided with a copy of all warranties and guarantees, including the starting date(s) of all warranties and guarantees, written and unwritten, required by the Contract Documents.

_____
(A/E Firm Name)

By: _____

Print Name: _____

Title: _____

CERTIFICATE OF PARTIAL OR SUBSTANTIAL COMPLETION BY CONTRACTOR

Date: _____

County of Albemarle, Virginia, and/or
The School Board of Albemarle County, Virginia
c/o Facilities & Environmental Services – Facilities Planning & Construction Division
401 McIntire Road
Charlottesville, Virginia 22902-4596

Project Title: _____
RFQ/Contract No.: _____

In accordance with the requirements of the Agreement between the Owner and the Contractor, the undersigned Contractor hereby states that portions of the above named project are substantially completed in accordance with the requirements of the Contract Documents as modified by approved change orders. Those portions of the project now substantially complete are:

_____
_____
_____

All applicable tests, certificates and regulatory inspections required by the Contract Documents and any local, state or federal regulations have been performed with respect to the substantially completed portions of the project and the Owner has been provided with a copy of each report.

As-built marked up prints of the substantially completed portions of the project have been provided to the Architect/Engineer as required by the Contract Documents.

The Owner has been provided with a copy of all warranties and guarantees, including the starting date(s) of all warranties and guarantees, written and unwritten, required by the Contract Documents with respect to the completed portions of the project, except as follows:

_____
_____
_____

All training, operating instructions and maintenance manuals required by the Contract Documents have been provided to the Owner, except as follows:

_____
_____
_____

This certificate does not constitute an acceptance of Work not in accordance with the Contract Documents nor is it a release of CONTRACTOR'S obligation to complete the Work in accordance with the Contract Documents.

_____
(Contractor Name)

By: _____

Print Name: _____

Title: _____

CERTIFICATE OF FINAL COMPLETION BY CONTRACTOR

Date: _____

County of Albemarle, Virginia, and/or
The School Board of Albemarle County, Virginia
c/o Facilities & Environmental Services – Facilities Planning & Construction Division
401 McIntire Road
Charlottesville, Virginia 22902-4596

Project Title: _____
RFQ/Contract No.: _____

In accordance with the requirements of the Contract Between Owner and Contractor (Form AC-9) the undersigned Contractor hereby states that the above named project has been fully completed in accordance with the requirements of the Contract Documents as modified by approved change orders.

All applicable tests, certificates and regulatory inspections required by the Contract Documents and any local, state or federal regulations have been performed with respect to the completed project and the Owner has been provided with a copy of each report.

As-built marked up prints of the completed project have been provided to the Architect/Engineer as required by the Contract Documents.

The Owner has been provided with a copy of all warranties and guarantees, including the starting date(s) of all warranties and guarantees, written and unwritten, required by the Contract Documents.

All training, operating instructions and maintenance manuals required by the Contract Documents have been provided to the Owner.

_____
(Contractor Name)

By: _____

Print Name: _____

Title: _____

Copy: Architect/Engineer

GEOTECHNICAL ENGINEERING REPORT

Albemarle County Public Schools
High School Center II
Albemarle County, Virginia

Schnabel Reference 24430010.000
May 31, 2024

Schnabel ENGINEERING
T 434.975.3200
480 Four Seasons Drive / Charlottesville, VA 22901 schnabel-eng.com

May 31, 2024

Mr. Kagan Squire
Project Manager / Project Inspector
Albemarle County Public Schools
Building Services Department
2751 Hydraulic Road
Charlottesville, Virginia 22901

Subject: **Geotechnical Engineering Report, Albemarle County Public Schools, High School Center II, 2751 Hydraulic Road, Charlottesville, Virginia 22901 (Schnabel Reference 23430010.000)**

Dear Mr. Squire:

SCHNABEL ENGINEERING, LLC (Schnabel) is pleased to submit our geotechnical engineering report for this project. This study was performed in accordance with our proposal dated March 8, 2024, as authorized by Task Order #3, our Term Contract No. 2023-548-RFP-3062133 (Schnabel Reference No. 22430042.00S) dated February 7, 2023, and Renewal No. 1 dated February 6, 2024, and the Construction & Professional Services Manual dated December 15, 2023.

SITE AND PROJECT DESCRIPTION

The project site is at the existing Albemarle High School (AHS), which is south of Lambs Lane and west of Hydraulic Road. The site is just north of the City of Charlottesville in the central portion of Albemarle County. The project footprint encompasses areas on the south and west of the existing AHS building. Existing conditions within the proposed development include the Albemarle County Building Services facility and associated paved areas, driveways, and parking areas on the south and west sides of the existing AHS building, and the practice fields northwest of the AHS building.

The proposed development includes a new High School Center (HSC) II south of the existing AHS. The new structure will be a two-story facility with a partial third level below grade on the western corner of the building footprint. We understand the partial below-grade level will be used for mechanical space, while the two above-grade stories will consist of educational space. The basement level will have a finished floor elevation (FFE) of about EL 564 ft. The main level will have an FFE of about EL 578 ft. We understand maximum column loads of 285 kips and maximum wall loads of 6.5 klf are anticipated.

The existing Building Services buildings and surrounding pavement will be razed for the new building and pavement. Existing ground surface elevations in this area vary from about EL 560 ft in the southwestern corner to about EL 592 ft in the southeastern corner. A new driveway will go around the proposed HSC II

building and connect to the existing Georgetown Green Road entrance near Hydraulic Road. We expect up to about 12 ft of cut will be required for the proposed basement and up to about 10 ft of fill will be placed for the new driveway on the southwestern corner of the proposed building.

The existing pick-up and drop-off loop west of AHS will be reconfigured in addition to associated sidewalk improvement. The existing paved area south of the tennis courts will be reconfigured to parking to increase capacity. Part of the existing practice field northwest of the loop and existing AHS building will be converted to parking, which will add about 200 spaces. The parking lot will have access to Lambs Lane to the north. A new underground stormwater storage pipe was initially planned northwest of the planned parking lot, but we understand that location may have changed. The storage pipe will connect to an existing stormwater pond that was recently installed during a sidewalk improvement project. We understand the improvements in this area will require minimal grading.

Lastly, we understand a new geothermal well field is being considered for the parking lot on the south of the existing AHS building and northeast of the proposed HSCII.

We obtained the site and project information based on our review of the drawings provided by you, our site reconnaissance, our review of aerial imagery and communication with you and the design team. We referenced the drawings by Quinn Evans dated December 9, 2023, and January 9, 2024, and drawings by Timmons Group dated January 24, 2024.

SUBSURFACE EXPLORATION AND LABORATORY TESTING PROGRAM

We performed a subsurface exploration and field testing program to identify the subsurface stratigraphy underlying the site and to evaluate the geotechnical properties of the materials encountered. This program included test borings and one hand auger. Exploration methods used are discussed below. The appendices contain the results of our exploration.

Subsurface Exploration Methods

Test Borings

Our subcontractor, Ayers and Ayers, Inc., drilled 24 test borings under our observation on April 4 and 5, 2024. The Standard Penetration Test (SPT) was performed at selected depths in the borings. Appendix A includes specific observations, remarks, and logs for the borings; classification criteria; drilling methods; and sampling protocols. Figures 2A and 2B, included at the end of this report, indicate the approximate test boring locations. We will retain soil samples up to 45 days beyond the issuance of this report, unless you request other disposition.

Hand Auger

Due to difficult access, our personnel drilled one hand auger on April 10, 2024. Appendix A includes specific observations, remarks, and logs for the hand augers; classification criteria; excavation methods; and sampling protocols. Figure 2B, included at the end of this report, indicates the approximate hand auger location.

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Soil Laboratory Testing

Our laboratory performed tests on selected samples collected during the subsurface exploration. The testing aided in the classification of materials encountered in the subsurface exploration and provided data for use in the development of recommendations for design of foundations, earthwork, below-grade walls, and pavements. The results of the laboratory tests are included in Appendix B and are summarized in the Site Geology and Subsurface Conditions section of this report. Selected test results are also shown on the boring logs in Appendix A.

SITE GEOLOGY AND SUBSURFACE CONDITIONS

Site Geology

Our subsurface exploration indicates the site is underlain by existing fill soils associated with prior site development. Below the existing fill soils, alluvial soils, residual soils, and disintegrated rock were encountered. Residual soil and disintegrated rock are derived from the in-place weathering of underlying bedrock.

Existing geologic data in our files were reviewed including the Geologic Map of Virginia, prepared by the Virginia Division of Mineral Resources in 1993. Based on this review, the project site is underlain by the Lynchburg Group formation from the late Proterozoic period. The underlying bedrock consists of metagraywacke, quartzose schist, and conglomerate.

Generalized Subsurface Stratigraphy

We characterized the following generalized subsurface stratigraphy based on the exploration and laboratory test data included in the appendices.

Ground Cover:

We encountered 1 to 7 inches of topsoil in eleven of the borings and hand auger that were performed in grass and wooded areas. The remaining borings were performed on existing pavement and encountered 1.5 to 7.5 inches of asphalt underlain by up to 21 inches of crushed stone. A summary of pavement thicknesses is provided below in Table 1.

Table 1: Approximate Pavement Thicknesses Observed

Boring	Asphalt Thickness (in)	Crushed Stone Thickness (in)
B-03	1.5	5
B-04	3.5	1.5
B-05	4	3
B-06	5	4
B-07	6	2
B-08	3	3

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Boring	Asphalt Thickness (in)	Crushed Stone Thickness (in)
P-01	2.5	3
P-02	2.5	4
P-03	7	4
P-04	7.5	N.E.
P-05	3.5	3
P-06	3	21
P-07	5.5	4
P-08	2	3

N.E. = Not Encountered

Stratum A: Existing Fill

Existing fill soils of Stratum A were encountered below the ground surface at all test locations except Borings B-06, P-08, P-09, and P-10, and Hand Auger HA-01. Fill soils extended to depths varying from 0.5 to 14 ft. The fine-grained fill soils of this stratum were classified as LEAN CLAY (CL), ELASTIC SILT (MH), and SILT (ML) with varying amounts of sand, mica, rock fragments, organics, ash, wood fragments, root fragments, crushed stone, concrete fragments, and asphalt fragments. The coarse-grained fill soils of this stratum consisted of SILTY SAND (SM) with varying amounts of mica, quartz fragments, asphalt fragments, root fragments, and crushed stone. Three samples representing this stratum were tested, which indicate these soils are generally of moderate to high plasticity with liquid limits of 39 to 53 and plasticity indices of 8 to 29. Based on the SPTs performed, this stratum is generally soft to hard consistency and loose to medium dense relative density with N values varying from 2 to 36 blows per foot (bpf).

We performed a Standard Proctor Compaction test and a California Bearing Ratio (CBR) test on two bulk samples representing this stratum. The results are summarized in the table below.

Table 2: Standard Proctor and CBR Testing Summary

Boring Number / Depth (ft)	USCS / AASHTO Classification	Maximum Dry Density, (pcf)	Optimum Moisture Content (%)	CBR Value	Swell (%)
P-03 0.9 – 5.0	MH / A-6	110.5	15.3	8.9	0.9
P-14 0.3 – 5.0	SM / A-7-5	114.8	13.0	11.2	0.8

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Natural moisture content values of Stratum A soils tested in our laboratory varied from 17 to 25 percent, or 2 to 12 percent above the optimum value. Laboratory tests performed on samples representing this stratum indicate these soils exhibit a low to medium potential for moisture-related volume change (shrink/swell behavior).

Stratum B: Alluvium

Below the fill soils of Stratum A, alluvial soils of Stratum B were encountered in Borings B-01 and B-08 at depths ranging from 9 to 22 ft. The fine-grained alluvium soil was classified as LEAN CLAY (CL) with varying amounts of sand, mica, wood fragments, and rock fragments. The coarse-grained alluvium soils were classified as CLAYEY SAND (SC) and SILTY SAND (SM) with varying amounts of mica and root fragments. One sample tested from this stratum had a natural moisture content of about 14 percent. Based on SPTs performed, this stratum is generally stiff consistency and loose density with N values varying from 4 to 10 bpf.

Stratum C: Residuum

Residual soils were encountered below the exiting fill soils, alluvium, and ground cover in 17 of the test locations and extended to depths varying from 2 to 30 ft below the ground surface, the maximum depth of exploration. The fine-grained residual soils were classified as LEAN CLAY (CL), ELASTIC SILT (MH), and SILT (ML) with varying amounts of sand, mica, and root fragments. The coarse-grained materials consisted of SILTY SAND (SM) with mica and root fragments. Three samples were tested from this stratum and indicate these soils are generally of low to high plasticity with liquid limits ranging from non-plastic to 72 and plasticity indices from non-plastic to 29. The natural moisture contents measured varied from about 18 to 29 percent. Based on the SPTs performed, this stratum is medium stiff to hard consistency and loose to dense with N values ranging from 8 to 50 bpf.

Laboratory tests performed on samples representing Stratum C indicate these soils exhibit a low to medium potential for moisture-related volume change (shrink/swell behavior).

Testing conducted to evaluate the corrosivity of soils for the initial location of the proposed stormwater storage pipe (Boring S-01) resulted in a pH value of 4.7, Redox Potential value of 175, a Resistivity value of 22,000, and a negative test for sulfides. Based on the test results, the soils in this area are considered to have a low potential for corrosion affecting ferrous metal buried structures in accordance with the American Water Works Association (AWWA) Standards. The method is included for reference in Appendix B.

Stratum D: Disintegrated Rock and Rock

Disintegrated rock of Stratum D was encountered below the fill soils and residual soils in 10 of the 24 test locations at depths varying from 2 to 20 ft below the ground surface. These soils extended to depths of about 3.8 to 30 ft, the maximum depth of exploration. The materials classified as SILTY SAND (SM) and contained mica and quartz fragments.

Disintegrated rock is defined as residual material with SPT N values between 60 bpf and refusal. Sampler refusal is defined as an N value of 50 blows for a penetration of one inch or less and auger

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refusal is defined when an auger cannot be safely advanced any further. Sampler and auger refusal are generally indicative of rock. Disintegrated rock and rock depths and elevations are listed in Table 3.

Table 3: Summary of Disintegrated Rock and Rock in Borings

Boring Number	Depth to Disintegrated Rock (ft)	Elevation of Disintegrated Rock (ft)	Depth to Rock (ft)	Elevation of Rock (ft)
B-02	20.0	554.0	N.E.	N.E.
B-03	19.5	556.5	20.5	555.5
B-04	17.0	560.0	N.E.*	N.E.*
B-05	7.5	573.5	10.1	570.9
B-06	7.0	576.0	12.1	570.9
B-08	14.5	563.5	17.1	560.9
P-01	4.0	569.0	N.E.	N.E.
P-11	2.0	570.0	N.E.*	N.E.*
P-13	2.0	570.0	N.E.*	N.E.*
S-01	6.5	562.5	8.0	561.0

N.E. = Not Encountered
** Rock not encountered but may be just below explored depth.*

Groundwater

We observed groundwater in five borings at depths of 14 to 18.5 ft, about EL 557.5 to 564. The remaining borings caved dry at depths varying from 2 to 18.5 ft. The test boring logs in Appendix A include groundwater observations obtained during our subsurface exploration. These data include depths to groundwater encountered during drilling, upon drilling completion, and following completion of the boring.

Our drilling subcontractor installed a temporary water observation well in Boring B-02. We observed groundwater in this well at a depth of about 16.1 ft (about EL 557.1) six weeks after completion of the borings. We did not obtain long-term water level readings in the remaining borings since we backfilled them upon completion for safety.

Based on our groundwater observations, we do not expect groundwater will be encountered in excavations for foundations and utilities. However, the groundwater levels on the logs indicate our estimate of the hydrostatic water table at the time of our subsurface exploration. The final design should anticipate the fluctuation of the hydrostatic water table depending on variations in precipitation, surface runoff, pumping, evaporation, leaking utilities, stream levels, and similar factors.

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Seismic Site Classification

We evaluated the Seismic Site Class for this project according to the International Building Code (IBC) Section 1615 (2021). Our analysis indicates Site Class D for this location. This Site Class was evaluated based on SPT values extrapolated to a depth of 100 ft.

GEOTECHNICAL RECOMMENDATIONS

We based our geotechnical engineering analysis on the information developed from our subsurface exploration and soil laboratory testing, along with the project development plans, and site plans furnished to our office. We recommend shallow spread footings for support of the proposed structure based on our analysis. The following sections of the report provide our detailed recommendations.

Site Grading and Earthwork

Proposed building and site grades will require placement of up to 5 ft of compacted structural fill. Cuts of up to 10 ft are also anticipated. Rock is expected to be encountered in utility excavations across the site, but rock excavation is less likely for the building. Recommendations for compacted fill subgrade preparation, fill soil requirements, placement and compaction criteria, evaluating rock excavation are presented in subsequent sections.

Compacted Fill Subgrades

Subgrades to receive compacted structural fill for building or pavement support should be stripped of vegetation, topsoil, and organic matter. Our subsurface exploration indicated topsoil to depths of 1 to 7 inches below the ground surface. However, stripping of wooded or previously cultivated sites typically results in some disturbance and contamination of near-surface soils, particularly during periods of wet weather. Therefore, we recommend a topsoil stripping depth of 12 inches be considered for the site during the project planning.

Compacted structural fill subgrades should consist of suitable natural soils of Strata C and D. These soils are expected to be encountered at varying depths beneath the ground cover.

Existing fill soils of Stratum A were encountered to depths varying from 0.5 to 14 ft below the ground surface across the site (as low as about EL 562 ft). The consistency of man-made uncontrolled fills can vary significantly in short distances. Based on the available boring data, the existing fill appears to have been placed with compaction. However, existing fill soils can be variable and may or may not be suitable for placement of compacted structural fill to support the proposed building. Therefore it's critical that fill subgrades consisting of existing fill should be further evaluated during construction by the Geotechnical Engineer.

The Geotechnical Engineer should evaluate the suitability of the fill subgrades. The stripped subgrades should be proofrolled with a loaded dump truck to evaluate the subgrade suitability for support of the compacted structural fill prior to any undercutting or initiation of fill placement. Areas that exhibit excessive pumping, weaving, or rutting should be scarified, dried and recompacted, or undercut and replaced with compacted structural fill as recommended by the Geotechnical Engineer. Subgrade

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evaluation techniques complementary to proofrolling could include a combination of probing with a penetrometer, drilling hand augers, or observing test pits.

Subgrades beyond the building limits that exhibit unsuitable movements during proofrolling may be stabilized by using crushed stone and geotextile working platforms. Recommendations for working platforms should be provided by the Geotechnical Engineer.

If stripping and earthwork operations are performed during an extended period of warm, dry weather, the non-organic portions of the undercut materials may be reused as compacted structural fill. The use of these materials as compacted structural fill will depend on the soil moisture content, and the Contractor's ability to limit contamination of these materials with organic matter during stripping and undercutting.

When removal of unsuitable materials is required, the excavation should be performed in a manner to limit disturbance of the underlying suitable material. The excavation should be performed under the observation of the Geotechnical Engineer to evaluate required excavation depths.

Undercut volumes should be evaluated by cross sectioning. Other methods of calculating volumes of undercut, such as counting trucks, are less accurate and generally result in additional expense. If truck counts are used, we recommend the method of payment be in accordance with Section 109 of *VDOT Road and Bridge Specifications.*

Compacted structural fill subgrades should be kept free of ponded water. If springs or other flowing water is present at the compacted structural fill subgrade level, the Contractor should direct water to discharge beyond the fill limits. Recommendations for discharging springs should be provided by the Geotechnical Engineer.

Compacted structural fill subgrades should be free of snow, ice, and frozen soils. If snow, ice, or frozen soils are present at subgrade levels, these materials should be removed as recommended by the Geotechnical Engineer.

Some existing structures present on site will need to be removed before earthwork construction. Therefore, buried foundations and other associated debris may be encountered during grading activities. Existing foundations should be completely removed from the proposed building area. Existing utilities and drainage structures within the building area should be removed and replaced with compacted structural fill.

Compacted structural fill subgrades should not be steeper than about 4H:1V. If steeper slopes are present, subgrades should be benched to permit placement of horizontal lifts of fill.

Compacted Fill

Compacted structural fill and backfill in building and pavement areas should consist of non-organic on-site soils, except as follows. On-site material classifying as CH and MH should not be used behind below-grade walls or within 3 ft of pavement subgrades. If off-site borrow materials are needed, these soils should classify CL, ML, SC, SM, SP, SW, GC, GM, GP or GW according to ASTM D2487. Fill materials should not contain particles larger than 4 inches.

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Compacted structural fill should be placed in maximum 8-inch thick horizontal, loose lifts. Fill should be compacted to at least 95 percent of the maximum dry density per ASTM D698 (Standard Proctor). Backfill placed in excavations, trenches, and other areas that large compaction equipment cannot access should be placed in maximum 6-inch thick lifts. Backfill should meet the material, placement, and compaction requirements outlined above.

Successful re-use of the excavated, on-site soils as compacted structural fill will depend on their natural moisture contents during excavation. Laboratory test results indicate soils encountered in proposed borrow areas are wet of the optimum moisture content. Scarifying and drying of these soils should be anticipated to achieve the recommended compaction. Drying of these soils will likely result in some delays, and may not be possible during cooler, wetter weather. We recommend that the earthwork be performed during the warmer, drier times of the year.

Rock Excavation

Test boring and hand auger data, when compared to planned foundation grades, indicate that rock is less likely to be encountered during building excavation. However, we anticipate rock will be encountered in utility excavations across the site, as indicated in Table 3. Conditions encountered during excavation may be different than those observed in the test boring data. Therefore, we recommend the contract documents include unit prices for rock excavation.

Variations in rock conditions should be expected since the rock surface can fluctuate across the site. Also, the extent of rock excavation will depend on the Contractor's methods, rock jointing, and rock foliation. Rock excavation methods may be needed at higher elevations in footing and utility excavations.

A sample definition of rock for excavation specifications is provided below:

> *For mass excavation, rock is defined as any material that cannot be dislodged by a Caterpillar Model No. D-8 heavy-duty tractor, or equivalent, equipped with a hydraulically operated, single-tooth power ripper without the use of hoe-ramming or blasting. For trench, footing and pit excavations, rock excavation shall be defined in terms of a Caterpillar Model No. 330 hydraulic excavator, or equivalent. This classification does not include material such as loose rock, concrete, cemented gravel, or other materials that can be removed by means other than hoe-ramming or blasting, but which for reasons of economy in excavating, the Contractor chooses to remove by hoe-ramming or blasting. Rock does not include boulders less than one cubic yard in volume. Boulders larger than one cubic yard in volume will be considered rock for payment purposes.*

Where the rock cannot be removed with conventional excavation equipment, special means of excavation may be needed. Removal of rock may require the use of blasting, air-powered tools, rock splitters, or large hoe rams.

Spread Footings

We consider spread footings suitable for support of the proposed structure. Footings should be founded on suitable material consisting of the existing fill of Stratum A, residual soils of Stratum B, disintegrated rock of Stratum D or on compacted structural fill. Compacted structural fill should meet the requirements

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outlined in the Site Grading and Earthwork section of this report. We recommend footings supported on these materials be designed for a net allowable soil bearing pressure of 2,500 psf. This bearing pressure provides a factor of safety against general bearing capacity failure of at least 3.0.

The above allowable soil bearing pressure may be increased by 33 percent for wind and seismic loads when used in conjunction with load combinations defined in IBC 2018 Section 1605.3.2, Alternative Basic Load Combinations for use with allowable stress design. This increase is not applicable for other allowable stress load combinations, strength design, or load and resistance factor design.

As discussed in the Site Grading and Earthwork section, existing fill soils of Stratum A were encountered to depths varying from 0.5 to 14 ft below the ground surface across the site (as low as about EL 562 ft). The consistency of man-made uncontrolled fills can vary significantly in short distances. Therefore, fill subgrades consisting of existing fill should be further evaluated during construction. For example, soft unsuitable existing fill soils were encountered in Boring B-03 to a depth of about 4 ft in the location of the proposed basement. These soils are not considered suitable for support of the proposed structure, but based on proposed building grades, the soils will be removed. Project planning should consider that some footings subgrade will require undercut during construction.

All footing subgrades should be observed by the Geotechnical Engineer prior to placement of concrete to evaluate if subgrade materials are as anticipated.

If unsuitable soils are encountered at the design bearing grade, these soils should be removed and replaced as recommended by the Geotechnical Engineer. Unsuitable soils should be replaced with compacted fill consisting of fine-grained soils, controlled low strength material (CLSM), or concrete. Open-graded stone such as VDOT No. 57 stone should not be used as undercut backfill as this material would provide a pathway for surface water to increase the moisture content of the underlying soils and potentially increase the risk of shrink/swell.

Settlements of shallow foundations supported on suitable natural soils and on properly placed compacted structural fill are not expected to exceed about one inch. Differential settlements between similarly loaded footings are not expected to exceed about half this value.

Column and wall footings should be at least 24 and 16 inches wide, respectively, for shear considerations.

Moderate to high plasticity silts and clays were encountered in the fill soils of Stratum A and residual soils of Stratum B. Based on laboratory testing, these soils exhibit a medium to high potential for moisture-related volume change (shrink/swell behavior). To limit the potential for damage due to seasonal moisture-related volume change of foundation soils, we recommend footings be founded at least 3 ft below final exterior grades. This depth will also be satisfactory for footings that are subject to freezing. Interior footings may be founded at nominal depths below the floor slabs.

Where bearing grades between adjacent footings vary, the slope between the bottom edges of adjacent footings should not be steeper than 45 degrees (1H:1V).

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Floor Slabs

The proposed floor slabs should be supported on suitable soils of Strata A, C, and D or compacted structural fill. A modulus of subgrade reaction, k, of 125 pci should be used in the design of floor slabs. The recommended modulus value is for a 1-ft-square plate. Some slab design software may consider different definitions of k for input. The Structural Engineer should contact our office if their software considers a different definition of k.

A four-inch crushed stone or washed gravel capillary moisture barrier should underlie floor slabs on grade. Moisture barrier material should consist of VDOT No. 57 crushed stone. The Contractor should compact the stone in place with at least two passes of suitable vibratory compaction equipment.

The Contractor should compact floor slab subgrades to repair any disturbance that may occur due to construction operations before placing capillary moisture barrier materials. Since floors will be slab-on-grade, footing and utility excavations should be backfilled with compacted structural fill as defined in the Site Grading and Earthwork section of this report.

Below-Grade Walls

Below-grade building walls will be braced by the structure preventing movement. Site retaining walls that are not braced should be designed as cantilevered walls. Equivalent fluid pressure factors are presented in Table 4 for the respective backfill conditions. The surcharge pressure ordinate should be obtained by multiplying the surface surcharge pressure, q, by the factor in Table 4 for the respective backfill condition.

Table 4: Recommended Design Parameters for Walls

Wall Type	Backfill Materials	Equivalent Fluid Pressure Factor, g_{ef} (psf/ft depth)	Surcharge Pressure Factor	Passive Equivalent Fluid Pressure Factor, γ_P (psf/ft depth)
Braced	On-site	50	0.50	-
Braced	Free-draining	42	0.38	
Cantilevered	On-site	33	0.33	300
Cantilevered	Free-draining	26	0.24	

Cantilevered retaining walls may resist sliding based on an ultimate frictional resistance factor, f, between the concrete base and the soil of 0.30, and the ultimate passive resistance along the face of the footing and a possible key beneath the wall footing. The design should base ultimate passive resistance on the passive equivalent fluid unit weight for on-site soils shown above in Table 4. The design should not consider passive resistance to act against the front face of the wall above a depth of 2 ft. The evaluation of sliding and overturning resistance should use a factor of safety of 2.0. Sliding resistance may use a factor of safety of 1.5 when the design considers frictional resistance alone and ignores passive resistance.

The above parameters consider a horizontal ground surface behind and in front of the walls. We should be contacted to provide alternative parameters if sloping ground surface conditions are anticipated.

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These design parameters do not consider hydrostatic pressure since we recommend subdrainage behind the walls. Basement walls should be backfilled as recommended below. Basement walls should be water proofed.

Backfill materials for walls designed considering free-draining backfill should consist of non-plastic material classifying SP-SM, SW-SM, SP, SW, GW-GM, GP-GM, GP or GW according to ASTM D2487. This classification includes open-graded crushed stone such as VDOT No. 57. Free-draining backfill should be placed in the zone extending from the base of the wall upwards at 45 degrees. Backfill materials for walls designed considering on-site materials used for backfill should consist of material classifying CL, ML, SC, SM, SP, SW, GP or GW according to ASTM D2487. Soils classifying as CH and MH should not be placed as backfill behind below-grade walls.

The Contractor should place backfill in maximum 6-inch thick loose lifts, and compact each lift to at least 95 percent of maximum dry density according to ASTM D698 (Standard Proctor), or to at least 70 percent relative density according to ASTM D4253 and D4254. Only light hand-operated equipment should be used to compact backfill against walls. The Structural Engineer of Record should approve the size of the compaction equipment. If backfill consists of open-graded aggregate, the Contractor should place backfill in maximum 12-inch thick lifts, and compact each lift using suitable vibratory equipment.

To reduce the potential for infiltration of surface water into free-draining backfill, we recommend capping wall backfill outside the building limits with a minimum 1.5-ft thick layer of compacted structural fill consisting of lo permeability clay or silt soils. A layer of drainage geotextile such as Mirafi 160N should separate these soils from the VDOT No. 57 open-graded aggregate. A layer of low permeability soils is not required where pavements will be installed against the building. Finished grades should slope away from the building to provide positive drainage.

Earth pressure recommendations provided do not include hydrostatic pressure since subdrainage will be provided behind the basement walls. Subdrainage should consist of perimeter subdrains located on top of the wall footing, next to the wall. Subdrains should consist of perforated Schedule 40 PVC pipe surrounded by at least six inches of filter drainage material. Subdrains should drain by gravity to an outlet, or to a sump or storm sewer.

Geocomposite drainage panels consisting of Miradrain G100N or equivalent should be installed on all basement walls when on-site soils are used as wall backfill. Drainage panels should be placed along the entire wall face to within 1.5 ft of finished grade. The Contractor should bind the edges of the panels with drainage geotextile to limit the potential for soil intrusion into the drainage system.

Drainage filter material should consist of VDOT No. 57 or 78 aggregate. Drainage geotextile should consist of a non-woven geotextile such as Mirafi 160N or equivalent.

Pavements

The Contractor should prepare pavement subgrades and place compacted structural fill for pavement support as described in the Site Grading and Earthwork section of this report. Dense-graded aggregate placed as pavement base course should be compacted to at least 95 percent of maximum dry density according to ASTM D698, Standard Proctor. Dense-graded aggregate should be placed in maximum 8-inch thick loose lifts.

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Final pavement subgrades should be proofrolled under the observation of the Geotechnical Engineer immediately prior to placing subbase or base course aggregate to evaluate their suitability to support the pavement.

We developed the recommended pavement sections according to the AASHTO 1993 design method for flexible pavements based on a design CBR value of 6.7. This design CBR value represents two-thirds of the measured laboratory average of 10.1.

The traffic volumes considered in our analysis are 2,500 vehicles per day in the driveways and service roadways. This traffic volumes include five percent truck and bus traffic.

Our analysis considers that proper grading will be maintained to provide runoff from the pavement surface and beyond the limits of paved areas. We recommend the following pavement sections:

Table 5: Pavement Sections

Type Section	Thickness (inches)
Automobile Parking Areas – Type I Section	
Asphalt Concrete Surface Course, VDOT SM-9.5A	2.0
Dense-Graded Aggregate Base Course, VDOT 21A/B	6.0
Driveways and Service Roadways – Type II Section	
Asphalt Concrete Surface Course, VDOT SM-9.5A	1.5
Asphalt Concrete Base Course, VDOT BM-25.0A	4.0
Dense-Graded Aggregate Subbase Course, VDOT 21A/B	6.0
Rigid Pavement – Type III Section	
Jointed Reinforced Concrete	6.0
Dense-Graded Aggregate Subbase Course, VDOT 21A/B	6.0

The Type I Section should be used only in automobile parking areas. The Type II Section should be used where truck and bus traffic or high traffic volumes are anticipated.

We recommend that reinforced concrete pavement be used in the loading dock pad and basement entrance approach pad areas. These pads should be designed based on a modulus of subgrade reaction value, k, of 125 pci. The recommended modulus value is for a 1-ft-square plate. Some pavement design software may consider different definitions of k for input. The Civil Engineer should contact our office if their software considers a different definition of k.

Adequate control of surface drainage will be a very important consideration for the overall performance of this pavement design. The area surrounding pavements should be graded to direct surface water away from paved areas. Utility excavations within pavement areas should be backfilled with compacted structural fill.

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CONSTRUCTION CONSIDERATIONS

Site Grading and Earthwork

The test boring and hand auger data indicate the approximate depth of topsoil based on our visual identification procedures. The depth of stripping needed to provide a suitable base for placement of earthwork or pavements may include topsoil and other softer surficial layers. Stripping depths in wooded or previously cultivated areas will be greater, particularly during periods of wet weather. The depth of required stripping should be determined by the excavation Contractor prior to construction using test pits, probes, or other means.

The on-site soils are susceptible to moisture changes, will be easily disturbed, and will be difficult to compact under wet weather conditions. Drying and reworking of the soils are likely to be difficult during periods of wet months. We recommend that the earthwork phases of this project be performed during the warmer, drier times of the year to limit the potential for disturbance of on-site soils.

Traffic on stripped or undercut subgrades should be limited to reduce disturbance of underlying soils. Also, using lightweight, track-mounted dozer equipment for stripping will limit the disturbance of underlying soils, and may reduce the undercut volume needed. The Contractor should provide site drainage to maintain subgrades free of water and to avoid saturation and disturbance of the subgrade soils before placing compacted structural fill, pavement base course or moisture barrier material. This site drainage will be important during all phases of the construction work. The Contractor should be responsible for reworking of subgrades and compacted structural fill that were initially considered suitable but were later disturbed by equipment and/or weather.

Spread Footings

The Contractor should exercise care during excavation for spread footings so that as little disturbance as possible occurs at the foundation level. The Contractor should carefully clean loose or soft soils from the bottom of the excavation before placing concrete. A Geotechnical Engineer from our firm should observe footing subgrades prior to concrete placement to evaluate whether subgrade soils are as anticipated in this report.

Due to the presence of existing fill soils of Stratum A, project planning should consider that some footings subgrade will require undercut during construction. Footing subgrades needing undercut may be concreted at the elevation of undercut or backfilled to the original design subgrade elevation with compacted fill consisting of fine-grained soils, controlled low strength material (CLSM), or concrete. Open-graded stone such as VDOT No. 57 stone should not be used as undercut backfill as this material would provide a pathway for surface water to increase the moisture content of the underlying soils and potentially increase the risk of shrink/swell. Placement of concrete should take place the same day as excavation of footings.

The potential for variation of moisture content in foundation soils is probably greatest during construction. If the moisture content of foundation soils increases or decreases during construction, a moisture-related change in volume will likely occur as theses soils return to their natural moisture content. Therefore,

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prompt placement of concrete, backfilling, and grading are very important for proper foundation performance.

Engineering Services During Construction

The engineering recommendations provided in this report are based on the information obtained from the subsurface exploration and laboratory testing. However, conditions on the site may vary between the discrete locations observed at the time of our subsurface exploration. The nature and extent of variations between borings may not become evident until during construction.

To account for this variability, we should provide professional observation and testing of subsurface conditions revealed during construction as an extension of our engineering services. These services will also help in evaluating the contractor's conformance with the plans and specifications in accordance with building code and Special Inspection requirements. Because of our unique position to understand the intent of the geotechnical engineering recommendations, retaining Schnabel for these services will allow the owner to receive consistent service throughout the project construction.

General Specification Recommendations

An allowance should be established to account for possible additional costs that may be required to construct earthwork and foundations as recommended in this report. Additional costs may be incurred for a variety of reasons including variation of soil between borings, greater than anticipated unsuitable soils, need for borrow fill material, wet on-site soils, obstructions, rock excavation, temporary dewatering, etc.

The project specifications should indicate the Contractor's responsibility for providing adequate site drainage during construction. Inadequate drainage will most likely lead to disturbance of soils by construction traffic and increased volume of undercut.

This report may be made available to prospective bidders for informational purposes. We recommend that the project specifications contain the following statement:

> *Schnabel Engineering, LLC has prepared this geotechnical engineering report for this project. This report is for informational purposes only and is not part of the contract documents. The opinions expressed represent the Geotechnical Engineer's interpretation of the subsurface conditions, tests, and the results of analyses performed. Should the data contained in this report not be adequate for the Contractor's purposes, the Contractor may make, before bidding, independent exploration, tests and analyses. This report may be examined by bidders at the office of the Owner, or copies may be obtained from the Owner at nominal charge.*

Additional data and reports prepared by others that could have an impact upon the Contractor's bid should also be made available to prospective bidders for informational purposes.

LIMITATIONS

We based the analyses and recommendations submitted in this report on the information revealed by our exploration. We attempted to provide for normal contingencies, but the possibility remains that unexpected conditions may be encountered during construction.

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This report has been prepared to aid in the evaluation of this site and to assist in the design of the project. It is intended for use concerning this specific project. We based our recommendations on information on the site and proposed construction as described in this report. Substantial changes in loads, locations, or grades should be brought to our attention so we can modify our recommendations as needed. We would appreciate an opportunity to review the plans and specifications as they pertain to the recommendations contained in this report, and to submit our comments to you based on this review.

We have endeavored to complete the services identified herein in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in the same locality and under similar conditions as this project. No other representation, express or implied, is included or intended, and no warranty or guarantee is included or intended in this report, or other instrument of service.

We appreciate the opportunity to be of service for this project. Please call us if you have any questions regarding this report.

Sincerely,

SCHNABEL ENGINEERING, LLC

Caleb J. Irizarry, EIT
Senior Staff Engineer

Noland M. Silman, PE
Associate

COMMONWEALTH OF VIRGINIA
NOLAND SILMAN
Lic. No. 050054
PROFESSIONAL ENGINEER

Figures
Appendix A: Subsurface Exploration Data
Appendix B: Soil Laboratory Test Data

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FIGURES

Figure 1: Site Vicinity Map
Figures 2A and 2B: Boring Location Plan

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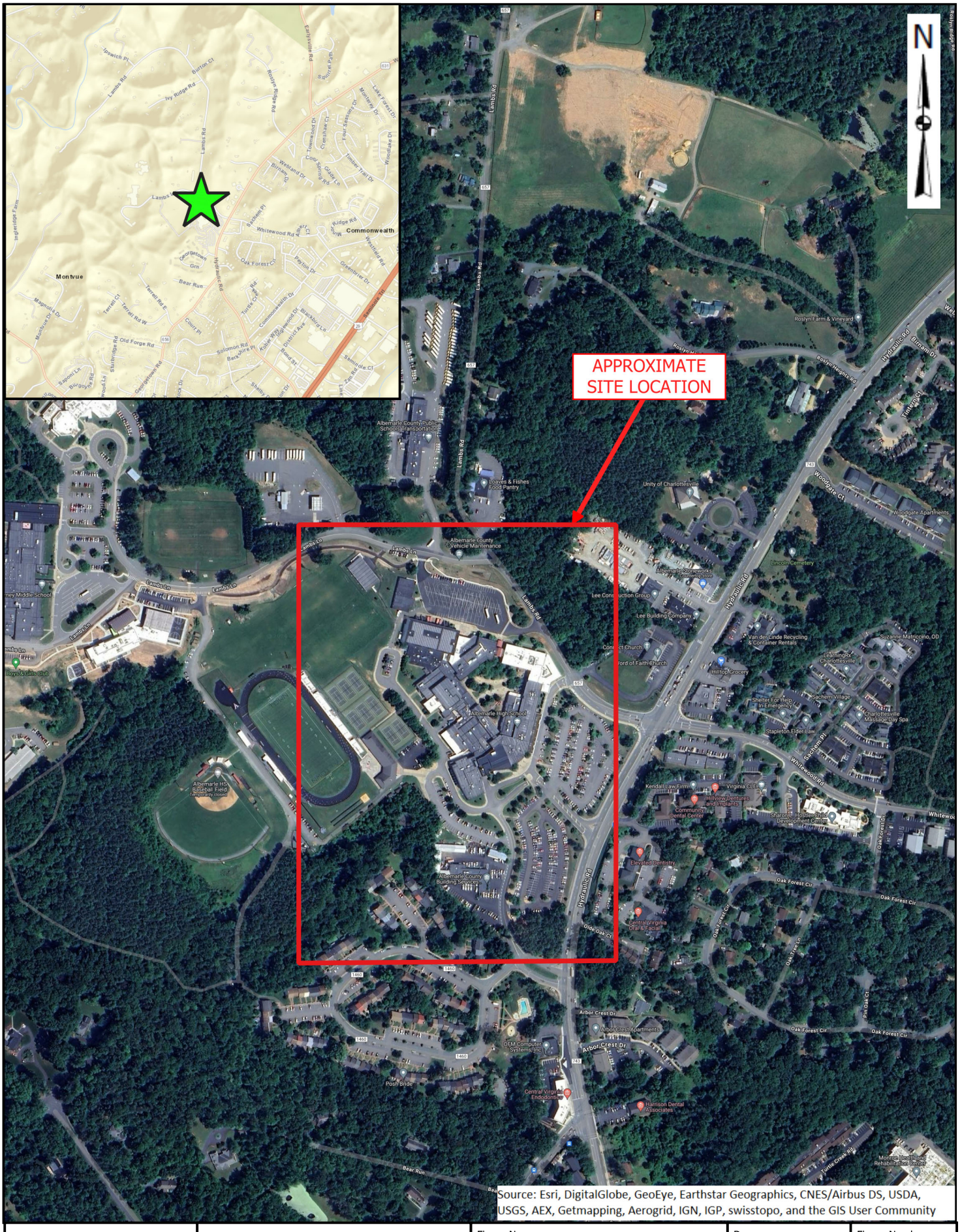
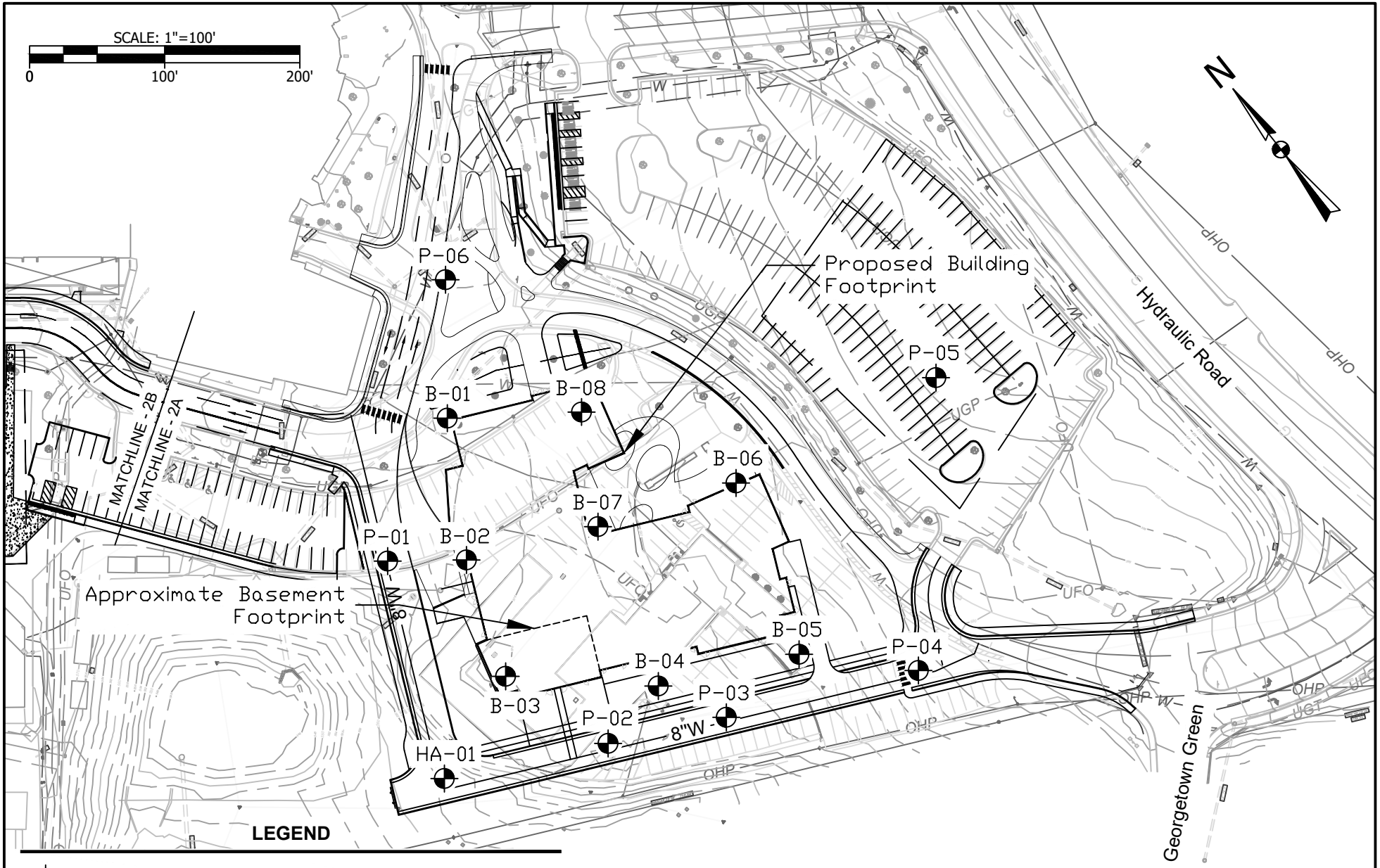


Schnabel ENGINEERING	ALBEMARLE COUNTY PUBLIC SCHOOLS HIGH SCHOOL CENTER II 2751 HYDRAULIC ROAD ALBEMARLE COUNTY, VIRGINIA	Figure Name: SITE VICINITY MAP	Done: G. MARRERO-GARCIA	Figure Number: 1
		Project Number: 24430010	Reviewed: N. SILMAN	Date: APR 2024



Base Plan Provided by Timmons Group on April 17, 2024.

Schnabel ENGINEERING	ALBEMARLE COUNTY PUBLIC SCHOOLS HIGH SCHOOL CENTER II 2751 HYDRAULIC ROAD ALBEMARLE COUNTY, VIRGINIA	Figure Name: BORING LOCATION PLAN	Done: C. IRIZARRY	Figure Number: 2A
		Project Number: 24430010.000	Reviewed: N. SILMAN	Date: MAY 2024

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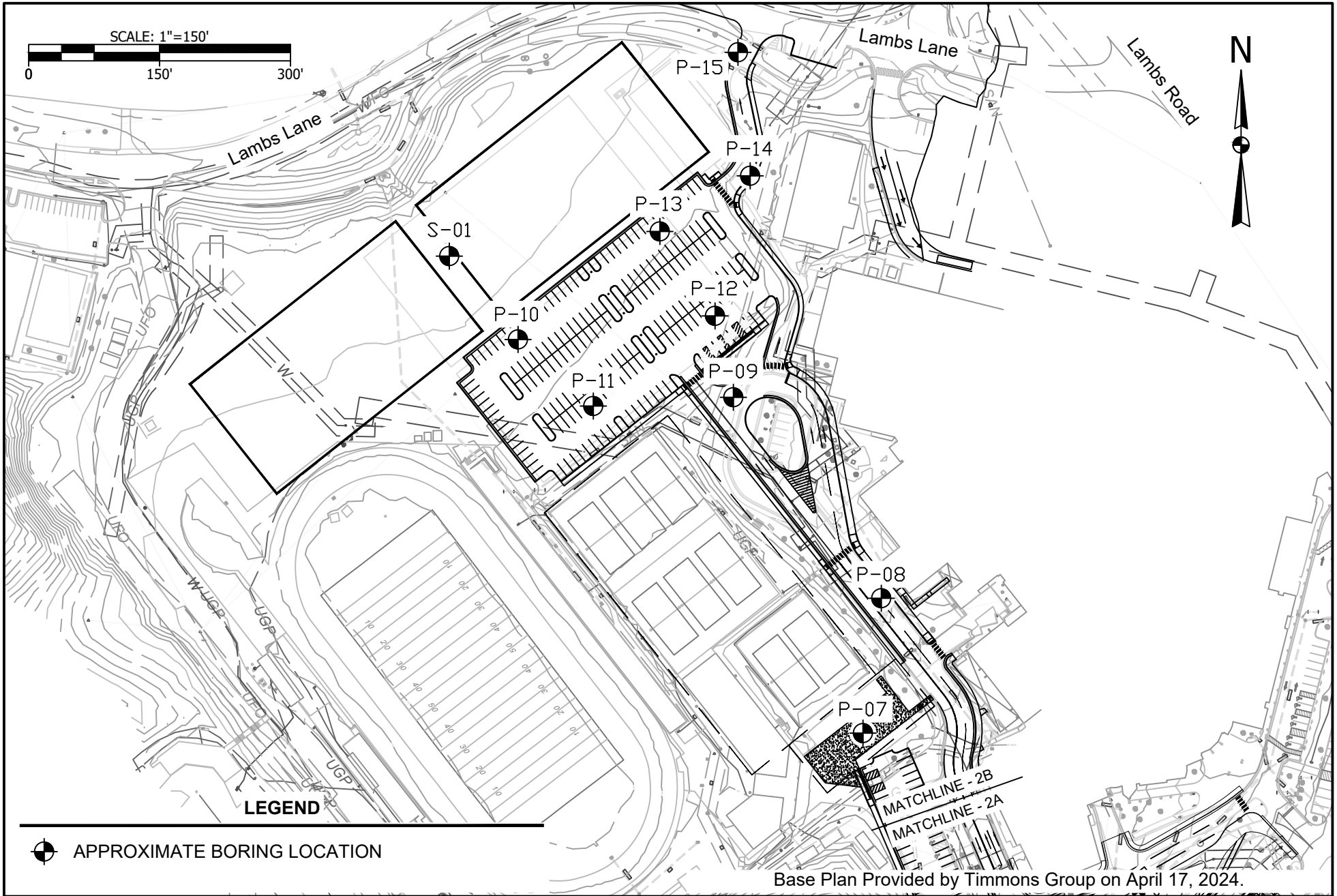

Base Plan Provided by Timmons Group on April 17, 2024.

Schnabel ENGINEERING	ALBEMARLE COUNTY PUBLIC SCHOOLS HIGH SCHOOL CENTER II 2751 HYDRAULIC ROAD ALBEMARLE COUNTY, VIRGINIA	Figure Name: BORING LOCATION PLAN	Done: C. IRIZARRY	Figure Number: 2B
		Project Number: 24430010.000	Reviewed: N. SILMAN	Date: MAY 2024

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APPENDIX A

SUBSURFACE EXPLORATION DATA

Subsurface Exploration Procedures
General Notes for Subsurface Exploration Logs
Identification of Soil
Boring Logs, B-01 through B-08, P-01 through P-15, and S-01
Hand Auger Log, HA-01

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SUBSURFACE EXPLORATION PROCEDURES

Test Borings – Hollow Stem Augers

The borings are advanced by turning a continuous flight auger with a center opening of 2¼ inches. A plug device blocks off the center opening while augers are advanced. Cuttings are brought to the surface by the auger flights. Sampling is performed through the center opening in the hollow stem auger, by standard methods, after removal of the plug. Usually, no water is introduced into the boring using this procedure.

Hand Auger

Our personnel drilled the hand auger using a three-inch O.D. auger. We visually classified the soils encountered according to ASTM D2488. Geostick penetrometer readings were taken during excavation. Geostick penetrometer readings give a general indication of the soil's in place density or consistency. Geostick penetrations are shown in the Remarks column on the hand auger log as "GP= ."

Standard Penetration Test Results

The numbers in the Sampling Data column of the boring logs represent Standard Penetration Test (SPT) results. Each number represents the blows needed to drive a 2-inch O.D., 1⅜-inch I.D. split-spoon sampler 6 inches, using a 140-pound hammer falling 30 inches. The sampler is typically driven a total of 18 or 24 inches. The first 6 inches are considered a seating interval. The total of the number of blows for the second and third 6-inch intervals is the SPT "N value." The SPT is performed according to ASTM D1586.

Soil Classification Criteria

The group symbols on the logs represent the Unified Soil Classification System Group Symbols (ASTM D2487) based on visual observation and limited laboratory testing of the samples. Criteria for visual identification of soil samples are included in this appendix. Some variation can be expected between samples visually classified and samples classified in the laboratory.

Volatile Organic Vapor Screening

The headspaces of soil samples collected during our subsurface exploration were screened for the presence of volatile organic compound (VOC) vapors with a Photoionization Detector (PID). The PID provides an indication of the concentration of organic vapors in the headspace in parts per million (ppm). The PID detects a variety of organic vapors but does not detect the presence of methane. PID readings are presented in the remarks column of the test boring logs.

Water Observation Well

A temporary water observation well was installed in Boring B-02 by inserting a hand-slotted, 1¼-inch PVC pipe in the boring. The pipe was capped and the area surrounding the pipe was backfilled with cuttings from the boring.

Boring and Hand Auger Locations and Elevations

Boring and hand auger locations were located using sub-meter GPS equipment. Approximate boring and hand auger locations are shown on Figures 2A and 2B. Ground surface elevations at the boring and hand auger locations were obtained from the site topographic plan and are indicated on the boring logs. Locations and elevations should be considered no more accurate than the methods used to determine them.

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GENERAL NOTES FOR SUBSURFACE EXPLORATION LOGS

1. Numbers in sampling data column next to Standard Penetration Test (SPT) symbols indicate blows required to drive a 2-inch O.D., 1⅜-inch I.D. sampling spoon 6 inches using a 140 pound hammer falling 30 inches. The Standard Penetration Test (SPT) N value is the number of blows required to drive the sampler 12 inches, after a 6 inch seating interval. The Standard Penetration Test is performed in general accordance with ASTM D1586.
2. Visual classification of soil is in accordance with terminology set forth in "Identification of Soil." The ASTM D2487 group symbols (e.g., CL) shown in the classification column are based on visual observations.
3. Estimated water levels indicated on the logs are only estimates from available data and may vary with precipitation, porosity of the soil, site topography, and other factors.
4. Refusal at the surface of rock, boulder, or other obstruction is defined as an SPT resistance of 50 blows for 1 inch or less of penetration.
5. The logs and related information depict subsurface conditions only at the specific locations and at the particular time when drilled or excavated. Soil conditions at other locations may differ from conditions occurring at these locations. Also, the passage of time may result in a change in the subsurface soil and water level conditions at the subsurface exploration location.
6. The stratification lines represent the approximate boundary between soil and rock types as obtained from the subsurface exploration. Some variation may also be expected vertically between samples taken. The soil profile, water level observations and penetration resistances presented on these logs have been made with reasonable care and accuracy and must be considered only an approximate representation of subsurface conditions to be encountered at the particular location.
7. Key to symbols and abbreviations:

S-01, SPT	Sample No., Standard Penetration Test
5+10+1	Number of blows in each 6-inch increment

S-01, SAMPLE	Sample No., Hand Auger sample

LL	Liquid Limit
PL	Plastic Limit
%Passing#200	Percent by weight passing a No. 200 Sieve
MC	Moisture Content (percent)
GP	Geostick Penetration Reading (inches)
VOC	Volatile Organic Compound Reading (ppm)

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IDENTIFICATION OF SOIL

I. DEFINITION OF SOIL GROUP NAMES (ASTM D2487)

			SYMBOL	GROUP NAME
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels – More than 50% of coarse fraction retained on No. 4 sieve Coarse, ¾" to 3" Fine, No. 4 to ¾"	Clean Gravels Less than 5% fines	GW	WELL GRADED GRAVEL
			GP	POORLY GRADED GRAVEL
		Gravels with fines More than 12% fines	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	Sands – 50% or more of coarse Fraction passes No. 4 sieve Coarse, No. 10 to No. 4 Medium, No. 40 to No. 10 Fine, No. 200 to No. 40	Clean Sands Less than 5% fines	SW	WELL GRADED SAND
			SP	POORLY GRADED SAND
		Sands with fines More than 12% fines	SM	SILTY SAND
			SC	CLAYEY SAND
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silts and Clays – Liquid Limit less than 50 Low to medium plasticity	Inorganic	CL	LEAN CLAY
			ML	SILT
		Organic	OL	ORGANIC CLAY
				ORGANIC SILT
	Silts and Clays – Liquid Limit 50 or more Medium to high plasticity	Inorganic	CH	FAT CLAY
			MH	ELASTIC SILT
		Organic	OH	ORGANIC CLAY
				ORGANIC SILT
Highly Organic Soils	Primarily organic matter, dark in color and organic odor		PT	PEAT

II. DEFINITION OF SOIL COMPONENT PROPORTIONS (ASTM D2487)

			Examples
Adjective Form	GRAVELLY SANDY	>30% to <50% coarse grained component in a fine-grained soil	GRAVELLY LEAN CLAY
	CLAYEY SILTY	>12% to <50% fine grained component in a coarse-grained soil	SILTY SAND
"With"	WITH GRAVEL WITH SAND	>15% to <30% coarse grained component in a fine-grained soil	FAT CLAY WITH GRAVEL
	WITH GRAVEL WITH SAND	>15% to <50% coarse grained component in a coarse-grained soil	POORLY GRADED GRAVEL WITH SAND
	WITH SILT WITH CLAY	>5% to <12% fine grained component in a coarse-grained soil	POORLY GRADED SAND WITH SILT

III. GLOSSARY OF MISCELLANEOUS TERMS

SYMBOLS ..... Unified Soil Classification Symbols are shown above as group symbols. A dual symbol "-" indicates the soil belongs to two groups. A borderline symbol "/" indicates the soil belongs to two possible groups.

FILL..... Man-made deposit containing soil, rock and often foreign matter.

DISINTEGRATED ROCK (DR)..... Residual materials with a standard penetration resistance (SPT) between 60 blows per foot and refusal. Refusal is defined as an SPT of 100 blows for 2" or less penetration.

MOISTURE CONDITIONS..... Wet, moist or dry to indicate visual appearance of specimen.

COLOR..... Overall color, with modifiers such as light to dark or variation in coloration.

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Schnabel ENGINEERING **TEST BORING LOG**

Project: Albemarle County Public Schools
High School Center II
Albemarle County, Virginia

Boring Number: **B-01**
Contract Number: 24430010
Sheet: 1 of 2

Contractor: Ayers & Ayers, Inc.
Powhatan, Virginia
Contractor Foreman: M. White
Schnabel Representative: C. Irizarry
Equipment: CME-45B (ATV)
Method: 2-1/4" I.D. Hollow Stem Auger

Hammer Type: Safety Hammer (140 lb)
Dates Started: 4/5/24 **Finished:** 4/5/24
Location: See Location Plan

Ground Surface Elevation: 576± (ft) **Total Depth:** 30.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered ▽	4/5	---	18.5'	---	---
Completion ▼	4/5	---	26.0'	---	---
Casing Pulled	4/5	---	Dry	---	3.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.3	Topsoil; 3 inches		575.8					
	FILL, sampled as sandy silt; moist, brown, contains mica	FILL				S-01, SPT 3+8+10 REC=7", 39%		FILL
						S-02, SPT 8+17+15 REC=10", 56%		
	Change: contains concrete fragments				5	S-03, SPT 4+6+8 REC=11", 61%		
6.5	FILL, sampled as sandy elastic silt; moist, reddish brown, contains mica, and rock fragments		569.5	A		S-04, SPT 5+7+7 REC=10", 56%		
	Change: gray, contains organics	FILL			10	S-05, SPT 4+7+8 REC=12", 67%		
14.0	SILTY SAND, fine to coarse grained sand; moist, dark gray, contains mica, and root fragments	SM	562.0		15	S-06, SPT 3+3+5 REC=18", 100%		ALLUVIUM
18.0	SANDY LEAN CLAY; wet, light brown, ▽ contains mica, and rock fragments	CL	558.0	B	20	S-07, SPT 3+5+5 REC=15", 83%		
22.0	SANDY LEAN CLAY; moist, mottled brown and gray, contains mica	CL	554.0	C		S-08, SPT 3+4+4 REC=18", 100%		RESIDUUM

(continued)

Schnabel ENGINEERING **TEST BORING LOG**

Project: Albemarle County Public Schools
High School Center II
Albemarle County, Virginia

Boring Number: **B-01**
Contract Number: 24430010
Sheet: 2 of 2

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
	SANDY LEAN CLAY; moist, mottled brown and gray, contains mica *(continued)*	CL						RESIDUUM
27.0	SILTY SAND, fine to coarse grained sand; moist, brown and gray, contains mica	SM	549.0	C				
30.0			546.0		30	S-09, SPT 9+13+19 REC=15", 83%		

Bottom of Boring at 30.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings and borehole plug upon completion.

Schnabel ENGINEERING **TEST BORING LOG**

Project: Albemarle County Public Schools
High School Center II
Albemarle County, Virginia

Boring Number: **B-02**
Contract Number: 24430010
Sheet: 1 of 2

Contractor: Ayers & Ayers, Inc.
Powhatan, Virginia
Contractor Foreman: M. White
Schnabel Representative: C. Irizarry
Equipment: CME-45B (ATV)
Method: 2-1/4" I.D. Hollow Stem Auger

Hammer Type: Safety Hammer (140 lb)
Dates Started: 4/4/24 **Finished:** 4/4/24
Location: See Location Plan

Ground Surface Elevation: 574± (ft) **Total Depth:** 30.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered ▽	4/4	---	18.0'	---	---
Completion ▼	4/4	---	29.0'	---	---
Temporary Well ▼	4/4	---	29.0'	---	---
Temporary Well ▼	4/10	---	16.5'	---	---
Temporary Well ▼	5/15	---	16.1'	---	---

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.1	Topsoil; 1 inch		573.9					
	FILL, sampled as sandy lean clay; moist, brown and black, contains mica, root fragments, and crushed stone					S-01, SPT 9+12+15 REC=10", 56%		FILL
	Change: brown and gray					S-02, SPT 7+5+7 REC=13", 72%		
		FILL		A	5	S-03, SPT 6+14+14 REC=3", 17%		Low recovery due to rock in bottom of spoon.
						S-04, SPT 4+5+7 REC=14", 78%	LL = 47 PL = 22 MC = 23.9% % Passing #200 = 62.8	
					10	S-05, SPT 3+6+7 REC=15", 83%		
10.3	SILTY SAND; moist, brown and gray, contains mica, and root fragments		563.7					RESIDUUM
						S-06, SPT 4+4+4 REC=1", 6%	MC = 27.2%	
		SM		C	15			
	Change: wet							Low recovery due to rock in bottom of spoon.
						S-07, SPT 4+17+32 REC=18", 100%		
20.0	DISINTEGRATED ROCK, sampled as silty sand, fine to coarse grained sand; moist, brown and gray		554.0		20			
		DR		D		S-08, SPT 24+50/4"		

(continued)

TEST BORING LOG 24430010 - LOGS.GPJ SCHNABEL DATA TEMPLATE 2008_07_06.GDT 5/31/24

Schnabel ENGINEERING **TEST BORING LOG**

Project: Albemarle County Public Schools
High School Center II
Albemarle County, Virginia

Boring Number: **B-02**
Contract Number: 24430010
Sheet: 2 of 2

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
	DISINTEGRATED ROCK, sampled as silty sand, fine to coarse grained sand; moist, brown and gray *(continued)*	DR		D		REC=10", 100%		RESIDUUM Augers grinding/scraping.
						S-09, SPT 10+29+32 REC=12", 67%		
30.0			544.0		30			

Bottom of Boring at 30.0 ft.
Boring terminated at selected depth.
Temporary well installed upon completion.

Schnabel ENGINEERING **TEST BORING LOG**

Project: Albemarle County Public Schools
High School Center II
Albemarle County, Virginia

Boring Number: **B-03**
Contract Number: 24430010
Sheet: 1 of 1

Contractor: Ayers & Ayers, Inc.
Powhatan, Virginia
Contractor Foreman: M. White
Schnabel Representative: C. Irizarry
Equipment: CME-45B (ATV)
Method: 2-1/4" I.D. Hollow Stem Auger

Hammer Type: Safety Hammer (140 lb)
Dates Started: 4/4/24 **Finished:** 4/4/24
Location: See Location Plan

Ground Surface Elevation: 576± (ft) **Total Depth:** 20.5 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4/4	---	Dry	---	---
Completion	4/4	---	Dry	---	---
Casing Pulled	4/4	---	Dry	---	15.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.1	Asphalt; 1.5 inches		575.9					FILL
0.5	Crushed stone; 5 inches		575.5					
	FILL, sampled as sandy silt; moist, reddish brown, contains mica, and crushed stone	FILL		A		S-01, SPT 15+6+8 REC=14", 78%		
	Change: yellowish brown with gray					S-02, SPT 5+6+14 REC=6", 33%		
	Change: yellowish brown, contains asphalt fragments, and concrete fragments				5	S-03, SPT 2+1+1 REC=8", 44%	MC = 23.8% % Passing #200 = 36.8	Augers grinding/scraping. Hole deviated from vertical.
6.5	SANDY ELASTIC SILT; moist, reddish brown and brown, contains mica, and root fragments		569.5			S-04, SPT 2+4+7 REC=15", 83%		RESIDUUM
		MH			10	S-05, SPT 5+7+12 REC=13", 72%	LL = 72 PL = 43 MC = 28.8% % Passing #200 = 65.7	
13.0	SANDY SILT; moist, brown, contains mica		563.0	C				
		ML			15	S-06, SPT 10+9+10 REC=15", 83%		
19.5	DISINTEGRATED ROCK, sampled as silty sand, fine to coarse grained sand; moist, brown and gray, contains mica	DR	556.5	D	20	S-07, SPT 6+50/3" REC=9", 100%		Augers grinding/scraping. Drilling penetration rate slower.
20.5			555.5			S-08, SPT 50/0" REC=0"		

Bottom of Boring at 20.5 ft.
Auger refusal at 20.5 ft.
Boring terminated at SPT results of 50/1".
Boring backfilled with cuttings and Aquaphalt upon completion.

TEST BORING LOG 24430010 - LOGS.GPJ SCHNABEL DATA TEMPLATE 2008_07_06.GDT 5/31/24

Schnabel ENGINEERING **TEST BORING LOG**

Project: Albemarle County Public Schools
High School Center II
Albemarle County, Virginia

Boring Number: **B-04**
Contract Number: 24430010
Sheet: 1 of 1

Contractor: Ayers & Ayers, Inc.
Powhatan, Virginia
Contractor Foreman: M. White
Schnabel Representative: C. Irizarry
Equipment: CME-45B (ATV)
Method: 2-1/4" I.D. Hollow Stem Auger

Hammer Type: Safety Hammer (140 lb)
Dates Started: 4/4/24 **Finished:** 4/4/24
Location: See Location Plan

Ground Surface Elevation: 577± (ft) **Total Depth:** 20.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered ▽	4/4	---	18.0'	---	---
Completion ▼	4/4	---	18.0'	---	---
Casing Pulled ▼	4/4	---	13.5'	---	18.5'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.3	Asphalt; 3.5 inches		576.7					FILL
0.4	Crushed stone; 1.5 inches		576.6			S-01, SPT 6+6+7 REC=9", 50%		
	FILL, sampled as sandy lean clay; moist, dark gray, contains mica	FILL		A		S-02, SPT 4+16+9 REC=6", 33%		
3.0	Change: dark brown, contains wood fragments		574.0					
		FILL						
4.0	FILL, sampled as silty sand, fine to coarse grained sand; moist, yellowish brown	FILL	573.0			S-03, SPT 3+8+7 REC=12", 67%		Hole deviated from vertical.
5.0	FILL, sampled as sandy silt; moist, dark gray and black, contains ash and burnt wood fragments		572.0		5			RESIDUUM
	SILTY SAND, fine to coarse grained sand; moist, orangish brown, contains mica, and root fragments					S-04, SPT 8+9+10 REC=13", 72%		
						S-05, SPT 3+7+9 REC=11", 61%		
	Change: light gray	SM		C	10			Drilling penetration rate slower.
	Change: light brown and light gray ▼							
						S-06, SPT 9+10+8 REC=7", 39%		
17.0	DISINTEGRATED ROCK, sampled as silty sand, fine to coarse grained sand; wet, brown, contains mica ▼	DR	560.0	D	15			
20.0			557.0		20	S-07, SPT 44+50/3" REC=9", 100%		

Bottom of Boring at 20.0 ft.
Auger refusal at 20.0 ft.
Boring terminated at auger refusal.
Boring backfilled with cuttings and Aquaphalt upon completion.

TEST BORING LOG 24430010 - LOGS.GPJ SCHNABEL DATA TEMPLATE 2008_07_06.GDT 5/31/24

Schnabel ENGINEERING **TEST BORING LOG**

Project: Albemarle County Public Schools
High School Center II
Albemarle County, Virginia

Boring Number: **B-05**
Contract Number: 24430010
Sheet: 1 of 1

Contractor: Ayers & Ayers, Inc.
Powhatan, Virginia
Contractor Foreman: M. White
Schnabel Representative: C. Irizarry
Equipment: CME-45B (ATV)
Method: 2-1/4" I.D. Hollow Stem Auger

Hammer Type: Safety Hammer (140 lb)
Dates Started: 4/4/24 **Finished:** 4/4/24
Location: See Location Plan

Ground Surface Elevation: 581± (ft) **Total Depth:** 10.1 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4/4	---	Dry	---	---
Completion	4/4	---	Dry	---	---
Casing Pulled	4/4	---	Dry	---	8.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.3	Asphalt; 4 inches		580.7					FILL
0.6	Crushed stone; 3 inches		580.4			S-01, SPT 9+7+8 REC=10", 56%		
	FILL, sampled as sandy silt; moist, dark brown, contains mica Change: mottled yellowish brown and brown Change: dark gray Change: yellowish brown Change: contains rock fragments	FILL		A		S-02, SPT 8+6+10 REC=11", 61%		
					5	S-03, SPT 6+7+9 REC=9", 50%		Augers grinding/scraping.
6.0	SILTY SAND, fine to coarse grained sand; moist, yellowish brown and reddish brown, contains mica	SM	575.0	C				RESIDUUM
7.5	DISINTEGRATED ROCK, sampled as silty sand, fine to coarse grained sand; moist, light gray and orangish brown, contains mica	DR	573.5	D		S-04, SPT 8+27+33 REC=11", 61%		
10.1			570.9		10	S-05, SPT 19+50/4" REC=10", 100% S-06, SPT 50/1" REC=0", 0%		Augers grinding/scraping. Drilling penetration rate slower.

Bottom of Boring at 10.1 ft.
Auger refusal at 10.1 ft.
Boring terminated at SPT results of 50/1".
Boring backfilled with cuttings and Aquaphalt upon completion.

Schnabel ENGINEERING **TEST BORING LOG**

Project: Albemarle County Public Schools
High School Center II
Albemarle County, Virginia

Boring Number: **B-06**
Contract Number: 24430010
Sheet: 1 of 1

Contractor: Ayers & Ayers, Inc.
Powhatan, Virginia
Contractor Foreman: M. White
Schnabel Representative: C. Irizarry
Equipment: CME-45B (ATV)
Method: 2-1/4" I.D. Hollow Stem Auger

Hammer Type: Safety Hammer (140 lb)
Dates Started: 4/4/24 **Finished:** 4/4/24
Location: See Location Plan

Ground Surface Elevation: 583± (ft) **Total Depth:** 12.1 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4/4	---	Dry	---	---
Completion	4/4	---	Dry	---	---
Casing Pulled	4/4	---	Dry	---	9.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.4	Asphalt; 5 inches		582.6					
0.8	Crushed stone; 4 inches	MH	582.3			S-01, SPT 20+9+8 REC=10", 56%		RESIDUUM
2.0	SANDY ELASTIC SILT; moist, orangish brown, contains mica		581.0			S-02, SPT 6+16+18 REC=10", 56%		
	SILTY SAND, fine to coarse grained sand; moist, orangish brown and gray, contains mica	SM		C	5	S-03, SPT 9+10+14 REC=12", 67%	LL = NP MC = 17.8% % Passing #200 = 36.8	
7.0	DISINTEGRATED ROCK, sampled as silty sand, fine to coarse grained sand; moist, orangish brown and light gray, contains mica, and quartz fragments		576.0			S-04, SPT 35+30+23 REC=13", 72%		
	Change: gray and light brown	DR		D	10	S-05, SPT 9+34+50/4" REC=10", 63%		Augers grinding/scraping. Drilling penetration rate slower.
12.1			570.9			S-06, SPT 50/1" REC=1", 100%		

Bottom of Boring at 12.1 ft.
Auger refusal at 12.1 ft.
Boring terminated at SPT results of 50/1".
Boring backfilled with cuttings and Aquaphalt upon completion.

Schnabel ENGINEERING **TEST BORING LOG**

Project: Albemarle County Public Schools
High School Center II
Albemarle County, Virginia

Boring Number: **B-07**
Contract Number: 24430010
Sheet: 1 of 1

Contractor: Ayers & Ayers, Inc.
Powhatan, Virginia
Contractor Foreman: M. White
Schnabel Representative: C. Irizarry
Equipment: CME-45B (ATV)
Method: 2-1/4" I.D. Hollow Stem Auger

Hammer Type: Safety Hammer (140 lb)
Dates Started: 4/4/24 **Finished:** 4/4/24
Location: See Location Plan

Ground Surface Elevation: 579± (ft) **Total Depth:** 20.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered ▽	4/4	---	18.0'	---	---
Completion ▼	4/4	---	18.0'	---	---
Casing Pulled	4/4	---	Dry	---	8.5'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.5	Asphalt; 6 inches		578.5					FILL
0.6	Crushed stone; 2 inches	FILL	578.4			S-01, SPT 12+9+8 REC=12", 67%		
2.0	FILL, sampled as sandy elastic silt; moist, reddish brown with mottles of brown, contains mica, and crushed stone	FILL	577.0	A		S-02, SPT 5+5+6 REC=11", 61%		
4.0	FILL, sampled as silty sand, fine to coarse grained sand; moist, brown and black, contains quartz fragments, asphalt fragments, and root fragments	CL	575.0		5	S-03, SPT 3+5+9 REC=12", 67%		RESIDUUM
	SANDY LEAN CLAY; moist, reddish brown, contains mica							
6.5	SILTY SAND, fine to coarse grained sand; moist, orangish brown, contains mica		572.5			S-04, SPT 6+10+12 REC=12", 67%		
	Change: orangish brown, and pink				10	S-05, SPT 5+11+15 REC=14", 78%		
	Change: pink, streaks of orangish brown and white	SM		C	15	S-06, SPT 9+8+8 REC=11", 61%		
	Change: wet, orangish brown and light brown, with streaks of black							
20.0			559.0		20	S-07, SPT 5+5+5 REC=10", 56%		

Bottom of Boring at 20.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings and Aquaphalt upon completion.

Schnabel ENGINEERING **TEST BORING LOG**

Project: Albemarle County Public Schools
High School Center II
Albemarle County, Virginia

Boring Number: **B-08**
Contract Number: 24430010
Sheet: 1 of 1

Contractor: Ayers & Ayers, Inc.
Powhatan, Virginia
Contractor Foreman: M. White
Schnabel Representative: C. Irizarry
Equipment: CME-45B (ATV)
Method: 2-1/4" I.D. Hollow Stem Auger

Hammer Type: Safety Hammer (140 lb)
Dates Started: 4/4/24 **Finished:** 4/4/24
Location: See Location Plan

Ground Surface Elevation: 578± (ft) **Total Depth:** 17.1 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered ▽	4/4	---	14.0'	---	---
Completion ▽	4/4	---	17.0'	---	---
Casing Pulled ▽	4/4	---	13.5'	---	16.5'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.3	Asphalt; 3 inches		577.8					FILL
0.5	Crushed stone; 3 inches	FILL	577.5					
1.0	FILL, sampled as sandy elastic silt; moist, reddish brown, contains mica		577.0			S-01, SPT 13+9+9 REC=11", 61%		
	FILL, sampled as sandy silt; moist, brown, contains mica	FILL		A		S-02, SPT 8+9+15 REC=9", 50%		Augers grinding/scraping.
4.0	FILL, sampled as sandy elastic silt; moist, reddish brown, contains mica	FILL	574.0		5	S-03, SPT 7+9+10 REC=12", 67%		
6.5	SANDY LEAN CLAY; moist, gray, contains mica, and wood fragments	CL	571.5			S-04, SPT 4+4+5 REC=8", 44%		ALLUVIUM Fuel Odor Observed, VOC = 1.1 ppm
9.0	CLAYEY SAND, fine to coarse grained sand; moist, gray and brown, contains mica	SC	569.0	B	10	S-05, SPT 4+2+2 REC=9", 50%	MC = 14.0%	
14.5	Change: wet		563.5		15	S-06, SPT 10+28+48 REC=10", 56%		RESIDUUM Drilling penetration rate slower.
	DISINTEGRATED ROCK, sampled as silty sand, fine to coarse grained sand; moist, orangish brown, contains mica	DR		D				
17.1			560.9			S-07, SPT 50/1" REC=1", 100%		

Bottom of Boring at 17.1 ft.
Auger refusal at 17.1 ft.
Boring terminated at SPT results of 50/1".
Boring backfilled with cuttings and Aquaphalt upon completion.

Schnabel ENGINEERING **HAND AUGER LOG**

Project: Albemarle County Public Schools
High School Center II
Albemarle County, Virginia

Hand Auger Number: **HA-01**
Contract Number: 24430010
Sheet: 1 of 1

Contractor: Not Applicable

Contractor Foreman: Not Applicable

Schnabel Representative: C. Irizarry

Equipment: Geostick Penetrometer

Method: 3.0" O.D. Hand Auger

Dates Started: 4/10/24 **Finished:** 4/10/24

Location: See Location Plan

Ground Surface Elevation: 561± (ft) **Total Depth:** 10.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4/10	---	Dry	---	---
Completion	4/10	---	Dry	---	---

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.6	Forest litter, rootmat and topsoil; 7 inches		560.4					RESIDUUM GP = 11 inches
	SANDY ELASTIC SILT; moist, reddish brown, contains mica, and root fragments	MH				S-01, SAMPLE		GP = 1 inch
4.0	SILTY SAND, fine to coarse grained sand; moist, olive- brown, contains mica		557.0	C	5	S-02, SAMPLE		GP = 1 inch
	Change: olive- brown and gray	SM						GP = 1 inch
						S-03, SAMPLE		GP = 1 inch
10.0			551.0		10			GP = 0.5 inches

Bottom of Hand Auger at 10.0 ft.
Hand Auger terminated at selected depth.
Hand Auger backfilled with cuttings upon completion.

TEST BORING LOG 24430010 - LOGS.GPJ SCHNABEL DATA TEMPLATE 2008_07_06.GDT 5/31/24

Schnabel ENGINEERING **TEST BORING LOG**

Project: Albemarle County Public Schools
High School Center II
Albemarle County, Virginia

Boring Number: **P-01**
Contract Number: 24430010
Sheet: 1 of 1

Contractor: Ayers & Ayers, Inc.
Powhatan, Virginia
Contractor Foreman: M. White
Schnabel Representative: C. Irizarry
Equipment: CME-45B (ATV)
Method: 2-1/4" I.D. Hollow Stem Auger

Hammer Type: Safety Hammer (140 lb)
Dates Started: 4/5/24 **Finished:** 4/5/24
Location: See Location Plan

Ground Surface Elevation: 573± (ft) **Total Depth:** 5.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4/5	---	Dry	---	---
Completion	4/5	---	Dry	---	---
Casing Pulled	4/5	---	Dry	---	2.5'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.2	Asphalt; 2.5 inches		572.8					FILL
0.5	Crushed stone; 3 inches		572.5					
	FILL, sampled as sandy elastic silt; moist, brown, contains mica, and crushed stone	FILL		A		S-01, SPT 4+6+9 REC=7", 39%		
						S-02, SPT 14+14+22 REC=9", 50%		
4.0			569.0			S-03, SPT 15+18+41 REC=6", 33%		RESIDUUM
5.0	DISINTEGRATED ROCK, sampled as silty sand, fine to coarse grained sand; moist, brown and gray, contains mica	DR	568.0	D	5			

Bottom of Boring at 5.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings and Aquaphalt upon completion.

Schnabel ENGINEERING **TEST BORING LOG**

Project: Albemarle County Public Schools
High School Center II
Albemarle County, Virginia

Boring Number: **P-02**
Contract Number: 24430010
Sheet: 1 of 1

Contractor: Ayers & Ayers, Inc.
Powhatan, Virginia
Contractor Foreman: M. White
Schnabel Representative: C. Irizarry
Equipment: CME-45B (ATV)
Method: 2-1/4" I.D. Hollow Stem Auger

Hammer Type: Safety Hammer (140 lb)
Dates Started: 4/4/24 **Finished:** 4/4/24
Location: See Location Plan

Ground Surface Elevation: 576± (ft) **Total Depth:** 5.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4/4	---	Dry	---	---
Completion	4/4	---	Dry	---	---
Casing Pulled	4/4	---	Dry	---	2.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.2	Asphalt; 2.5 inches		575.8					
0.5	Crushed stone; 4 inches		575.5					FILL
	FILL, sampled as sandy lean clay; moist, dark brown and reddish brown, contains mica	FILL		A		S-01, SPT 16+7+6 REC=10", 56%		
						S-02, SPT 8+8+8 REC=10", 56%		
3.5	FILL, sampled as sandy silt; moist, brown, contains burnt wood	FILL	572.5			S-03, SPT 3+2+2 REC=9", 50%	MC = 25.4%	Fuel Odor Observed, VOC = Below Detectable Limits
5.0			571.0		5			

Bottom of Boring at 5.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings and Aquaphalt upon completion.

Schnabel ENGINEERING **TEST BORING LOG**

Project: Albemarle County Public Schools
High School Center II
Albemarle County, Virginia

Boring Number: **P-03**
Contract Number: 24430010
Sheet: 1 of 1

Contractor: Ayers & Ayers, Inc.
Powhatan, Virginia
Contractor Foreman: M. White
Schnabel Representative: C. Irizarry
Equipment: CME-45B (ATV)
Method: 2-1/4" I.D. Hollow Stem Auger

Hammer Type: Safety Hammer (140 lb)
Dates Started: 4/4/24 **Finished:** 4/4/24
Location: See Location Plan

Ground Surface Elevation: 577± (ft) **Total Depth:** 5.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4/4	---	Dry	---	---
Completion	4/4	---	Dry	---	---
Casing Pulled	4/4	---	Dry	---	3.5'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.6	Asphalt; 7 inches		576.4					FILL
0.9	Crushed stone; 4 inches	FILL	576.1			S-01, SPT 15+10+9 REC=8", 44%	LL = 53 PL = 30 MC = 17.2% % Passing #200 = 55.2	
2.0	FILL, sampled as silty sand, fine to coarse grained sand; moist, light brown and orangish brown, contains mica		575.0	A		S-02, SPT 7+7+7 REC=5", 28%		
	FILL, sampled as sandy elastic silt; moist, orangish brown, contains mica Change: reddish brown	FILL						
5.0	Change: brown and gray, contains rock fragments		572.0		5	S-03, SPT 4+4+5 REC=11", 61%		

Bottom of Boring at 5.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings and Aquaphalt upon completion.
Bulk sample collected from 0.9 to 5.0 ft depth.

Schnabel ENGINEERING **TEST BORING LOG**

Project: Albemarle County Public Schools
High School Center II
Albemarle County, Virginia

Boring Number: **P-04**
Contract Number: 24430010
Sheet: 1 of 1

Contractor: Ayers & Ayers, Inc.
Powhatan, Virginia
Contractor Foreman: M. White
Schnabel Representative: C. Irizarry
Equipment: CME-45B (ATV)
Method: 2-1/4" I.D. Hollow Stem Auger

Hammer Type: Safety Hammer (140 lb)
Dates Started: 4/4/24 **Finished:** 4/4/24
Location: See Location Plan

Ground Surface Elevation: 587± (ft) **Total Depth:** 5.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4/4	---	Dry	---	---
Completion	4/4	---	Dry	---	---
Casing Pulled	4/4	---	Dry	---	3.5'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.6	Asphalt; 7.5 inches		586.4					FILL
1.0	FILL, sampled as sandy silt; moist, brown, contains mica	FILL	586.0	A		S-01, SPT 3+4+5 REC=10", 56%		
2.0	FILL, sampled as sandy elastic silt; moist, reddish brown and brown, contains mica	FILL	585.0			S-02, SPT 7+9+5 REC=9", 50%		
3.0	FILL, sampled as sandy silt; moist, brown, contains mica, and crushed stone	ML	584.0	C		S-03, SPT 5+8+11 REC=7", 39%		RESIDUUM
5.0	SANDY SILT; moist, brown, contains mica		582.0		5			

Bottom of Boring at 5.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings and Aquaphalt upon completion.

Schnabel ENGINEERING **TEST BORING LOG**

Project: Albemarle County Public Schools
High School Center II
Albemarle County, Virginia

Boring Number: **P-05**
Contract Number: 24430010
Sheet: 1 of 1

Contractor: Ayers & Ayers, Inc.
Powhatan, Virginia
Contractor Foreman: M. White
Schnabel Representative: C. Irizarry
Equipment: CME-45B (ATV)
Method: 2-1/4" I.D. Hollow Stem Auger

Hammer Type: Safety Hammer (140 lb)
Dates Started: 4/5/24 **Finished:** 4/5/24
Location: See Location Plan

Ground Surface Elevation: 597± (ft) **Total Depth:** 5.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4/5	---	Dry	---	---
Completion	4/5	---	Dry	---	---
Casing Pulled	4/5	---	Dry	---	3.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.3	Asphalt; 3.5 inches		596.7					FILL
0.5	Crushed stone; 3 inches		596.5					
	FILL, sampled as sandy elastic silt; moist, reddish brown, contains mica Change: contains crushed stone	FILL		A		S-01, SPT 9+14+17 REC=13", 72% S-02, SPT 12+14+16 REC=1", 6%		Low recovery due to rock in bottom of spoon.
3.5	SANDY SILT; moist, light brown and orangish brown, contains mica	ML	593.5	C	5	S-03, SPT 9+12+10 REC=14", 78%		RESIDUUM
5.0			592.0					

Bottom of Boring at 5.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings and Aquaphalt upon completion.

TEST BORING LOG 24430010 - LOGS.GPJ SCHNABEL DATA TEMPLATE 2008_07_06.GDT 5/31/24

Schnabel ENGINEERING **TEST BORING LOG**

Project: Albemarle County Public Schools
High School Center II
Albemarle County, Virginia

Boring Number: **P-06**
Contract Number: 24430010
Sheet: 1 of 1

Contractor: Ayers & Ayers, Inc.
Powhatan, Virginia
Contractor Foreman: M. White
Schnabel Representative: C. Irizarry
Equipment: CME-45B (ATV)
Method: 2-1/4" I.D. Hollow Stem Auger

Hammer Type: Safety Hammer (140 lb)
Dates Started: 4/5/24 **Finished:** 4/5/24
Location: See Location Plan

Ground Surface Elevation: 578± (ft) **Total Depth:** 5.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4/5	---	Dry	---	---
Completion	4/5	---	Dry	---	---
Casing Pulled	4/5	---	Dry	---	3.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.3	Asphalt; 3 inches		577.8					FILL
	Crushed stone; 21 inches					S-01, SPT 23+20+13 REC=7", 39%		
2.0	FILL, sampled as sandy silt; moist, reddish brown, contains mica, and crushed stone	FILL	576.0	A		S-02, SPT 9+6+7 REC=1", 6%		Low recovery due to rock in bottom of spoon.
						S-03, SPT 7+7+8 REC=11", 61%		
5.0			573.0		5			

Bottom of Boring at 5.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings and Aquaphalt upon completion.

Schnabel ENGINEERING **TEST BORING LOG**

Project: Albemarle County Public Schools
High School Center II
Albemarle County, Virginia

Boring Number: **P-07**
Contract Number: 24430010
Sheet: 1 of 1

Contractor: Ayers & Ayers, Inc.
Powhatan, Virginia
Contractor Foreman: M. White
Schnabel Representative: C. Irizarry
Equipment: CME-45B (ATV)
Method: 2-1/4" I.D. Hollow Stem Auger

Hammer Type: Safety Hammer (140 lb)
Dates Started: 4/5/24 **Finished:** 4/5/24
Location: See Location Plan

Ground Surface Elevation: 572± (ft) **Total Depth:** 5.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4/5	---	Dry	---	---
Completion	4/5	---	Dry	---	---
Casing Pulled	4/5	---	Dry	---	2.5'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.5	Asphalt; 5.5 inches		571.5					FILL
0.8	Crushed stone; 4 inches		571.2					
	FILL, sampled as sandy elastic silt; moist, reddish brown, contains mica	FILL		A		S-01, SPT 10+7+11 REC=9", 50%		
						S-02, SPT 14+10+13 REC=0", 0%		No recovery due to rock in bottom of spoon.
						S-03, SPT 11+16+18 REC=3", 17%		
5.0			567.0		5			

Bottom of Boring at 5.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings and Aquaphalt upon completion.

Schnabel ENGINEERING **TEST BORING LOG**

Project: Albemarle County Public Schools
High School Center II
Albemarle County, Virginia

Boring Number: **P-08**
Contract Number: 24430010
Sheet: 1 of 1

Contractor: Ayers & Ayers, Inc.
Powhatan, Virginia
Contractor Foreman: M. White
Schnabel Representative: C. Irizarry
Equipment: CME-45B (ATV)
Method: 2-1/4" I.D. Hollow Stem Auger

Hammer Type: Safety Hammer (140 lb)
Dates Started: 4/5/24 **Finished:** 4/5/24
Location: See Location Plan

Ground Surface Elevation: 577± (ft) **Total Depth:** 5.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4/5	---	Dry	---	---
Completion	4/5	---	Dry	---	---
Casing Pulled	4/5	---	Dry	---	2.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.2	Asphalt; 2 inches		576.8					RESIDUUM
0.4	Crushed stone; 3 inches		576.6					
	SANDY ELASTIC SILT; moist, reddish brown, contains mica	MH		C		S-01, SPT 7+6+8 REC=10", 56%		
						S-02, SPT 10+12+8 REC=6", 33%		
						S-03, SPT 8+11+11 REC=7", 39%		
5.0			572.0		5			

Bottom of Boring at 5.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings and Aquaphalt upon completion.

Schnabel ENGINEERING **TEST BORING LOG**

Project: Albemarle County Public Schools
High School Center II
Albemarle County, Virginia

Boring Number: **P-09**
Contract Number: 24430010
Sheet: 1 of 1

Contractor: Ayers & Ayers, Inc.
Powhatan, Virginia
Contractor Foreman: M. White
Schnabel Representative: C. Irizarry
Equipment: CME-45B (ATV)
Method: 2-1/4" I.D. Hollow Stem Auger

Hammer Type: Safety Hammer (140 lb)
Dates Started: 4/5/24 **Finished:** 4/5/24
Location: See Location Plan

Ground Surface Elevation: 579± (ft) **Total Depth:** 10.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4/5	---	Dry	---	---
Completion	4/5	---	Dry	---	---
Casing Pulled	4/5	---	Dry	---	8.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.3	Topsoil; 3 inches		578.8					RESIDUUM
	SANDY ELASTIC SILT; moist, reddish brown, contains mica	MH		C	5	S-01, SPT 3+7+7 REC=13", 72% S-02, SPT 5+6+8 REC=12", 67% S-03, SPT 5+8+11 REC=13", 72%		
6.0	SILTY SAND, fine to coarse grained sand; moist, brown, contains mica	SM	573.0		10	S-04, SPT 7+6+7 REC=10", 56% S-05, SPT 4+7+8 REC=9", 50%		
10.0			569.0					

Bottom of Boring at 10.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings upon completion.

Schnabel ENGINEERING **TEST BORING LOG**

Project: Albemarle County Public Schools
High School Center II
Albemarle County, Virginia

Boring Number: **P-10**
Contract Number: 24430010
Sheet: 1 of 1

Contractor: Ayers & Ayers, Inc.
Powhatan, Virginia
Contractor Foreman: M. White
Schnabel Representative: C. Irizarry
Equipment: CME-45B (ATV)
Method: 2-1/4" I.D. Hollow Stem Auger

Hammer Type: Safety Hammer (140 lb)
Dates Started: 4/5/24 **Finished:** 4/5/24
Location: See Location Plan

Ground Surface Elevation: 571± (ft) **Total Depth:** 5.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4/5	---	Dry	---	---
Completion	4/5	---	Dry	---	---
Casing Pulled	4/5	---	Dry	---	3.5'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.2	Topsoil; 2 inches		570.8					RESIDUUM
	SANDY ELASTIC SILT; moist, reddish brown, contains mica, and root fragments	MH				S-01, SPT 4+4+7 REC=13", 72%		
2.0			569.0	C				
	SANDY ELASTIC SILT; moist, brown, contains mica	MH				S-02, SPT 15+20+25 REC=10", 56%		
						S-03, SPT 14+23+27 REC=12", 67%		
5.0			566.0		5			

Bottom of Boring at 5.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings and borehole plug upon completion.

Schnabel ENGINEERING **TEST BORING LOG**

Project: Albemarle County Public Schools
High School Center II
Albemarle County, Virginia

Boring Number: **P-11**
Contract Number: 24430010
Sheet: 1 of 1

Contractor: Ayers & Ayers, Inc.
Powhatan, Virginia
Contractor Foreman: M. White
Schnabel Representative: C. Irizarry
Equipment: CME-45B (ATV)
Method: 2-1/4" I.D. Hollow Stem Auger

Hammer Type: Safety Hammer (140 lb)
Dates Started: 4/5/24 **Finished:** 4/5/24
Location: See Location Plan

Ground Surface Elevation: 572± (ft) **Total Depth:** 4.3 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4/5	---	Dry	---	---
Completion	4/5	---	Dry	---	---
Casing Pulled	4/5	---	Dry	---	3.5'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.2	Topsoil; 2 inches	FILL	571.8	A				FILL
0.5	FILL, sampled as sandy elastic silt; moist, brown, contains mica	SM	571.5	C		S-01, SPT 10+12 REC=6", 50%		RESIDUUM SPT terminated due to sampler deflection.
2.0	SILTY SAND, fine to coarse grained sand; moist, brown, contains mica		570.0			S-02, SPT 18+48+50/5" REC=10", 59%		
	DISINTEGRATED ROCK, sampled as silty sand, fine to coarse grained sand;	DR		D				
4.3	moist, brown, contains mica		567.8			S-03, SPT 32+50/3" REC=9", 100%		

Bottom of Boring at 4.3 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings and borehole plug upon completion.

Schnabel ENGINEERING **TEST BORING LOG**

Project: Albemarle County Public Schools
High School Center II
Albemarle County, Virginia

Boring Number: **P-12**
Contract Number: 24430010
Sheet: 1 of 1

Contractor: Ayers & Ayers, Inc.
Powhatan, Virginia
Contractor Foreman: M. White
Schnabel Representative: C. Irizarry
Equipment: CME-45B (ATV)
Method: 2-1/4" I.D. Hollow Stem Auger

Hammer Type: Safety Hammer (140 lb)
Dates Started: 4/5/24 **Finished:** 4/5/24
Location: See Location Plan

Ground Surface Elevation: 573± (ft) **Total Depth:** 5.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4/5	---	Dry	---	---
Completion	4/5	---	Dry	---	---
Casing Pulled	4/5	---	Dry	---	3.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.2	Topsoil; 2 inches		572.8					
	FILL, sampled as sandy silt; moist, reddish brown and gray, contains mica	FILL		A		S-01, SPT 3+4+7 REC=12", 67%		FILL
2.0	SILTY SAND, fine to coarse grained sand; moist, brown and gray, contains mica	SM	571.0	C		S-02, SPT 7+7+11 REC=9", 50%		RESIDUUM
					5	S-03, SPT 7+6+7 REC=11", 61%		
5.0			568.0					

Bottom of Boring at 5.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings and borehole plug upon completion.

Schnabel ENGINEERING **TEST BORING LOG**

Project: Albemarle County Public Schools
High School Center II
Albemarle County, Virginia

Boring Number: **P-13**
Contract Number: 24430010
Sheet: 1 of 1

Contractor: Ayers & Ayers, Inc.
Powhatan, Virginia
Contractor Foreman: M. White
Schnabel Representative: C. Irizarry
Equipment: CME-45B (ATV)
Method: 2-1/4" I.D. Hollow Stem Auger

Hammer Type: Safety Hammer (140 lb)
Dates Started: 4/5/24 **Finished:** 4/5/24
Location: See Location Plan

Ground Surface Elevation: 572± (ft) **Total Depth:** 3.8 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4/5	---	Dry	---	---
Completion	4/5	---	Dry	---	---
Casing Pulled	4/5	---	Dry	---	3.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.2	Topsoil; 2 inches	FILL	571.8	A				FILL
1.0	FILL, sampled as sandy silt; moist, brown, contains mica	MH	571.0	C		S-01, SPT 3+3+6 REC=14", 78%		RESIDUUM
2.0	SANDY ELASTIC SILT; moist, orangish brown, contains mica	DR	570.0	D		S-02, SPT 26+50/6" REC=10", 83%		
3.8	DISINTEGRATED ROCK, sampled as silty sand, fine to coarse grained sand; moist, light brown and gray, contains mica		568.2			S-03, SPT 50/4" REC=4", 100%		

Bottom of Boring at 3.8 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings and borehole plug upon completion.

Schnabel ENGINEERING **TEST BORING LOG**

Project: Albemarle County Public Schools
High School Center II
Albemarle County, Virginia

Boring Number: **P-14**
Contract Number: 24430010
Sheet: 1 of 1

Contractor: Ayers & Ayers, Inc.
Powhatan, Virginia
Contractor Foreman: M. White
Schnabel Representative: C. Irizarry
Equipment: CME-45B (ATV)
Method: 2-1/4" I.D. Hollow Stem Auger

Hammer Type: Safety Hammer (140 lb)
Dates Started: 4/5/24 **Finished:** 4/5/24
Location: See Location Plan

Ground Surface Elevation: 576± (ft) **Total Depth:** 5.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4/5	---	Dry	---	---
Completion	4/5	---	Dry	---	---
Casing Pulled	4/5	---	Dry	---	3.5'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.3	Topsoil; 4 inches		575.7					
	FILL, sampled as silty sand, fine to coarse grained sand; moist, reddish brown, contains mica, crushed stone, and root fragments	FILL		A		S-01, SPT 5+8+5 REC=8", 44%	LL = 39 PL = 31 MC = 19.8% % Passing #200 = 42.7	FILL
						S-02, SPT 3+2+2 REC=7", 39%		
						S-03, SPT 3+6+9 REC=14", 78%		
5.0			571.0		5			

Bottom of Boring at 5.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings and borehole plug upon completion.
Bulk sample collected from 0.3 to 5.0 ft depth.

Schnabel ENGINEERING **TEST BORING LOG**

Project: Albemarle County Public Schools
High School Center II
Albemarle County, Virginia

Boring Number: **P-15**
Contract Number: 24430010
Sheet: 1 of 1

Contractor: Ayers & Ayers, Inc.
Powhatan, Virginia
Contractor Foreman: M. White
Schnabel Representative: C. Irizarry
Equipment: CME-45B (ATV)
Method: 2-1/4" I.D. Hollow Stem Auger

Hammer Type: Safety Hammer (140 lb)
Dates Started: 4/5/24 **Finished:** 4/5/24
Location: See Location Plan

Ground Surface Elevation: 570± (ft) **Total Depth:** 5.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4/5	---	Dry	---	---
Completion	4/5	---	Dry	---	---
Casing Pulled	4/5	---	Dry	---	3.0'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.3	Topsoil; 3 inches		569.8					
	FILL, sampled as sandy silt; moist, brown, contains mica, and crushed stone	FILL		A		S-01, SPT 6+5+4 REC=10", 56%		FILL
2.5	SANDY ELASTIC SILT; moist, orangish brown, contains mica	MH	567.5	C		S-02, SPT 6+7+8 REC=16", 89%		RESIDUUM
					5	S-03, SPT 6+8+10 REC=13", 72%		
5.0			565.0					

Bottom of Boring at 5.0 ft.
Boring terminated at selected depth.
Boring backfilled with cuttings upon completion.

Schnabel ENGINEERING **TEST BORING LOG**

Project: Albemarle County Public Schools
High School Center II
Albemarle County, Virginia

Boring Number: **S-01**
Contract Number: 24430010
Sheet: 1 of 1

Contractor: Ayers & Ayers, Inc.
Powhatan, Virginia
Contractor Foreman: M. White
Schnabel Representative: C. Irizarry
Equipment: CME-45B (ATV)
Method: 2-1/4" I.D. Hollow Stem Auger

Hammer Type: Safety Hammer (140 lb)
Dates Started: 4/5/24 **Finished:** 4/5/24
Location: See Location Plan

Ground Surface Elevation: 569± (ft) **Total Depth:** 8.0 ft

Groundwater Observations

	Date	Time	Depth	Casing	Caved
Encountered	4/5	---	Dry	---	---
Completion	4/5	---	Dry	---	---
Casing Pulled	4/5	---	Dry	---	7.2'

DEPTH (ft)	MATERIAL DESCRIPTION	SYMBOL	ELEV (ft)	STRATUM	SAMPLING DEPTH	SAMPLING DATA	TESTS	REMARKS
0.2	Topsoil; 2 inches	FILL	568.8					FILL
1.0	FILL, sampled as sandy elastic silt; moist, reddish brown, contains mica, and root fragments	FILL	568.0	A		S-01, SPT 8+10+9 REC=14", 78%		
						S-02, SPT 11+9+8 REC=11", 61%		
3.0	FILL, sampled as sandy silt; moist, dark brown and gray, contains mica		566.0					RESIDUUM
	SANDY ELASTIC SILT; moist, reddish brown, contains mica, and root fragments	MH		C	5	S-03, SPT 6+10+11 REC=12", 67%	LL = 57 PL = 38 MC = 22.6% % Passing #200 = 59.6 Resistivity = 22000 Ohms-cm Redox = 175 mv Sulfides = 0 pH = 4.7	
6.5	DISINTEGRATED ROCK, sampled as silty sand, fine to coarse grained sand; moist, brown, contains mica	DR	562.5	D		S-04, SPT 50/3" REC=3", 100%		
8.0			561.0			S-05, SPT 50/0" REC=0"		

Bottom of Boring at 8.0 ft.
Auger refusal at 8.0 ft.
Boring terminated at SPT results of 50/1".
Boring backfilled with cuttings and borehole plug upon completion.

APPENDIX B

SOIL LABORATORY TEST DATA

Summary of Laboratory Tests
Gradation Curves
Atterberg Limits
Moisture-Density Relationships
California Bearing Ratio Test Results
Soil Test Evaluation for the Corrosion Potential Series

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Summary Of Laboratory Tests

Project Number: 24430010

Boring No.	Sample Depth ft / Elevation ft	Sample Type	Description of Soil Specimen	Stratum	Natural Moisture (%)	% Retained No. 4 Sieve	% Passing No. 40 Sieve	% Passing No. 200 Sieve	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Dry Density (pcf)	Optimum Moisture Content (%)	CBR Value	CBR Percent Swell	pH	Oxidation Reduction Potential (mV)	Resistivity (ohm-cm)	Sulfides
B-02	7.0 - 8.5 567.0 - 565.5	Jar	SANDY LEAN CLAY (CL); moist, brown and gray, contains mica and root fragments	A	23.9	3.1	85.9	62.8	47	22	25	--	--	--	--	--	--	--	--
B-03	9.0 - 10.5 567.0 - 565.5	Jar	SANDY ELASTIC SILT (MH); moist, reddish brown and brown, contains mica and root fragments	C	28.8	0.0	92.7	65.7	72	43	29	--	--	--	--	--	--	--	--
B-06	4.0 - 5.5 579.0 - 577.5	Jar	SILTY SAND (SM), fine to coarse grained sand; moist, orangish brown and gray, contains mica	C	17.8	0.2	66.0	36.8	NP	NP	NP	--	--	--	--	--	--	--	--
P-03	0.9 - 5.0 576.1 - 572.0	Bulk	SANDY ELASTIC SILT (MH); moist, orangish brown, contains mica	A	17.2	0.9	75.8	55.2	53	30	23	110.5	15.3	8.9	0.9	--	--	--	--
P-14	0.3 - 5.0 575.7 - 571.0	Bulk	SILTY SAND (SM), fine to coarse grained sand; moist, reddish brown, contains mica, crushed stone, and root fragments	A	19.8	6.0	70.9	42.7	39	31	8	114.8	13.0	11.2	0.8	--	--	--	--
S-01	4.0 - 5.5 565.0 - 563.5	Jar	SANDY ELASTIC SILT (MH); moist, reddish brown, contains mica and root fragments	C	22.6	0.0	84.8	59.6	57	38	19	--	--	--	--	4.7	175	22000	0

Notes:
1. Soil tests in general accordance with ASTM standards.
2. Soil classifications are in general accordance with ASTM D2487(as applicable), based on testing indicated and visual classification.
3. Key to abbreviations: NP=Non-Plastic; -- indicates no test performed

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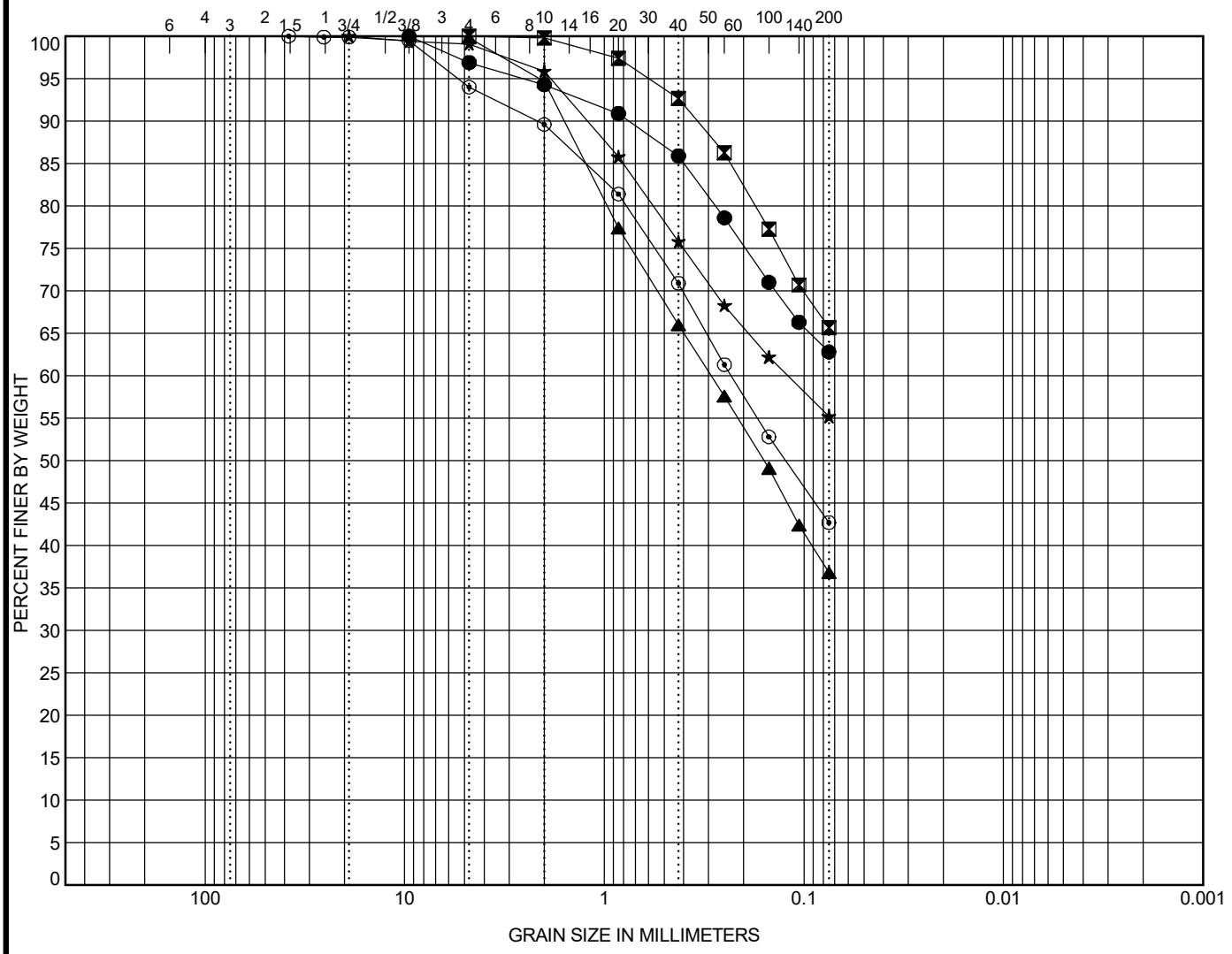
Project: Albemarle County Public Schools
High School Center II
Albemarle County, VA

DYNAMIC LAB SUMMARY 24430010 - LOGS.GPJ SCHNABEL DATA TEMPLATE 2010_02_25.GDT 5/23/24



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen		Sample Description	LL	PL	PI		
●	B-02	7.0 ft	SANDY LEAN CLAY (CL); moist, brown and gray, contains mica and root fragments	47	22	25		
⊠	B-03	9.0 ft	SANDY ELASTIC SILT (MH); moist, reddish brown and brown, contains mica and root fragments	72	43	29		
▲	B-06	4.0 ft	SILTY SAND (SM), fine to coarse grained sand; moist, orangish brown and gray, contains mica	NP	NP	NP		
★	P-03	0.9 ft	SANDY ELASTIC SILT (MH); moist, orangish brown, contains mica	53	30	23		
⊙	P-14	0.3 ft	SILTY SAND (SM), fine to coarse grained sand; moist, reddish brown, contains mica, crushed stone, and root fragments	39	31	8		

	Specimen		Test Method	Testing Lab	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-02	7.0 ft		CVL	9.5	--	--	--	3.1	34.1	62.8	
⊠	B-03	9.0 ft		CVL	4.75	--	--	--	0.0	34.3	65.7	
▲	B-06	4.0 ft		CVL	4.75	0.29	--	--	0.2	63.0	36.8	
★	P-03	0.9 ft		CVL	19	0.12	--	--	0.9	43.9	55.2	
⊙	P-14	0.3 ft		CVL	38.1	0.23	--	--	6.0	51.3	42.7	

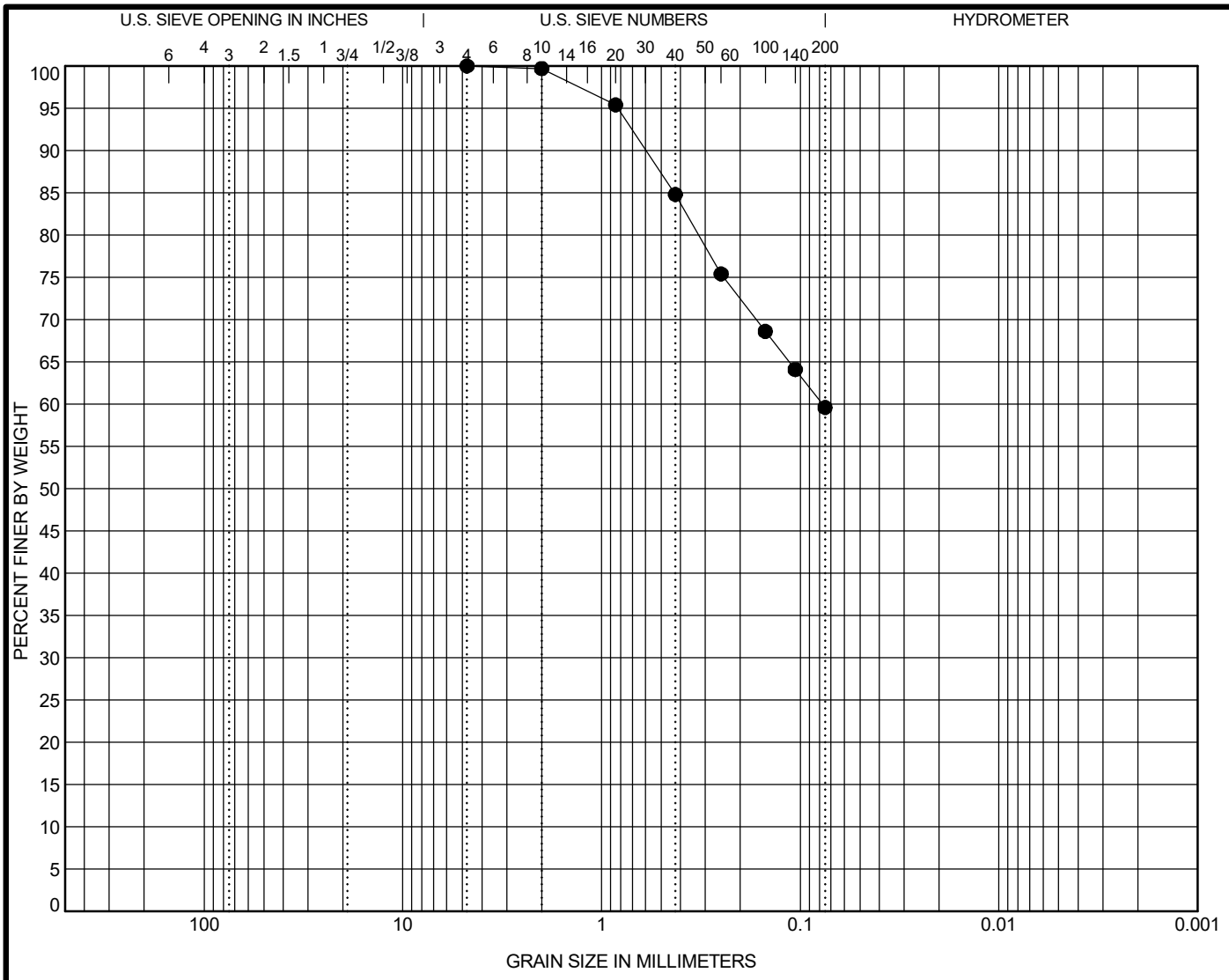
Schnabel ENGINEERING

GRADATION CURVES

Project: Albemarle County Public Schools
High School Center II
Albemarle County, VA

Contract: 24430010

SIEVE 5 SHEET 24430010 - LOGS.GPJ SCHNABEL DATA TEMPLATE 2010 02 25.GDT 5/14/24



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen		Sample Description	LL	PL	PI
● S-01	4.0 ft	**SANDY ELASTIC SILT (MH); moist, reddish brown, contains mica and root fragments**	**57**	**38**	**19**

Specimen		Test Method	Testing Lab	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● S-01	4.0 ft		CVL	4.75	0.08	--	--	0.0	40.4	59.6	

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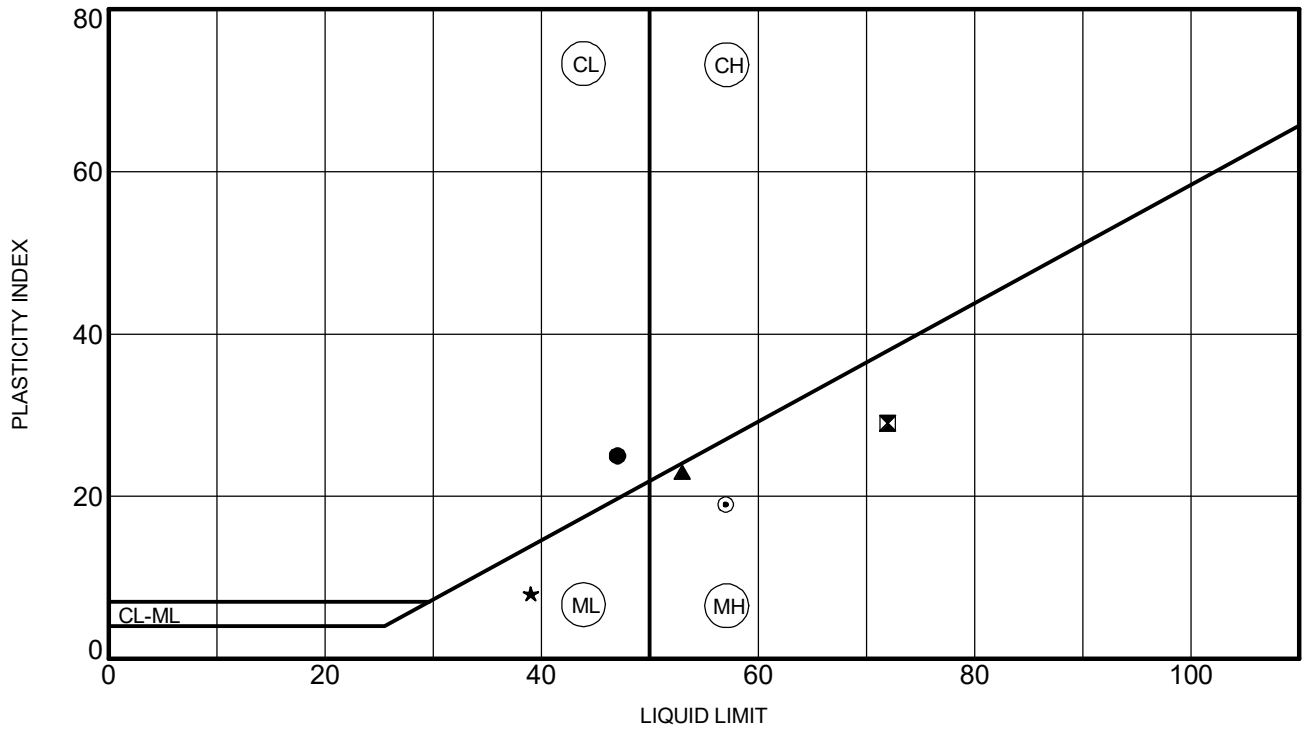
GRADATION CURVES

Project: Albemarle County Public Schools
High School Center II
Albemarle County, VA

Contract: 24430010

SIEVE 5 SHEET 24430010 - LOGS.GPJ SCHNABEL DATA TEMPLATE 2010 02 25.GDT 5/14/24



PLOTTED DATA REPRESENTS SOIL PASSING NO. 40 SIEVE

	Specimen		LL	PL	PI	Fines	Testing Lab	Description
●	B-02	7.0 ft	47	22	25	63	CVL	SANDY LEAN CLAY (CL); moist, brown and gray, contains mica and root fragments
⧓	B-03	9.0 ft	72	43	29	66	CVL	SANDY ELASTIC SILT (MH); moist, reddish brown and brown, contains mica and root fragments
▲	P-03	0.9 ft	53	30	23	55	CVL	SANDY ELASTIC SILT (MH); moist, orangish brown, contains mica
★	P-14	0.3 ft	39	31	8	43	CVL	SILTY SAND (SM), fine to coarse grained sand; moist, reddish brown, contains mica, crushed stone, and root fragments
⊙	S-01	4.0 ft	57	38	19	60	CVL	SANDY ELASTIC SILT (MH); moist, reddish brown, contains mica and root fragments

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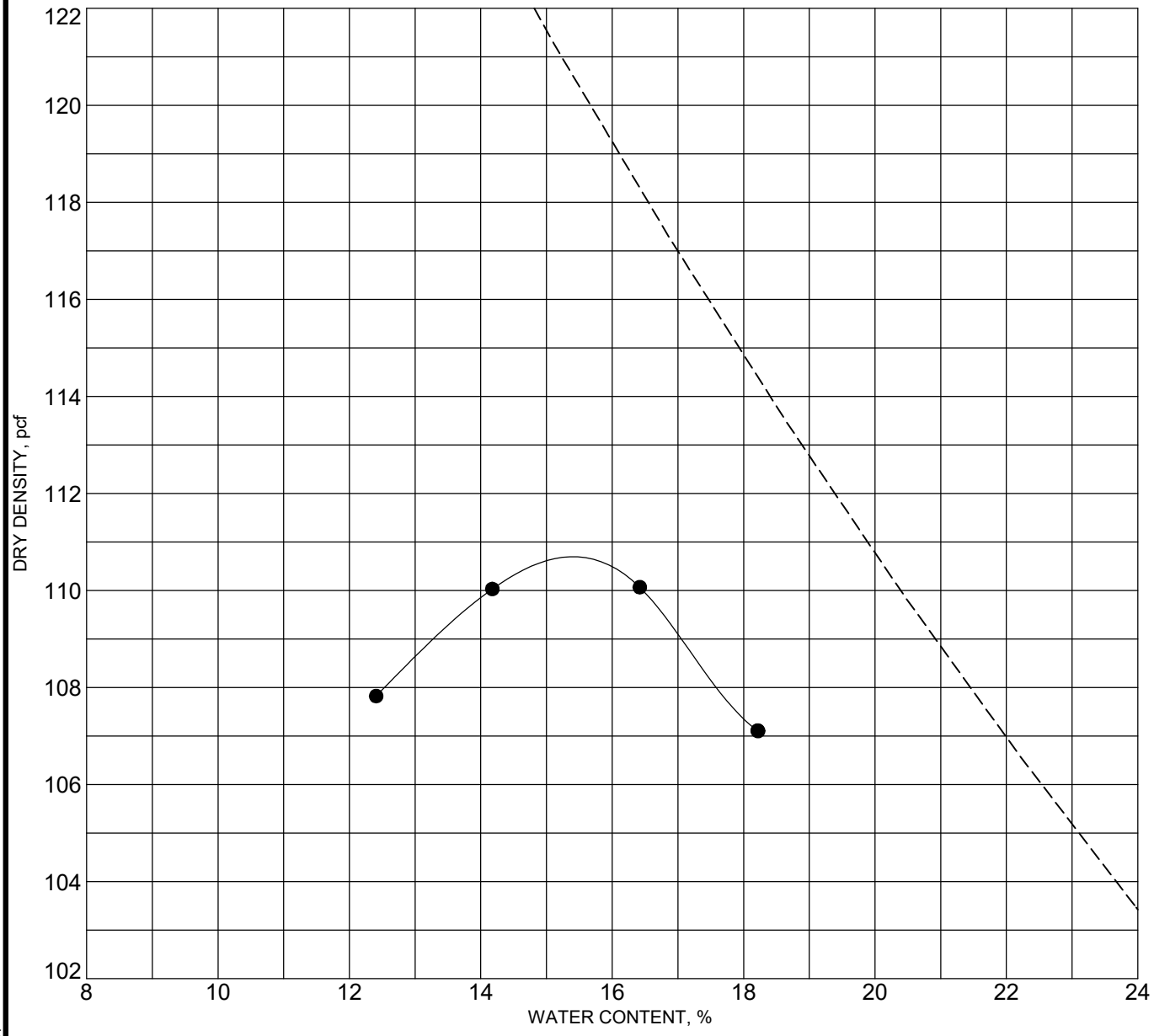
ATTERBERG LIMITS

Project: Albemarle County Public Schools
High School Center II
Albemarle County, VA

Contract: 24430010

ATTERBERG_LIMITS 24430010 - LOGS.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 5/14/24



Sample Description:	SANDY ELASTIC SILT (MH); moist, orangish brown, contains mica
Sample Source:	P-03, 0.9 ft
Test Methods:	ASTM D698 Method B

Assumed Specific Gravity:	2.75
Max. Dry Density (pcf):	110.5
Opt. Moisture (%):	15.3

Liquid Limit (LL):	53
Plasticity Index (PI):	23
% Retained #4 Sieve:	0.9
% Passing # 200 Sieve:	55.2

Comments:
Natural Moisture Content = 17.2%

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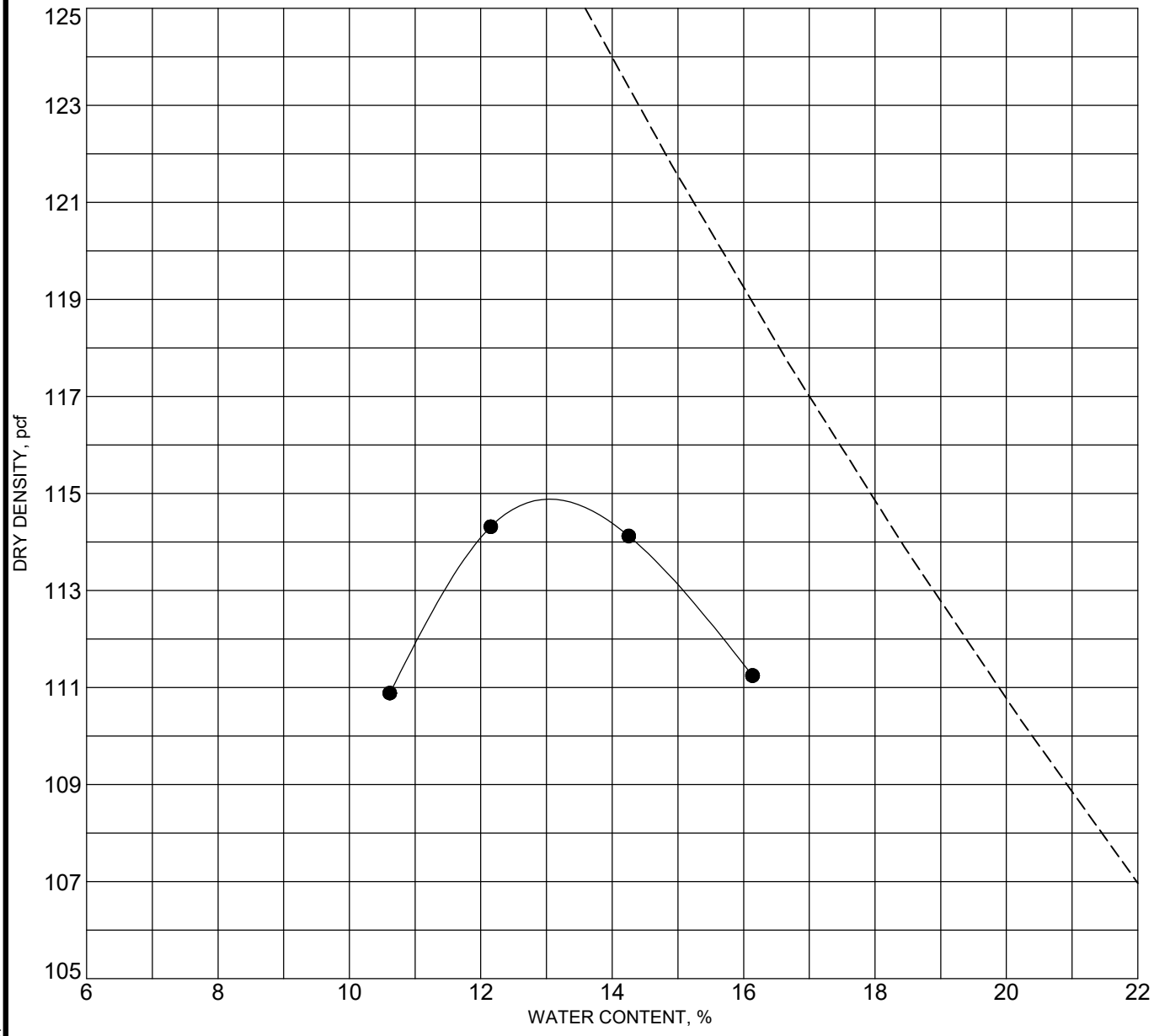
MOISTURE DENSITY RELATIONSHIP

Project: Albemarle County Public Schools
High School Center II
Albemarle County, VA

Contract: 24430010 **Testing Lab:** CVL

COMPACTION 24430010 - LOGS.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 5/24/24



Sample Description:	SILTY SAND (SM), fine to coarse grained sand; moist, reddish brown, contains mica, crushed stone, and root fragments
Sample Source:	P-14, 0.3 ft
Test Methods:	ASTM D698 Method B

Assumed Specific Gravity:	2.75
Max. Dry Density (pcf):	114.8
Opt. Moisture (%):	13.0

Liquid Limit (LL):	39
Plasticity Index (PI):	8
% Retained #4 Sieve:	6.0
% Passing # 200 Sieve:	42.7

Comments:
Natural Moisture Content = 19.8%

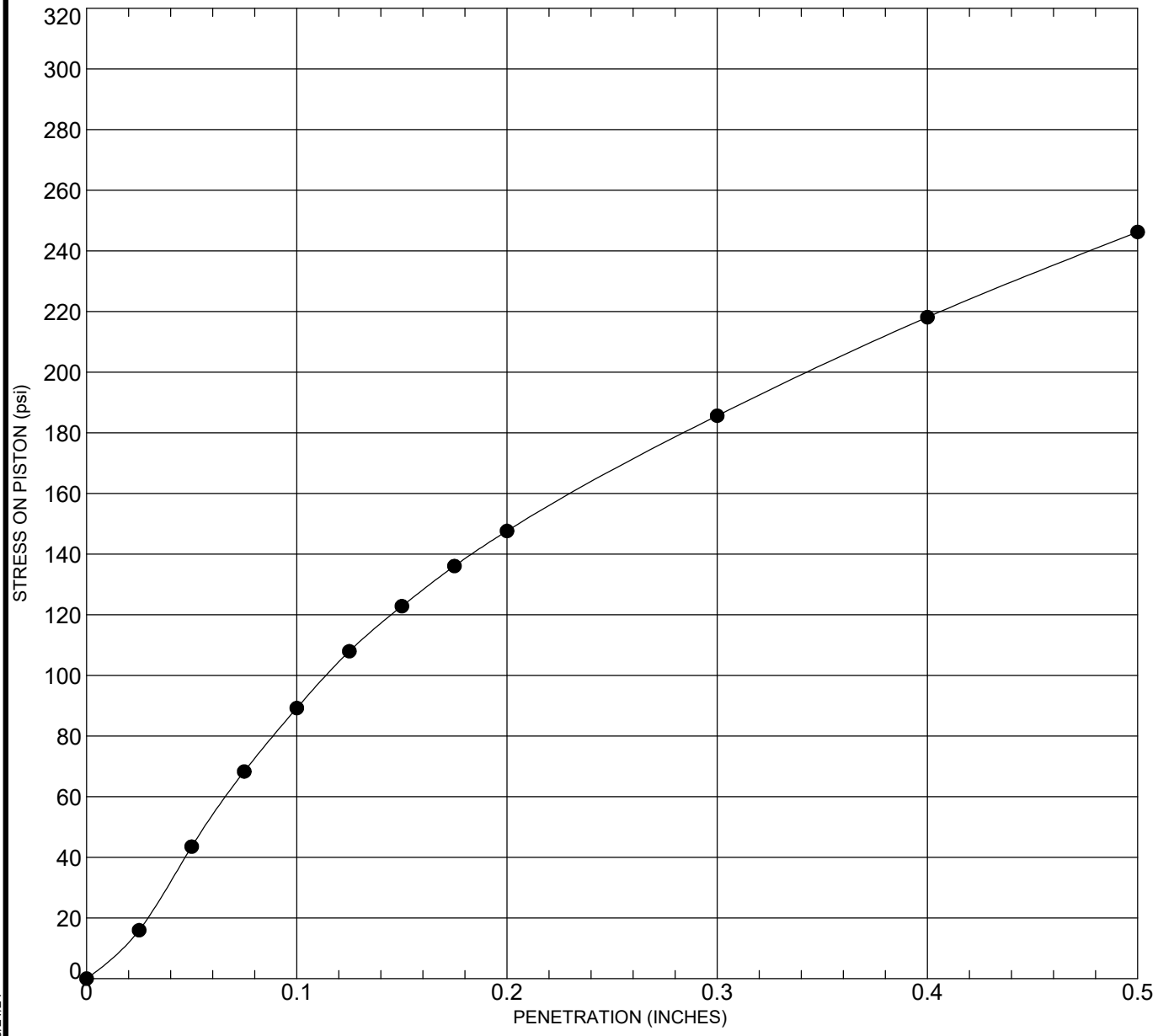
Schnabel ENGINEERING

MOISTURE DENSITY RELATIONSHIP

Project: Albemarle County Public Schools
High School Center II
Albemarle County, VA

Contract: 24430010 **Testing Lab:** CVL

COMPACTION 24430010 - LOGS.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 5/24/24



Sample Description:	SANDY ELASTIC SILT (MH); moist, orangish brown, contains mica
Sample Source:	P-03
Sample Depth:	0.9 ft
Test Method:	ASTM D1883

Dry Density Before Soaking (pcf):	110.3
Dry Density After Soaking (pcf):	109.2
Maximum Dry Density (pcf):	110.5
Moisture Content Before Soaking (%):	15.5
Moisture Content After Soaking (Avg) (%):	18.0
Moisture Content Top Inch After Soak (%):	22.8
Optimum Moisture Content (%):	15.3

Liquid Limit (LL):	53
Plasticity Index (PI):	23
% Retained #4 Sieve:	0.9
% Passing # 200 Sieve:	55.2

CBR:	8.9, Soaked
Surcharge (psf):	50
Swell (%):	0.9

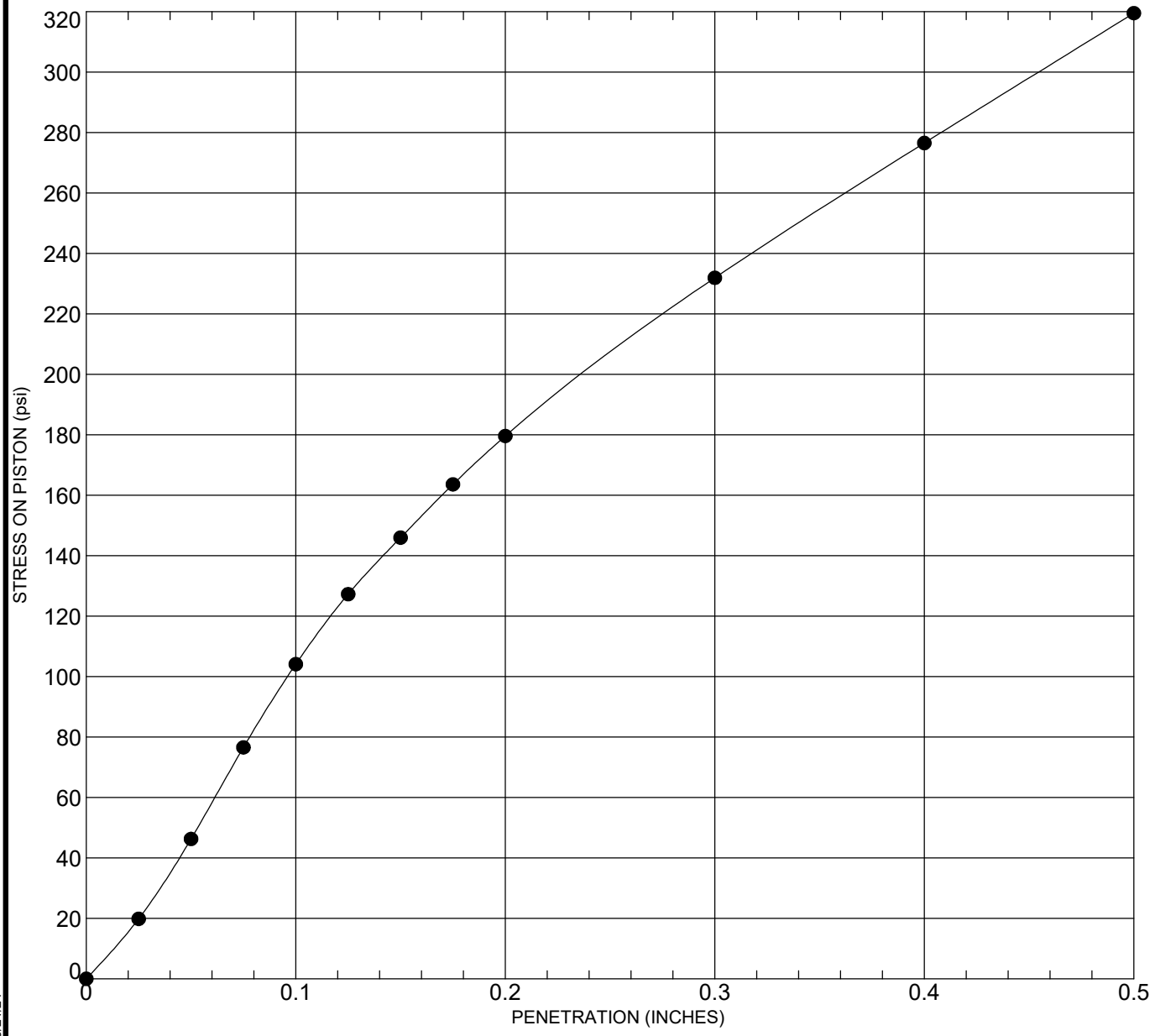
Schnabel ENGINEERING

CALIFORNIA BEARING RATIO TEST

Project: Albemarle County Public Schools
High School Center II
Albemarle County, VA

Contract: 24430010 **Testing Lab:** CVL

CBR SINGLE POINT 24430010 - LOGS.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 5/21/24



Sample Description:	SILTY SAND (SM), fine to coarse grained sand; moist, reddish brown, contains mica, crushed stone, and root fragments
Sample Source:	P-14
Sample Depth:	0.3 ft
Test Method:	ASTM D1883

Dry Density Before Soaking (pcf):	114.3
Dry Density After Soaking (pcf):	113.4
Maximum Dry Density (pcf):	114.8
Moisture Content Before Soaking (%):	13.3
Moisture Content After Soaking (Avg) (%):	15.8
Moisture Content Top Inch After Soak (%):	19.9
Optimum Moisture Content (%):	13

Liquid Limit (LL):	39
Plasticity Index (PI):	8
% Retained #4 Sieve:	6.0
% Passing # 200 Sieve:	42.7

CBR:	11.2, Soaked
Surcharge (psf):	50
Swell (%):	0.8

Schnabel ENGINEERING

CALIFORNIA BEARING RATIO TEST

Project: Albemarle County Public Schools
High School Center II
Albemarle County, VA

Contract: 24430010 **Testing Lab:** CVL

CBR SINGLE POINT 24430010 - LOGS.GPJ SCHNABEL DATA TEMPLATE 2008 04 22.GDT 5/21/24

Schnabel ENGINEERING

SOIL MECHANICS LABORATORY
CORROSION POTENTIAL SERIES

TABLE 1
Soil Test Evaluation for the Corrosion Potential Series

TEST	POINTS
Resistivity (Ω/cm)	
< 1,500	10
1,500 – 1,800	8
1,800 – 2,100	5
2,100 – 2,500	2
2,500 – 3,000	1
> 3,000	0
pH	
0 – 2	5
2.01 – 4.01	3
4.01 – 6.5	0
6.51 – 7.5	0 (*)
7.51 – 8.5	0
> 8.5	3
Redox potential (mV)	
> +100	0
+50 to +100	3.5
0 to +50	4
< 0	5
Sulfides	
Positive	3.5
Trace	2
Negative	0
Moisture	
Wet	2
Moist	1
Dry	0

* If sulfides are present and a low (< +20) or negative redox result is obtained, three points shall be given for this pH range.

NOTE: If total cumulative points >= 10, the tested soil has potential for corrosion, according to the Ductile Iron Pipe Research Association (DIPRA) criteria. See www.dipra.org for additional details.

TJL Environmental Health Consultants, Inc.
2304 Jefferson Park Avenue
Charlottesville, VA 22903
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ASBESTOS-CONTAINING MATERIALS INSPECTION

Albemarle County Schools
Old Building Services Department Building
2751 Hydraulic Road
Charlottesville, Virginia

June 10, 2024

TJL Environmental Health Consultants, Inc.
2304 Jefferson Park Avenue
Charlottesville, VA 22903
434-977-1409
tjloving@comcast.net

June 10, 2024

Mr. Kagan Squire
Senior Project Manager
Albemarle County Public Schools
Building Services Department
1180 Seminole Trail,
Suite 170,
Charlottesville, VA 22901

RE: Asbestos-Containing Materials (ACM) Inspection Report for the Old County Schools Building Services Department Building

Dear Mr. Squire:

On May 28, 2024, T. Joel Loving at TJL Environmental Health Consultants, Inc. (TJL) inspected the above referenced building for the presence of asbestos-containing materials (ACM). In accordance with Virginia Statewide Building Code and EPA NESHAP pre-demolition requirements, all suspect ACM* within this structure were sampled by TJL and later tested for asbestos content by a Virginia State-licensed laboratory using polarized light microscopy (PLM).

The ACM identified by this inspection are described below, along with their approximate locations, laboratory PLM results, and current physical conditions.

ACM	LOCATION(S)	LABORATORY RESULTS	CONDITIONS (Friable** or Non-Friable, Stable or Damaged)
(1) Exterior caulking compound	Around metal casement window frames in the rear (older) part of the building	5% Chrysotile Asbestos	These ACM were non-friable and in stable condition at the time of this inspection.

As indicated in the attached laboratory PLM report, no asbestos was detected within samples of the following materials:

1. Exterior surface filler on concrete block walls
2. Exterior caulking compound around metal door frames
3. 2'x2' Random pattern lay-in ceiling tiles
4. 4" and 6" Vinyl cove base materials and related mastic
5. Drywall and related joint compound
6. 12"x12" White floor tiles and related mastic under carpet tiles in main office area
7. Surface filler on concrete block walls
8. 12"x12" Gray floor tiles and related mastic in stairwell and rear offices

TJL Environmental Health Consultants, Inc.
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9. Brown and gray stair treads in stairwell
10. Glazing on metal casement windows in rear section of building
11. 2'x4' Random pattern lay-in ceiling tiles
12. 12"x12" Light gray floor tiles and related mastic in rear offices
13. 12"x12" Ivory floor tiles and related mastic in rear side office

***NOTE: Since there was no actual demolition performed by TJL to allow access behind, beneath, above, etc. exposed building materials, certain inaccessible ACM may not have been identified. TJL has made every possible effort to locate all suspect ACM that were reasonably accessible to the inspector during the survey. Future maintenance, renovations or demolition contractors should be informed that enclosed ACM may not have been identified during this inspection and that if encountered, to cease work until a positive identification of the suspect materials has been made. Also, since only building materials were tested, any equipment, appliances, fixtures or supplies within this building that were not part of its construction, were not examined.**

****NOTE: Friable materials are those that can be reduced to a fine powder by applying normal hand pressure. Removal of greater than 160 square feet or 260 linear feet of friable ACM must be monitored by a third-party Asbestos Project Monitor during all abatement activities. Project monitoring is recommended, but optional if less than these amounts of friable ACM are removed. Non-friable ACM that is in stable condition can be left in place during renovations if not disturbed or made friable. Non-friable ACM can be left in place during demolition provided they are not subjected to sanding, grinding, cutting, abrading or in any way made friable; however, all related construction debris must be properly disposed of as asbestos in a landfill approved to accept EPA NESHAP Category I or II Non-friable asbestos wastes, and all demolition workers must be properly trained, monitored and protected in accordance with the OSHA Asbestos Standard.**

Please do not hesitate to contact me should you have questions regarding this report, should you need TJL to monitor the abatement of the identified ACM, or if I can provide further assistance with environmental health matters on this or future projects.

Sincerely,

T. Joel Loving, M.S., C.E.I.
President
Virginia Asbestos Inspector License #3303-000057

AmeriSci Richmond
13635 GENITO ROAD
MIDLOTHIAN, VIRGINIA 23112
TEL: 8047631200 FAX: 8047631800

May 31, 2024

Environmental Health Consultants
Attn: T. Joel Loving
2304 Jefferson Park Avenue
Charlottesville, VA 22903

RE: Environmental Health Consultants
Job Number 124052216
P.O. #Loving
Albemarle County Schools Building Services Bldg

Dear T. Joel Loving:

Enclosed are the results for PLM asbestos analysis of the following Environmental Health Consultants samples received at AmeriSci on Wednesday, May 29, 2024, for a 48 hour turnaround:

Sample ID BS5-28-24-1 through BS5-28-24-48

The 48 samples contained in zip lock bag were shipped to AmeriSci via Fed Ex 7301 7889 8735 B 1030. These samples were prepared and analyzed according to EPA PLM Method (EPA 600/R-93/116 Section 2.2). The required analytical information, analysis results, analyst signature and laboratory identification are contained in the PLM Bulk Asbestos Report. If TEM analysis was requested for selected samples the gravimetric reduction data (by Sec 2.3) and TEM Asbestos % (by Sec 2.5) are included in Table 1 along with a summary of Asbestos % by PLM for all samples analyzed.

This report relates ONLY to the sample analysis expressed as % asbestos. AmeriSci assumes no responsibility for customer supplied data such as “sample type”, "location", or “area sampled”. This report must not be used to claim product endorsement by AmeriSci, NVLAP or any agency of the U. S. Government. The National Institute of Standards and Technology accreditation requirements mandate that this report must not be reproduced, except in full, without the written approval of the laboratory. This report may contain specific data not covered by NVLAP or ELAP accreditations, if so identified in relevant footnotes.

AmeriSci appreciates this opportunity to serve your organization. Please contact us for any further assistance or with any questions.

Sincerely,

Glenn F. Massey

QA Manager | Authorized Signatory

AmeriSci Richmond
13635 GENITO ROAD
MIDLOTHIAN, VIRGINIA 23112
TEL: (804) 763-1200 • FAX: (804) 763-1800

PLM Bulk Asbestos Report

Environmental Health Consultants
Attn: T. Joel Loving
2304 Jefferson Park Avenue

Charlottesville, VA 22903

Date Received 05/29/24
Date Examined 05/30/24

AmeriSci Job # 124052216
P.O. #
Page 1 **of** 14

RE: Albemarle County Schools Building Services Bldg

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
BS5-28-24-1 1	124052216-01 **Location:** Exterior Block Surface Filler Front Building	***No***	NAD (by CVES) by Daisha Addison on 05/30/24
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-2 1	124052216-02 **Location:** Exterior Block Surface Filler Front Building	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-3 2	124052216-03 **Location:** Exterior Block Surface Filler Back Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-4 2	124052216-04 **Location:** Exterior Block Surface Filler Back Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-5 3	124052216-05 **Location:** Caulking Around Metal Frame Windows Bldg	***Yes***	5.0% (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Cream, Heterogeneous, Fibrous, Bulk Material **Asbestos Types:** Chrysotile 5.0% **Other Material:** Non-fibrous 95%			

See Reporting notes on last page

PLM Bulk Asbestos Report

Albemarle County Schools Building Services Bldg

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
BS5-28-24-6 3	124052216-06 **Location:** Caulking Around Metal Frame Windows Bldg		NA/PS
Analyst Description: Bulk Material **Asbestos Types:** **Other Material:**			
BS5-28-24-7 4	124052216-07 **Location:** Caulking Around Metal Door Frames Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: White, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-8 4	124052216-08 **Location:** Caulking Around Metal Door Frames Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Lt. Grey, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-9 5	124052216-09 **Location:** 2' x 2' Random Pattern Lay-In Ceiling Tiles Storage Bldg Office	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Beige/Gray, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 85%, Fibrous glass 15%			
BS5-28-24-10 5	124052216-10 **Location:** 2' x 2' Random Pattern Lay-In Ceiling Tiles Storage Bldg Office	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Beige/Gray, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 85%, Fibrous glass 15%			
BS5-28-24-11 6	124052216-11L1 **Location:** Brown 6" Cove Base & Mastic Front Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Black, Heterogeneous, Non-Fibrous, Base Cove **Asbestos Types:** **Other Material:** Non-fibrous 100%			

See Reporting notes on last page

PLM Bulk Asbestos Report

Albemarle County Schools Building Services Bldg

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
BS5-28-24-11 6	124052216-11L2 **Location:** Brown 6" Cove Base & Mastic Front Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Clear, Heterogeneous, Non-Fibrous, Adhesive **Asbestos Types:** **Other Material:** Synthetic fibers 4.0%, Non-fibrous 96%			
BS5-28-24-12 6	124052216-12L1 **Location:** Brown 6" Cove Base & Mastic Front Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Black, Heterogeneous, Non-Fibrous, Base Cove **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-12 6	124052216-12L2 **Location:** Brown 6" Cove Base & Mastic Front Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Clear, Heterogeneous, Non-Fibrous, Adhesive **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-13 7	124052216-13.1 **Location:** Drywall & Joint Compound Front Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Drywall **Asbestos Types:** **Other Material:** Cellulose 3.0%, Non-fibrous 97%			
BS5-28-24-13 7	124052216-13.2 **Location:** Drywall & Joint Compound Front Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: White, Heterogeneous, Non-Fibrous, Joint Compound **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-14 7	124052216-14.1 **Location:** Drywall & Joint Compound Front Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Drywall **Asbestos Types:** **Other Material:** Cellulose 3.0%, Non-fibrous 97%			

See Reporting notes on last page

PLM Bulk Asbestos Report

Albemarle County Schools Building Services Bldg

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
BS5-28-24-14 7	124052216-14.2 **Location:** Drywall & Joint Compound Front Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: White, Heterogeneous, Non-Fibrous, Joint Compound **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-15 7	124052216-15.1 **Location:** Drywall & Joint Compound Front Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Drywall **Asbestos Types:** **Other Material:** Cellulose 3.0%, Non-fibrous 97%			
BS5-28-24-15 7	124052216-15.2 **Location:** Drywall & Joint Compound Front Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: White, Heterogeneous, Non-Fibrous, Joint Compound **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-16 8	124052216-16 **Location:** 2' x 2' Random Patterm Lay-In Ceiling Tiles Storage Bldg Office	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Beige/Gray, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 85%, Fibrous glass 15%			
BS5-28-24-17 8	124052216-17 **Location:** 2' x 2' Random Patterm Lay-In Ceiling Tiles Storage Bldg Office	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Beige/Gray, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 85%, Fibrous glass 15%			
BS5-28-24-18 9	124052216-18L1 **Location:** 12" x 12" White Floor Tiles & Mastic	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: White, Heterogeneous, Non-Fibrous, Tile **Asbestos Types:** **Other Material:** Non-fibrous 100%			

See Reporting notes on last page

PLM Bulk Asbestos Report

Albemarle County Schools Building Services Bldg

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
BS5-28-24-18 9	124052216-18L2 **Location:** 12" x 12" White Floor Tiles & Mastic	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Yellowish Brown, Heterogeneous, Non-Fibrous, Adhesive **Asbestos Types:** **Other Material:** Cellulose Trace, Non-fibrous 100%			
BS5-28-24-19 9	124052216-19L1 **Location:** 12" x 12" White Floor Tiles & Mastic	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Lt. Blue, Heterogeneous, Non-Fibrous, Tile **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-19 9	124052216-19L2 **Location:** 12" x 12" White Floor Tiles & Mastic	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Yellowish Brown, Heterogeneous, Non-Fibrous, Adhesive **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-20 10	124052216-20 **Location:** Concrete Block Surface Filler Front Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Gray/White, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-21 10	124052216-21 **Location:** Concrete Block Surface Filler Front Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Gray/White, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-22 11	124052216-22L1 **Location:** Gray 12" x 12" Floor Tile & Mastic Front Bldg Stairwell	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Tile **Asbestos Types:** **Other Material:** Non-fibrous 100%			

See Reporting notes on last page

PLM Bulk Asbestos Report

Albemarle County Schools Building Services Bldg

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
BS5-28-24-22 11	124052216-22L2 **Location:** Gray 12" x 12" Floor Tile & Mastic Front Bldg Stairwell	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Clear, Heterogeneous, Non-Fibrous, Adhesive **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-22 11	124052216-22L3 **Location:** Gray 12" x 12" Floor Tile & Mastic Front Bldg Stairwell	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Cream, Heterogeneous, Non-Fibrous, Tile **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-22 11	124052216-22L4 **Location:** Gray 12" x 12" Floor Tile & Mastic Front Bldg Stairwell	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Yellow, Heterogeneous, Non-Fibrous, Adhesive **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-23 11	124052216-23L1 **Location:** Gray 12" x 12" Floor Tile & Mastic Front Bldg Stairwell	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Tile **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-23 11	124052216-23L2 **Location:** Gray 12" x 12" Floor Tile & Mastic Front Bldg Stairwell	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Clear, Heterogeneous, Non-Fibrous, Adhesive **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-23 11	124052216-23L3 **Location:** Gray 12" x 12" Floor Tile & Mastic Front Bldg Stairwell	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Cream, Heterogeneous, Non-Fibrous, Tile **Asbestos Types:** **Other Material:** Non-fibrous 100%			

See Reporting notes on last page

PLM Bulk Asbestos Report

Albemarle County Schools Building Services Bldg

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
BS5-28-24-23	124052216-23L4	***No***	NAD
11	**Location:** Gray 12" x 12" Floor Tile & Mastic Front Bldg Stairwell		(by CVES) by Daisha Addison on 05/31/24
Analyst Description: Yellow, Heterogeneous, Non-Fibrous, Adhesive **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-24	124052216-24L1	***No***	NAD
12	**Location:** Brown Stair Treads & Mastic Front Bldg Stairwell		(by CVES) by Daisha Addison on 05/31/24
Analyst Description: Brown, Heterogeneous, Non-Fibrous, Stair Tread **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-24	124052216-24L2		NA
12	**Location:** Brown Stair Treads & Mastic Front Bldg Stairwell "Insufficient Material Submitted For Analysis"		
Analyst Description: Adhesive **Asbestos Types:** **Other Material:**			
BS5-28-24-25	124052216-25L1	***No***	NAD
12	**Location:** Brown Stair Treads & Mastic Front Bldg Stairwell		(by CVES) by Daisha Addison on 05/31/24
Analyst Description: Brown, Heterogeneous, Non-Fibrous, Stair Tread **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-25	124052216-25L2		NA
12	**Location:** Brown Stair Treads & Mastic Front Bldg Stairwell "Insufficient Material Submitted For Analysis"		
Analyst Description: Adhesive **Asbestos Types:** **Other Material:**			
BS5-28-24-26	124052216-26L1	***No***	NAD
13	**Location:** Gray Stair Treads & Mastic Front Bldg Stairwell		(by CVES) by Daisha Addison on 05/31/24
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Stair Tread **Asbestos Types:** **Other Material:** Non-fibrous 100%			

See Reporting notes on last page

PLM Bulk Asbestos Report

Albemarle County Schools Building Services Bldg

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
BS5-28-24-26 13	124052216-26L2 **Location:** Gray Stair Treads & Mastic Front Bldg Stairwell	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Cream, Heterogeneous, Non-Fibrous, Adhesive **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-27 13	124052216-27L1 **Location:** Gray Stair Treads & Mastic Front Bldg Stairwell	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Stair Tread **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-27 13	124052216-27L2 **Location:** Gray Stair Treads & Mastic Front Bldg Stairwell	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Cream, Heterogeneous, Non-Fibrous, Adhesive **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-28 14	124052216-28L1 **Location:** Gray 12" x 12" Floor Tile & Mastic Back Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Tile **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-28 14	124052216-28L2 **Location:** Gray 12" x 12" Floor Tile & Mastic Back Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Yellow, Heterogeneous, Non-Fibrous, Adhesive **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-29 14	124052216-29L1 **Location:** Gray 12" x 12" Floor Tile & Mastic Back Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Tile **Asbestos Types:** **Other Material:** Non-fibrous 100%			

See Reporting notes on last page

PLM Bulk Asbestos Report

Albemarle County Schools Building Services Bldg

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
BS5-28-24-29 14	124052216-29L2 **Location:** Gray 12" x 12" Floor Tile & Mastic Back Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Yellow, Heterogeneous, Non-Fibrous, Adhesive **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-30 15	124052216-30L1 **Location:** 4" Vinyl Cove Base & Mastic Back Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Base Cove **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-30 15	124052216-30L2 **Location:** 4" Vinyl Cove Base & Mastic Back Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Cream, Heterogeneous, Non-Fibrous, Adhesive **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-31 15	124052216-31L1 **Location:** 4" Vinyl Cove Base & Mastic Back Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Brown, Heterogeneous, Non-Fibrous, Base Cove **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-31 15	124052216-31L2 **Location:** 4" Vinyl Cove Base & Mastic Back Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Cream, Heterogeneous, Non-Fibrous, Adhesive **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-32 16	124052216-32 **Location:** 2' x 2' Random Pattern Lay-In Ceiling Tiles Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Beige/Gray, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 85%, Fibrous glass 15%			

See Reporting notes on last page

PLM Bulk Asbestos Report

Albemarle County Schools Building Services Bldg

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
BS5-28-24-33 16	124052216-33 **Location:** 2' x 2' Random Pattern Lay-In Ceiling Tiles Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Beige/Gray, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 85%, Fibrous glass 15%			
BS5-28-24-34 17	124052216-34 **Location:** 2' x 4' Random Pattern Lay-In Ceiling Tiles	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Beige/Gray, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 85%, Fibrous glass 15%			
BS5-28-24-35 17	124052216-35 **Location:** 2' x 4' Random Pattern Lay-In Ceiling Tiles	***No***	NAD (by CVES) by Daisha Addison on 05/31/24
Analyst Description: Beige/Gray, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose 85%, Fibrous glass 15%			
BS5-28-24-36 18	124052216-36L1 **Location:** 12" x 12" Light Gray Floor Tiles & Mastic Back Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/30/24
Analyst Description: Lt. Grey, Heterogeneous, Non-Fibrous, Tile **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-36 18	124052216-36L2 **Location:** 12" x 12" Light Gray Floor Tiles & Mastic Back Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/30/24
Analyst Description: Yellow, Heterogeneous, Non-Fibrous, Adhesive **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-37 18	124052216-37L1 **Location:** 12" x 12" Light Gray Floor Tiles & Mastic Back Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/30/24
Analyst Description: Lt. Grey, Heterogeneous, Non-Fibrous, Tile **Asbestos Types:** **Other Material:** Non-fibrous 100%			

See Reporting notes on last page

PLM Bulk Asbestos Report

Albemarle County Schools Building Services Bldg

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
BS5-28-24-37 18	124052216-37L2 **Location:** 12" x 12" Light Gray Floor Tiles & Mastic Back Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/30/24
Analyst Description: Yellow, Heterogeneous, Non-Fibrous, Adhesive **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-38 19	124052216-38 **Location:** Concrete Block Surface Filler Back Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/30/24
Analyst Description: Black/Grey, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-39 19	124052216-39 **Location:** Concrete Block Surface Filler Back Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/30/24
Analyst Description: Black/Grey, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-40 20	124052216-40 **Location:** Glazing On Metal Casement Window Panes	***No***	NAD (by CVES) by Daisha Addison on 05/30/24
Analyst Description: Tan, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Cellulose Trace, Non-fibrous 100%			
BS5-28-24-41 20	124052216-41 **Location:** Glazing On Metal Casement Window Panes	***No***	NAD (by CVES) by Daisha Addison on 05/30/24
Analyst Description: Tan, Heterogeneous, Non-Fibrous, Bulk Material **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-42 21	124052216-42L1 **Location:** 12" x 12" Ivory Floor Tiles & Mastic Back Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/30/24
Analyst Description: Ivory, Heterogeneous, Non-Fibrous, Tile **Asbestos Types:** **Other Material:** Non-fibrous 100%			

See Reporting notes on last page

PLM Bulk Asbestos Report

Albemarle County Schools Building Services Bldg

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
BS5-28-24-42 21	124052216-42L2 **Location:** 12" x 12" Ivory Floor Tiles & Mastic Back Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/30/24
Analyst Description: Yellow, Heterogeneous, Non-Fibrous, Adhesive **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-43 21	124052216-43L1 **Location:** 12" x 12" Ivory Floor Tiles & Mastic Back Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/30/24
Analyst Description: Ivory, Heterogeneous, Non-Fibrous, Tile **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-43 21	124052216-43L2 **Location:** 12" x 12" Ivory Floor Tiles & Mastic Back Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/30/24
Analyst Description: Yellow, Heterogeneous, Non-Fibrous, Adhesive **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-44 22	124052216-44L1 **Location:** 12" x 12" Dark Gray Floor Tiles & Mastic Back Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/30/24
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Tile **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-44 22	124052216-44L2 **Location:** 12" x 12" Dark Gray Floor Tiles & Mastic Back Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/30/24
Analyst Description: Yellow, Heterogeneous, Non-Fibrous, Adhesive **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-45 22	124052216-45L1 **Location:** 12" x 12" Dark Gray Floor Tiles & Mastic Back Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/30/24
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Tile **Asbestos Types:** **Other Material:** Non-fibrous 100%			

See Reporting notes on last page

PLM Bulk Asbestos Report

Albemarle County Schools Building Services Bldg

Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
BS5-28-24-45 22	124052216-45L2 **Location:** 12" x 12" Dark Gray Floor Tiles & Mastic Back Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/30/24
Analyst Description: Yellow, Heterogeneous, Non-Fibrous, Adhesive **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-46 23	124052216-46.1 **Location:** Drywall And Related Joint Compound Back Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/30/24
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Drywall **Asbestos Types:** **Other Material:** Cellulose 2.0%, Non-fibrous 98%			
BS5-28-24-46 23	124052216-46.2 **Location:** Drywall And Related Joint Compound Back Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/30/24
Analyst Description: White, Heterogeneous, Non-Fibrous, Joint Compound **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-47 23	124052216-47.1 **Location:** Drywall And Related Joint Compound Back Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/30/24
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Drywall **Asbestos Types:** **Other Material:** Cellulose 3.0%, Non-fibrous 97%			
BS5-28-24-47 23	124052216-47.2 **Location:** Drywall And Related Joint Compound Back Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/30/24
Analyst Description: White, Heterogeneous, Non-Fibrous, Joint Compound **Asbestos Types:** **Other Material:** Non-fibrous 100%			
BS5-28-24-48 23	124052216-48.1 **Location:** Drywall And Related Joint Compound Back Bldg	***No***	NAD (by CVES) by Daisha Addison on 05/30/24
Analyst Description: Gray, Heterogeneous, Non-Fibrous, Drywall **Asbestos Types:** **Other Material:** Cellulose 3.0%, Non-fibrous 97%			

See Reporting notes on last page

PLM Bulk Asbestos Report

Albemarle County Schools Building Services Bldg

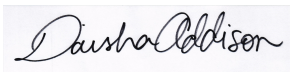
Client No. / HGA	Lab No.	Asbestos Present	Total % Asbestos
BS5-28-24-48 23	124052216-48.2	***No***	NAD (by CVES) by Daisha Addison on 05/30/24

Location: Drywall And Related Joint Compound Back Bldg

Analyst Description: White, Heterogeneous, Non-Fibrous, Joint Compound
Asbestos Types:
Other Material: Non-fibrous 100%

Reporting Notes:

Analyzed by: Daisha Addison
Date: 5/30/2024



Reviewed by: Glenn F. Massey

*NAD = no asbestos detected, Detection Limit <1%, Reporting Limits: CVES = 1%, 400 Pt Ct = 0.25%, 1000 Pt Ct = 0.1%; "Present" or NVA = "No Visible Asbestos" are observations made during a qualitative analysis; NA = not analyzed; NA/PS = not analyzed / positive stop; PLM Bulk Asbestos Analysis using Meiji, Model MT 6120 microscope, Serial #2200363, by EPA 600/R-93/116 per 40 CFR 763 (NVLAP Lab Code 101904-0) and ELAP PLM Analysis Protocol 198.1 for New York friable samples which includes quantitation of any vermiculite observed (198.6 for NOB samples) or EPA 400 pt ct by EPA 600/M4-82-020 (NYSDOH ELAP Lab # 10984); CA ELAP Lab # 2508; Note: PLM is not consistently reliable in detecting asbestos in floor coverings and similar NOB materials. NAD or Trace results by PLM are inconclusive, TEM is currently the only method that can be used to determine if this material can be considered or treated as non-asbestos-containing in New York State (also see EPA Advisory for floor tile, FR 59, 146, 38970, 8/1/94). NIST Accreditation requirements mandate that this report must not be reproduced except in full without the approval of the laboratory. This PLM report relates ONLY to the items tested.

Environmental Health Consultants, Inc.
2304 Jefferson Park Avenue
Charlottesville, VA 22903
Phone: (434) 962-8721 • Email: joel@tjlenvironmental.com

124052816

Laboratory Sample Analysis Request

Analysis and Turnaround Time Requested: PLM (48 hrs)

Project Description: Albemarle County Schools Building Services Bldg.

Instructions: Please email results as soon as analyses completed. Repeat all sample information shown below on final lab report. Please sign and return this form with written report. Other special requests: SP= Stop Positive

Sample #	Special Notes	Person/Area Sampled	Activity Occurring	Pump #	Pump Flow Rate (LPM)	Start Time	Stop Time
BSS-28-24-1		Exterior block	surface filler	front bldg			
-2	SP	"			"		
-3		"		"	Back Bldg		
-4	SP	"		"	"		
-5		Caulking around metal frame windows				"	
-6	SP	"		"		"	
-7		"	metal door frames			"	
-8	SP	"	"				
-9		2'x2' Random pattern lay-in ceiling tiles		storage bldg office			
-10	SP	"					
-11		Brown 6" Cove base + mastic		front bldg			
-12	SP	"					
-13		Drywall + joint compound		front bldg			
-14	SP	"					
-15	SP	"					
-16		2'x2' Random lay-in ceiling tiles		"			
-17	SP	"					
-18		12"x12" White floor tiles + mastic			"		
-19	SP	"					
-20		Concrete block surface filler		front	Bldg		
-21	SP	"					

Samples submitted by: [signature] Received **Date:** 5-28-24

Samples received by: MAY 29 2024 **Date:**

1240522 16

Environmental Health Consultants, Inc.
2304 Jefferson Park Avenue
Charlottesville, VA 22903
Phone: (434) 962-8721 • Email: joel@tjlenvironmental.com

Laboratory Sample Analysis Request

Analysis and Turnaround Time Requested: _____

Project Description: Albemarle (Page 2)

Instructions: Please email results as soon as analyses completed. Repeat all sample information shown below on final lab report. Please sign and return this form with written report. Other special requests: _____

Sample #	Special Notes	Person/Area Sampled	Activity Occurring	Pump #	Pump Flow Rate (LPM)	Start Time	Stop Time
-22 -23	sp	Gray 12"x12" floor tile + mastic	"	"	front bldg	stairwell	
-24 -25	sp	Brown stair treads + mastic	"	"	"		
-26 -27	sp	Gray "	"	"	"		
-28 -29	sp	Gray 12"x12" floor tile + mastic	"	"	Back Bldg		
-30 -31	sp	4" Vinyl cove base + mastic	"	"	"		
-32 -33	sp	2'x2' Random pattern lay-in ceiling tiles	"	"	"		
-34 -35	sp	2'x4' "	"	"	"		
-36 -37	sp	12"x12" Light gray floor tiles + mastic	"	"	back bldg		
-38 -39	sp	Concrete block surface filler	"	"	back bldg		
-40 -41	sp	Glazing on metal casement window panes	"	"	"		

Samples submitted by: _____ Received Date: 5-28-24

Samples received by: _____ MAY 29 2024 Date: _____

1240522 16

Environmental Health Consultants, Inc.
2304 Jefferson Park Avenue
Charlottesville, VA 22903
Phone: (434) 962-8721 • Email: joel@tjlenvironmental.com

Laboratory Sample Analysis Request

Analysis and Turnaround Time Requested: _____

Project Description: Albemarle (page 3)

Instructions: Please email results as soon as analyses completed. Repeat all sample information shown below on final lab report. Please sign and return this form with written report. Other special requests: _____

Sample #	Special Notes	Person/Area Sampled	Activity Occurring	Pump #	Pump Flow Rate (LPM)	Start Time	Stop Time
-42		12" x 12" Ivory	floor tiles + mastic back bldg				
-43	SP	"	"				
-44		12" x 12" Dark gray	"		"		
-45	SP	"	"				
-46		Drywall and related joint compound					back bldg
-47	SP	"			"		
-48	SP	"			"		

Samples submitted by: _____ **Date:** 5-28-24

Samples received by: _____ **Date:** _____

Received
MAY 29 2024

SIEMENS

PROPOSAL
AHS Center 2

PREPARED BY
Siemens Industry, Inc. ("Siemens")

PREPARED FOR
Albemarle County Public Schools

DELIVERED ON
September 27, 2024

K12 EDUCATION

Transforming the Everyday

SIEMENS

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SIEMENS

Contact Information

Proposal #:	9212454
Date:	September 27, 2024

Sales Executive:	Tammy Shifflett
Branch Address:	5106 Glen Alden Dr. Richmond, VA 23231
Telephone:	804-621-3047
Email Address:	tammy.shifflett@siemens.com

Customer Contact:	Interested Parties
Customer:	Albemarle County Public Schools
Address:	401 McIntire Road
	Charlottesville, VA
Services shall be provided at:	New Center Two Site

SIEMENS

Scope of Work

Siemens Industry, Inc. is pleased to propose pricing to furnish and install the Building Automation System (BAS) in accordance with plans dated 8/21/2024 and specifications dated 8/5/2024 and the following clarifications to the scope of work.

System Integration

- This will be an extension of Albemarle County Public Schools' existing Siemens APOGEE Building Automation System (BAS).
- We include updated programming and system graphics.
- We did not include any new servers or workstations.

Control Wiring

- Siemens includes power wiring to Siemens controllers if not specifically identified on the plans to be provided by Div 26 power electrician. We require the Div 26 power electrician to provide power where shown on their drawings.
- Siemens includes BAS Control System wiring per specifications.

Hydronic System Controls

- Siemens will provide field installer controllers/panels/control devices for hydronic system as shown on M-802 and as described below
- Ground Source Water to Water Heat Pump Chillers (3): Will come equipped with manufacturer's controls with BACnet interface. Siemens will integrate via BACnet.
- VFDs provided, installed, powered, and started up. They shall come equipped with BACnet interface. Siemens will integrate via BACnet and provide hardwired Start/Stop, Status, Speed, and Alarm.
- Summary of Points:
    - Well field differential pressure
    - Ground water supply temperature sensor
    - Ground water return temperature sensor
    - Ground water return flowmeter
    - 2-way geothermal bypass valve and actuator
    - Domestic water heater isolation valve and actuator
    - Domestic water heater inlet pressure
    - Domestic water heater inlet temperature sensor
    - Ground water inlet/outlet differential pressure sensor
    - Ground water system HRCH inlet temperature sensor
    - HRCH system differential pressure (HWS and HWR)
    - HRCH system differential pressure (CHWS and CHWR)
    - HRCH – HWS and HWR temperature sensors
    - HRCH – CHWS temperature sensor – pre-buffer tank
    - HRCH – CHWS pressure transmitter – pre-buffer tank
    - CHW – Buffer tank 2-way bypass valve and actuator

- CHW – Buffer tank temperature sensor
- HRCH – CHWS temperature sensor – post-buffer tank
- HRCH – CHWS pressure transmitter – post-buffer tank
- CHW building load loop pressure transmitter
- CHW system 3-way control valve and actuator
- HRCH – CHWR temperature sensor – CHW pump inlet
- HRCH – CHWR pressure transmitter – CHW pump inlet
- HWS – Buffer tank 2-way bypass valve and actuator
- HWS – Buffer tank temperature sensor
- HWS temperature sensor- post-buffer tank
- HWS pressure transmitter – post-buffer tank
- HW building load loop pressure transmitter
- HW system 3-way control valve and actuator
- HWR temperature sensor – HW pump inlet
- HWR pressure transmitter – HW pump inlet
- Global outdoor temperature, humidity, and CO2 sensors

Variable Air Volume Outside Air Unit (OAU-1)

- Unit will come equipped with manufacturer's controls with BACnet interface. All controls/control devices/sensors shall be provided by others. Siemens excludes providing any of these.
- Siemens will integrate via BACnet. We will make available to points that the unit manufacturer makes available to us.
- VFDs provided, installed, powered, and started up by others. They shall come equipped with BACnet interface. Siemens will integrate via BACnet.

Rooftop Unit – Commons (RTU-Commons)

- Unit will come equipped with manufacturer's controls with BACnet interface. All controls/control devices/sensors shall be provided by others. Siemens excludes providing any of these.
- Siemens will integrate via BACnet. We will make available to points that the unit manufacturer makes available to us.
- VFDs provided, installed, powered, and started up. They shall come equipped with BACnet interface. Siemens will integrate via BACnet.

Rooftop Unit – Kitchen (RTU-Kitchen)

- Unit will come equipped with manufacturer's controls with BACnet interface. All controls/control devices/sensors shall be provided by others. Siemens excludes providing any of these.
- Siemens will integrate via BACnet. We will make available to points that the unit manufacturer makes available to us.
- VFDs provided, installed, powered, and started up. They shall come equipped with BACnet interface. Siemens will integrate via BACnet.

(30) Air Terminal Units (ATO-xx)

- Siemens will provide controls per schematic and sequence of operation on M-803. Controller and

damper actuator will be shipped to box manufacturer for factory installation. IP DXRs will be looped in series.

- Summary of points:
    - Airflow CFM
    - Damper actuator
    - Zone CO2 sensor
    - Occupancy sensor
    - Control transformer

(56) Fan Coil Units – 4 -pipe (FC-02 through FC-12)

- Siemens will provide controls per schematic and sequence of operation on M-805. IP DXRs will be looped in series.
- Summary of points:
    - Supply air temperature sensor
    - Heating coil control valve and actuator – valve to be pressure independent
    - Cooling coil control valve and actuator – valve to be pressure independent
    - Supply fan ECM motor Speed signal
    - Supply fan ECM motor Enable/Disable signal
    - Supply fan ECM motor Fault
    - Condensate pan high water level switch – switch provided by others
    - Condensate pan water detection switch
    - Zone temperature and humidity

(5) Fan Coil Units – Heating Only (Stairwells and Vestibule)

- Siemens will provide controls per the schematic and sequence of operation on M-805. IP DXRs will be looped in series.
- Summary of points:
    - Supply air temperature sensor
    - Heating coil control vale and actuator – valve to be pressure independent
    - Supply fan ECM motor Speed signal
    - Supply fan ECM motor Enable/Disable signal
    - Supply fan ECM motor Fault
    - Condensate pan high water level switch – switch to be provided by others
    - Condensate pan water detection switch
    - Zone temperature sensor with override

(2) Fan Coil Units – Cooling Only (Stairwells)

- Siemens will provide controls per the schematic and sequence of operation on M-805. IP DXRs will be looped in series.
- Summary of points:
    - Supply air temperature sensor
    - Cooling coil control valve and actuator – valve to be pressure independent
    - Supply fan ECM motor Speed signal

- Supply fan ECM motor Enable/Disable signal
- Supply fan ECM motor Fault
- Condensate pan high water level switch – switch to be provided by others
- Condensate pan water detection switch
- Zone temperature sensor with override

(2) DX Computer Room Air Conditioning Units (CRAC-1 and CRAC-2)

- Units will come equipped with manufacturer's controls with BACnet interface. All controls/control devices/sensors shall be provided by others. Siemens excludes providing any of these.
- Siemens will integrate via BACnet. We will make available to points that the unit manufacturer makes available to us.

(2) General Exhaust Fans

- Fans are shown to be VFD enabled and controlled via local thermostat and/or wall switch. Thermostat and wall switches are to be provided by others. VFDs provided, installed, powered, and started up by others.
- Siemens will provide control for the following points:
  - VFD Speed feedback
  - VFD Fault
  - Fan run Status

Kitchen Make-Up Air Unit – Kitchen Exhaust

- Unit will come equipped with manufacturer's controls with BACnet interface. Siemens will monitor the points reflected in the control diagram and sequence of operation, assuming the unit manufacturer makes those points available to us.

Dishwasher Exhaust

- Will come equipped with manufacturer's controls.
- Exhaust fan VFD provided, installed, powered, and started up by others. VFD shall come equipped with BACnet interface. Siemens will integrate via BACnet.

Maintenance Room Exhaust

- Siemens will provide control for devices as shown in the points list on the controls schematic on M-807. Summary of points:
  - Exhaust fan ECM motor Speed signal
  - Exhaust fan ECM motor Enable/Disable signal
  - Exhaust fan ECM motor Fault
  - Make-up air damper control. Damper shall be provided by others; Siemens will provide damper actuator.
  - Enable/Disable of domestic water heater (located in room)

- Refrigerant Monitoring: Per ACPS, Siemens will not provide a 3rd party refrigerant monitoring system as described in the bid documents. Instead, we will provide a horn/strobe outside both doors to the

maintenance room and an Airtest R134a transmitter in room with connection to the exhaust fan, and Alarm communication to ACPS staff.

Water Metering

- Siemens will provide the following meters, to be installed by others. Meters to each include BAS system communication ability.
    - Building domestic water supply
    - Domestic hot water meter
    - Kitchen domestic water meter

Emergency Generator

- Per controls schematic and sequence of operation on M-807, Siemens will monitor the ATS Status and provide programming for "stepping" of BAS controlled equipment as described.
- Siemens will monitor normal and emergency power.

(1) Lab Fume Hood Ventilation

- Siemens will provide Lab Fume Hood Exhaust Terminal Unit and Lab IP DXR for installation by mechanical contractor. Units will include galvanized construction with slip-fit construction, and orifice plate airflow measurement and control transformer.
- Per schematic drawing and sequence of operation on M-807, Siemens will provide control devices for the points listed in the control schematic. Summary of points:
    - Fast acting damper actuator(s)
        - Fume hood
        - Exhaust air damper
    - Airflow CFM
    - Sash sensor
    - Fume hood monitor
    - Zone presence (occupancy) sensor
    - Exhaust fan control

Commons Area Stats (3)

- Will be installed by Siemens. They will be averaged and networked to the unit serving this space.

Training

- Siemens includes eight (8) hours training as specified.

Clarifications

- Work shall be performed during normal working hours. Overtime or off-hours work is not included.
- Cleanup provided for our work only in this proposal
- BAS product to be installed in piping shall be installed by others: control valves, DP transmitters, flow

meters, temp transmitters, etc.
- BAS product to be installed within ductwork shall be installed by others: control dampers, air flow stations, etc.

- Duct smoke detectors provided and installed by others
- Exhaust fan backdraft dampers and/or motorized isolation dampers provided by others
- Owner to provide Ethernet drop at field panel locations
- Turnaround time for submittals is approximately 4-6 weeks from receipt of PO/subcontract

Exclusions

- OCIP or CCIP participation
- Performance and Payment Bond
- Davis-Bacon wages
- Patching walls or painting

Acknowledged Addenda:

- None

SIEMENS

Sell Price

Total Quote Price	**$632,112.00**

Terms & Conditions Link(s)

Terms and Conditions (Click to download)
Terms & Conditions (Restricted) (www.siemens.com/standard-terms-project-restricted)

Price Escalation. If, during the term of this Contract, the price of various materials or labor or logistics are increased as reflected by CRU/IHS Markit/CMAI/COMEX market index, then Siemens may increase the Contract Sum or apply a surcharge to Customer accordingly.

As a result of the global Covid-19 Virus outbreak, temporary delays in delivery, labor or services from Siemens and its sub-suppliers or subcontractors may occur. Among other factors, Siemens' delivery is subject to the correct and punctual supply from sub-suppliers or subcontractors, and Siemens reserves the right to make partial deliveries or modify its labor or services. While Siemens shall make every commercially reasonable effort to meet the delivery or service or completion date mentioned above, such date is subject to change.

This quote will be valid for ninety (90) days.

Sincerely,

Tammy Shifflett

SIEMENS

Signature Page

Proposed by:

Siemens Industry, Inc.

Company

Tammy Shifflett

Name

9212454

Proposal #

$632,112.00

Proposal Amount

September 27, 2024

Date

Accepted by:

Albemarle County Public Schools

Company

Name (Printed)

Signature

Title

Date

Purchase Order # ☐ PO for billing/pmnt only ☐ PO not required

Albemarle County

BUILDING DEPARTMENT

ALBEMARLE COUNTY BUILDING DEPARTMENT
401 McINTIRE ROAD
CHARLOTTESVILLE, VA 22902

ALBEMARLE COUNTY SPECIAL INSPECTION GUIDELINES AND PROCEDURES

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Preface

As noted in the BOCA International manual ***designing a Special Inspection Program***

> The effects of structural failures are far too many to list. The seriousness of such events gained the attention of the U.S. government. In August of 1982, a Subcommittee, chaired by Albert Gore, Jr., held investigative hearings to examine the causes of structural failure and find common problems associated with these conditions. The Subcommittee's ultimate goal was to eliminate those problems; thereby, decreasing the number of failures. (BOCA, P. 2)

To accomplish this goal, the Albemarle County has formulated a uniform set of procedures for the manner in which participating jurisdictions enforce special inspection provisions of the Virginia Uniform Statewide Building Code (USBC). The provisions for special inspections are intended to provide a higher degree of expertise in the implementation of the structural design for critical aspects of building construction not normally found in the local building department.

The USBC effective November 16, 2005, incorporates and amends the International Code Council, Inc. (ICC) 2003 International Building Code. The ***Albemarle County Special Inspection Guidelines and Procedures*** provides and coordinates the procedures for special inspections that are required by both the referenced USBC and IBC. This procedure is intended to be useable during the design and permitting process and on the job site by containing the pertinent information needed for successful application of a special inspection program.

The ***Albemarle County Special Inspection Guidelines and Procedures*** *includes* the following:

1. The responsibilities of the registered design professional responsible for the structural design;
2. The role of each member of the building construction team to include the registered design professionals, building owner, contractors, the special inspectors and agents, and local building official;
3. The experience and qualifications necessary to supervise and perform special inspections;
4. Identification of the required areas of special inspections, and;
5. Administrative procedures that include a uniform special inspection form that is accepted by the participating localities, important definitions, reporting requirements, and conflict resolution procedures;

The purpose of the ***Albemarle County Special Inspection Guidelines and Procedures*** is to increase awareness of the special inspection requirements and to have a uniform procedure applicable throughout Albemarle County. In addition, the procedure should help reduce the problem associated with permitting and performing special inspections in the County. Should you have any questions or suggestions for future editions of this document, feel free to contact the Albemarle County Plans Examiner.

1. Introduction

A. Purpose

The provisions for special inspections are intended to provide a higher degree of scrutiny for aspects of construction that, upon failure, would cause significant harm. These aspects of construction include soil suitability analysis, fabrication and installation of structural steel members, certain concrete and masonry construction, fabrication and installation of wood structural elements, pile and pier foundations, sprayed fire-resistant materials, wall panels and veneer systems, EIFS, special cases and smoke control systems as detailed in the International Building Code (IBC).

The IBC as adopted by reference through the Virginia Uniform Statewide Building Code (USBC) intends that an experienced expert be in responsible charge of the inspection of these special types of construction. Albemarle County has implemented this uniform procedure for the manner in which jurisdictions enforce the special inspection requirements of the USBC and the IBC. This includes the standard for experience and qualifications necessary to adequately control the work being performed, duties of the special inspector, reporting requirements, as well as oversight by each jurisdiction. It specifies the type and manner of work and how it is to be performed and any supervision required. It also clarifies the requirements for reporting the results and record keeping.

This procedure is intended to safeguard public safety and general welfare through structural strength of building materials by:

- Clearly defining the responsibility of all parties involved in the special inspection process and
- Standardizing the necessary qualifications required for Special Inspectors and Laboratories and
- Applying the special inspection provisions of the USBC in a consistent manner throughout Albemarle County.

B. Background

Numerous structural failures occurred during the late 1970's and early 1980's throughout the United States. These failures resulted in personal tragedies and tremendous property damage costs. However, most if not all of these failures, were predicable in nature and centered on one common theme; lack of an adequate construction inspection process.

In August of 1982, the U.S. House of Representatives, Subcommittee on Investigations and Oversight, chaired by Albert Gore, Jr., held investigative hearings to examine the causes of structural failures. This subcommittee was part of the Committee on Science and Technology. In March of 1984, the Committee on Science and Technology's report titled *Structural Failures in Public Facilities,* House Report 98-621, was presented to the 98th Congress. The following are highlights from this report.

The central issue addressed by the Subcommittee was:

> "Are there common problems associated with structural failures, the elimination of which would decrease the number of failures?"

While the Subcommittee identified over twenty contributing factors, two common problems were felt to be the most critical;

- The need for improved organization on construction projects and better communication between participants.
- The need for construction inspection by the Structural Engineer of Record (SER) during the construction of principal structural components.

The Subcommittee found that:

> "For a variety of reasons, the structural engineer of record or his designee is often not present on the job site during the construction of principal structural components. The absence of the structural engineer has permitted flaws and changes on site to go unnoticed and uncorrected."

The Subcommittee recommended that:

> "Professional organizations, such as the Building Officials and Code Administrators International (BOCA), the International Conference and Building Officials (ICBO), and the Southern Building Code Conference International, should make every effort to ensure that provisions are written into the building codes and adopted in public forum which make the on-site presence of the structural engineer mandatory during the construction of structural components on public facilities."

Model code organizations and building officials have attempted to address structural failures by enacting and enforcing Special Inspection provisions since 1987. However, the model codes fell short of requiring the Structural Engineer of Record to serve as the Special Inspector.

As time has elapsed and memories fade, special inspections and the role of the Structural Engineer of Record have been topics of controversy and confusion in recent years. Many organizations, such as the American Consulting Engineers Council and the Virginia Structural Engineers Council as well as the Council of American Structural Engineers (CASE), agree with the Subcommittee's recommendations and believe strongly that the SER or his agent should serve as the Special Inspector whenever possible and practical.

2. Definitions

Words used in this procedure shall have a meaning as defined in the USBC and the IBC. Unless otherwise expressly stated, other words and terms shall have the meaning shown in this procedure. Where terms are not defined through the methods authorized by this section, such terms shall have ordinarily accepted meanings such as the context implies.

Agents* of *Special Inspector (Agents). Qualified individuals or agencies working under the direction of the SI who are providing the inspections and tests necessary to complete the special inspection process.

Approved. See IBC-202

Approved Agency. See IBC-1702.1

Approved Documents. Includes building construction documents as approved by the municipality including all approved revisions; and also fabrication and erection documents as approved by municipality including all approved revisions.

Architect of Record (AR). The registered design professional (RDP) retained by the Owner to design or specify architectural construction in accordance with the USBC and whose signature and seal appears on the

approved architectural construction documents.

Building. See USBC-202

Building Official. The local government authority charged with the administration and enforcement of the USBC. This shall include any duly authorized technical assistant as specified in the USBC.

Construction documents. See IBC-202

Contractor: A general contractor licensed in the Commonwealth of Virginia (See Commonwealth of Virginia, Title 54.1)

Fabrication item. See IBC-1702.1

Fabrication and erection documents. All of the written, graphic, and pictorial documents prepared or assembled after issuance of a building permit and in addition to the municipality approved construction documents, describing the design, location, and physical characteristics of the building components or materials necessary for fabrication, assembly, or erection of the elements of the project. (Examples would include, but are not limited to, concrete reinforcing shop drawings, steel fabrication and erection shop drawings, and metal building fabrication and erection shop drawings.)

Final Report of Special Inspections. A certification by the special inspector which shall indicate that all construction elements subject to special inspections as identified by the jurisdiction approved Statement of Special Inspections (SSI) for all materials or phases of construction have been inspected prior to concealment, and in the special inspector's professional opinion and knowledge, the construction project complies with jurisdiction's approved Construction Documents.

Geotechnical Engineer of Record (GER). The RDP retained by the Owner to design or specify earthwork and foundations in accordance with the USBC, and whose seal and signature appear on the jurisdiction approved geotechnical report.

Inspection. The continuous or periodic observation of work and the performance of tests for certain building or structural components to establish conformance with jurisdiction approved documents as required by the USBC and the IBC.

Inspection certificate. See IBC 1702.1

Inspection and testing agency. An established and recognized agency or agencies, meeting the requirements of ASTM E 329 and accredited, retained by the Owner, independent of the contractors performing the work subject to special inspections, to perform special inspections and materials testing required by the USBC and the IBC. See IBC-1702.1 Approved agency.

Owner. See USBC-202.

Pre-engineered structural elements. Structural elements specified by the SER but which may be designed by a specialty RDP. (Examples are items such as open web steel joists and joist girders; wood trusses; combination wood, metal and plywood joists; pre-cast concrete elements; prefabricated wood or metal buildings; tilt-up concrete panel reinforcement and lifting hardware.)

Primary Structural System. The combination of elements which serve to laterally brace and support the weight of the building's structural shell, the applicable live loads based upon use and occupancy, wind, snow, ice, thermal and seismic environmental loads.

Registered Design Professional (RDP). See USBC-202

Primary Registered Design Professional of Record. The leader of the design team charged with the preparation of construction documents, either an architect or engineer. The Primary Registered Design Professional of Record is responsible for determining and interpreting the needs of the client and for coordinating the work of the other members of the design team.

Special Inspection, Continuous and Periodic. See IBC-1702.1

Sprayed Fire-Resistant Materials. See IBC-1702.1

Structural Observation. See IBC-1702.1

Shall. This term indicates mandatory requirements.

Special Inspector (SI). The SI is the RDP who is directly responsible for special inspections, materials testing and related services as described in the approved SSI. The SI shall be retained by the Owner, independent of the contractors performing the work subject to special inspection. The SI must be approved by the Building Official. The SI shall be listed as Agent 1 on the SSI.

Statement of Special Inspections (SS/). The SSI is a statement prepared by an RDP and shall be approved by the appropriate RDP(s) of Record and submitted by the permit applicant. The SSI includes the scope (schedule) of the special inspection services applicable to a construction project, and the RDP's and inspection and testing agencies that will provide those services. **The SSI is required as a condition for permit issuance in accordance with IBC as amended by USBC and must be approved by the Building Official.**

Structural Engineer of Record (SER). The RDP retained by the Owner to design or specify structural documents in accordance with the USBC, and whose signature and seal appear on the jurisdiction approved structural construction documents.

Structure. See USBC-202.

3. Responsibilities

The **Building Official** is responsible for the issuance of the building permit and the Certificate of Occupancy. Prior to issuing the building permit, the Building Official will review and approve the Construction Documents, the SSI, and the qualifications of the SI and the Agents. The Building Official shall review field reports of special inspections as directed by these guidelines and procedures. The Building Official has the authority to issue a stop work order if it is found that the approved special inspectors or laboratories are not being utilized to perform required special inspections. The Certificate of Occupancy or final inspection shall be issued only after the Building Official has received and approved the Final Report of Special Inspections.

The **Contractor** is responsible for the construction of the project in accordance with the approved Construction Documents and the USBC. In addition, the Contractor is responsible for controlling the quality of construction and for providing the SI and Agents safe access to the elements that require inspection or testing. The Contractor shall coordinate construction related activities, including scheduling and timely notification of the need for Special Inspections and shall cooperate with the project's design professionals, including the SI and

Agents. The Contractor shall make the site available for inspections as necessary and shall deliver samples for testing when needed. The Contractor shall respond promptly when informed of nonconforming work. The special inspection process does not relieve the Contractor of responsibility for quality control.

The **Owner** shall be responsible for the fees and costs related to the performance of special inspection services. The Owner or their authorized agent shall sign the SSI.

The Primary **Registered Design Professional of Record (PROP of Record)** shall be responsible for informing the Owner of the need to provide for Special Inspections and for assisting the Owner as may be needed to retain the services of an SI. A Registered Design Professional (RDP) shall complete a SSI that shall include the special inspector(s) and Agent(s). The RDP shall also review and act upon conditions noted in interim special inspection reports. The RDP shall also be responsible for supplying the SI with the necessary copies of current appropriate Construction Documents and approved submittals, fabrication, and erection documents, including those revisions and change orders affecting work to be inspected or tested.

The **Special Inspector (SI)** is responsible for performing, documenting, managing and coordinating the special inspections and the efforts of the various Agents. Individual Agents may be retained by the Owner or by the SI, but they are responsible to the SI. The Agents who are responsible for conducting inspections or tests shall be identified in the SSI that is submitted to the Building Official. The SI shall provide copies of inspection reports to the RDP of Record, Owner, Contractor and Building Official. All discrepancies shall be brought to the attention of the Contractor for correction. The SI shall report deviations from the approved Construction Documents to the appropriate RDP of Record for their resolution. Uncorrected work shall be reported to the Building Official and the appropriate RDP of Record.

The **Structural Engineer of Record (SER)** shall be responsible for identifying in the Construction Documents the specific structural special inspections to be performed for the project in order to meet the requirements of the USBC and any other requirements specified by the SER.

4. When Special Inspections are Required

The USBC requires special inspections be made in accordance with the requirements of the IBC. The requirements for special inspections shall be determined prior to and are requisite for issuance of the building permit.

Special inspections are required for building components identified in the IBC when the design of these components are required to be performed by a professional engineer or architect. (See attached CHART A in Appendix B which is taken from § 54.1 - 402 of the Code of Virginia.)

Special inspections are not required:

- For work of a minor nature or as warranted by conditions in the jurisdiction as approved by the building official.
- Unless otherwise required by the building official, for occupancies in Groups R-3, R-4 or R-5 and occupancies in Group U that are accessory to a residential occupancy.

Note: Check the requirements for each component of a building or structure listed in IBC Chapter 17 to determine if the exceptions to the requirement for special inspections of that component are applicable.

5. Special Inspector / Laboratory Qualifications

Special inspections shall be performed by individuals and agents that are qualified in accordance with these procedures and are under the direct supervision of an RDP in responsible charge of special inspection

activities. The RDP shall ensure that the individuals under their charge are performing only those special inspections that are consistent with their knowledge and training for the specified inspections in accordance with ASTM E329 and the USBC that is in force at the time of permit issuance.

The USBC requires that special inspections must be conducted under the supervision of a registered design professional. This places a requirement that the individual responsible for the coordination of special inspections (Agent 1) must be a Virginia licensed engineer or architect. Individuals or firms that conduct testing and/or special inspections (and the procedures they must follow) must comply with the requirements of ASTM E329. Firms providing special inspection services (or qualifications for individual inspectors) may submit documentation demonstrating equivalency by another recognized standard to the minimum qualifications, certification and experience requirements of ASTM E329. The Building Official may approve the firm or individual after evaluating and determining that equivalency has been met.

Written documentation shall be provided to the Building Official demonstrating the applicable Agency's laboratory accreditation. Individual resumes' indicating pertinent training, certifications and/or other qualifications shall be provided for special inspection personnel associated with the project. Each local building department may prescribe the manner of qualification documentation and frequency of updating information regarding firm or individual inspector approval.

6. Pre-construction Meeting

Pre-construction meetings are to be conducted by the SI at the start of the project unless work is of a minor nature and waived by the Building Official. The meeting is to be attended by the following individuals:

- Special Inspector
- Special Inspection Agent(s)
- Contractor
- Subcontractor's representatives for each trade of work specified in the SSI

The following individuals are to be notified of the pre-construction meeting and are encouraged to attend whenever possible:

- Owner
- RDP(s) of Record for each scope of work specified in the SSI
- Building Official (or his/her designee)

The meeting should provide a forum to review and explain the following:

- Work to be reviewed as specified in the SSI.
- Inspections performed by the Building Official.
- Timely notification required by the Contractor to the SI of when the work is ready for inspections during the course of the work.
- Procedures to document, correct, re-inspect, and complete items found to be non compliant or deficient.
- Identification of the RDP designated to resolve field deviations and non-compliant items if different from the RDPs responsible for preparing the construction documents.
- Contact information of individuals involved with the project.
- Discussion of the inspections and testing to be performed.
- Proper submission and distribution of reports and supplemental information.
- Discussion of coordination of all work to be performed in accordance with the Contract Documents and that no changes shall be permitted unless authorized and approved in writing by the RDP of Record for the work in question.

A report shall be prepared by the SI indicating that the pre-construction meeting was conducted. The report shall indicate the date and location of the meeting, who attended and a brief description of the items discussed. A copy of the report shall be distributed as required in Section 7.

7. Reports of Special Inspections

The SI shall provide copies of inspection reports to the SER, Owner, Contractor, and Building Official. The SI shall report deviations from the approved Construction Documents to the appropriate RDP for their resolution before proceeding with the inspection of the deficient work. All inspection and test reports shall be submitted within seven (7) working days of the inspection or test performed. In no case shall inspections be performed by the Building Official that would allow the concealment of work required to be inspected by the special inspector unless verification has been received that the special inspection has been successfully performed.

Special inspection and testing reports shall indicate that the specified work has been inspected and found to be in compliance with the approved construction documents unless deficiencies are noted. Reports containing deficiencies or non compliant work shall describe the nature and specific location of the discrepancies.

At the completion of a project, all recorded non compliant work shall be documented as having been corrected or approved by the RDP(s) of Record or other RDP(s) responsible for any review and approval of deviations or changes from the approved construction documents as appropriate.

Upon request of the Building Official, the SI shall submit a letter indicating completion of a specific area or phase of special inspections and testing for a particular construction discipline.

Upon completion of all special inspections and testing specified on the SSI, the SI shall, after review and approval by the appropriate RDP(s), submit a Final Report of Special Inspections to the Building Official for review and approval. The **Building Official review and approval is required prior to final building inspection approval or issuance of Certificate of Occupancy.**

8. Completing the Statement of Special Inspection (SSI)

A complete SSI shall be provided with the application for permit. A complete SSI will contain the following:

- The Statement of Special Inspection form shall be completed to include original signatures by the parties identified on the SSI to include:
    - A Registered Design Professional (RDP) is required to complete the statement and schedule. Although not required, typically this is accomplished by an RDP associated with the project design and understanding the critical elements. This can be the Structural Engineer of Record (SER), Special Inspector (SI) or any other RDP knowledgeable of the project that can execute the form. Their name is typed/printed on the line "Type or print name of the preparer of the Schedule." The Virginia RDP seal and signature of the preparer is to be located above the printed name where indicated.
    - The applicant's signature is required if the person applying for the permit is different from the owner. This can be the owner's authorized representative, an RDP authorized by the owner or the appropriately licensed contractor that will be performing the work. The applicant provides a signature on the "Permit Applicant's Signature" line. If the applicant and owner are the same and the owner has signed on the "Owner's Authorization" line, a separate signature is not required on this line.

- The project owner's authorization is required as they are responsible for the fees and costs of the special inspector. By signing this form, they acknowledge that special inspections are required for the project and agree to notify the Building Official of any changes regarding the special inspection agents. The owner provides a signature on the "Owner's Authorization" line.

- The Primary RDP of Record for the design provides a signature on the "Primary RDP of Record" line. The Primary RDP of Record is usually the person with the most direct contact with the owner. Typically, this would be the primary design professional that coordinated the completion of the plans. By signing, the Primary RDP of Record is not taking on a responsibility for the entire special inspection process nor approval of the special inspection team. The signature is an acknowledgement that special inspections are required on the job based on the design of his/her project, has advised the owner of their responsibility to provide and pay for special inspections, and has assured that special inspections are properly called for in the schedule for areas dictated by his/her design are incorporated.

- The Structural Engineer of Record (if different from the Primary RDP of Record noted above) signs the SER line. The signature is an acknowledgement that the SER has reviewed the statement to ensure all required inspections dictated by his/her design are incorporated.

- The company name of the Special Inspector (Agent 1) is to be typed or printed on "Special Inspector" line. The RDP overseeing the implementation of special inspections for the project for the above named company will place his/her signature in the "Special Inspector (Signature)" line.

- The Building Official shall sign the form after all required original signatures have been executed, he/she is satisfied that the area(s) of special inspections have been properly identified and called for, and he/she is satisfied that the special inspection agents and testing laboratories are properly qualified and certified. The signature of the Building Official shall signify acceptance and approval of the Statement/Schedule of Special Inspections.

- The Schedule of Special Inspections shall be included with proper identification of elements requiring special inspections and the associated Agent(s} responsible for inspection and/or testing.

- Agents for special inspections shall be identified to include address, phone number and responsible party. (Agent 1, Agent 2, Laboratory, etc ...) Agent 1 shall always be the primary special inspector responsible for the coordination of the entire special inspection process.

- Proper documentation as to appropriate qualifications and certifications as discussed in Section 5.

- Changes to a special inspector or testing laboratory approved by the Building Official after a permit has been issued must be submitted in the form of a new Statement and Schedule of Special Inspections. This must be approved by the Building Official prior to resuming special inspections.

9. Referenced Documents

- The most current edition of the USBC.
- The most current edition of the IBC published by the International Code Council.
- Special Inspections: Implementation in Albemarle County; Revised August, 2018.
- National Practice Guidelines for Special Inspections by CASE (Council of American Structural Engineers).
- ASTM E-329.

10. Revisions to this document (including Statement of Special Inspections)

This document is endorsed by Albemarle County Building Inspections Department. Revisions will be made from time to time by this department. Any unauthorized revision may cause the document not to be accepted by this jurisdiction.

Appendix A

ALBEMARLE COUNTY STATEMENT OF SPECIAL INSPECTIONS

PROJECT
NEW CONSTRUCTION HIGH SCHOOL CENTER II

PERMIT APPLICANT

PRIMARY RDP OF RECORD

STRUCTURAL ENGINEER OF RECORD
DUNBAR PLLC (JEFFREY S. DAVIS)
1025 BOULDERS PARKWAY SUITE 310
NORTH CHESTERFIELD, VA 23225

This Statement of Special Inspections is submitted as a condition for permit issuance in accordance with the International Building Code (IBC) as stated in the Virginia Uniform Statewide Building Code (USBC). It includes a Schedule of Special Inspections applicable to this project as well as the name of the Special Inspector, and the identity of other testing laboratories or agencies intended to be retained for conducting these inspections or tests.

The Special Inspector shall keep records of all inspections, and shall furnish inspection reports to the Building Official, appropriate RDP(s), Owner and Contractor. All discrepancies shall be brought to the immediate attention of the Contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the Building Official and appropriate registered design professional(s). Interim reports shall be submitted to the Building Official, Owner, Contractor and the appropriate RDP(s) according to the *Albemarle County Special Inspection Guidelines and Procedures.*

Jobsite safety is solely the responsibility of the contractor. Materials and activities to be Inspected are not to include the contractor's equipment and methods used to erect or install the materials listed. **All fees/costs related to the performance of Special Inspections shall be the responsibility of the Owner. Additionally, the undersigned (RDP or SER) are only acknowledging that the items enumerated on the Schedule of Special Inspections are consistent with the required design elements, the applicable sections of the Uniform Statewide Building Code and their area of expertise.**

REVIEW, AUTHORIZATION & ACCEPTANCE

Permit Applicant *(If not Owner):*

Signature / Date: _____

Printed Name _____

Owner's Authorization *(If other than Applicant):*

Signature / Date: _____

Printed Name _____

Primary RDP of Record:
(Review and Acceptance of Schedule)

Signature / Date: _____

Printed Name _____

SER of Record:
(Review and Acceptance of Schedule)

Signature / Date: 8/19/2024

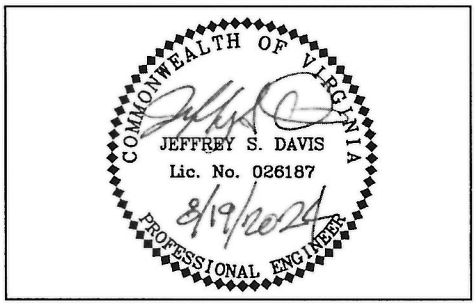
Printed Name JEFFREY S. DAVIS, PE

Building Official's Acceptance:

Signature / Date: _____

Printed Name _____

SCHEDULE OF SI PREPARED BY:



Virginia RDP Seal of SI Preparer

JEFFREY S. DAVIS, PE
Printed Name of the Preparer of the Schedule

Special Inspector:

Signature/Date: _____

Printed Name: _____

SI Company Name: _____

SCHEDULE OF SPECIAL INSPECTIONS

MATERIAL ACTIVITY	TYPE OF INSPECTION	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT/REFERENCE	AGENT	COMPLETED
GENERAL					
Pre-Construction conference	Meeting with parties listed in Section 6 of HRRSIGP to discuss Special Inspection procedures	Y	Scheduled by SI with the Contractor prior to commencement of work	1 TYP	
EARTHWORK					
Site Preparation (building)	Field testing and inspection	Y	Field Review, IBC 1705.6 / Chapter 17		
Fill Placement (building)	Review submittals, field testing and inspection	Y	Field Review, IBC 1705.6 / Chapter 17		
Fill Compaction (building)	In-place density tests	Y	Field Review, IBC 1705.6 / Chapter 17		
Foundation Sub-Grade	Field inspection of foundation subgrade prior to placement of concrete	Y	Field Review, IBC 1705.6 / Chapter 17		
PILE FOUNDATIONS					
Test Piles	Monitor driving of test piles	N	IBC 1704.8 / Chapter 17		
Pile Installation	Monitor driving of piles, including cut off & tip elevation	N	IBC 1704.8 / Chapter 17		
Pile Load Test	Monitor pile load test	N	IBC 1704.8 / Chapter 17		
Pile Survey	Review as-driven survey	N	IBC 1704.8 / Chapter 17		
CONCRETE					
Materials	Review product supplied versus certificates of compliance and mix design	Y	Chapter 17, ACI 318, Chapter 19		
Reinforcing Steel	Field inspection of placement	Y	Chapter 17, ACI 318, Chapter 19		
Formwork Installation	Field inspection	Y	Chapter 17, ACI 318, Chapter 19		
Concreting Operations & Placement	Field inspection of placement	Y	Chapter 17, ACI 318, Chapter 19		
Concrete Curing	Field inspection of curing process	Y	Chapter 17, ACI 318, Chapter 19		
Concrete Strength	Evaluation of concrete strength	Y	Chapter 17, ACI 318, Chapter 19		

SCHEDULE OF SPECIAL INSPECTIONS

MATERIAL ACTIVITY	TYPE OF INSPECTION	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT/REFERENCE	AGENT	COMPLETED
PRECAST CONCRETE					
Quality Control	In-plant review **	N	Chapter 17 ACI 318		
Erection and installation	Field inspection of in-place precast	N	Chapter 17 ACI 318		
MASONRY					
Materials	Review of products supplied versus certificate of compliance and material submitted	Y	Chapter 17 ACI 530		
Strength	Testing / review of strength	Y	Chapter 17 ACI 530		
Mortar and Grout	Inspection of proportioning and mixing	Y	Chapter 17 ACI 530		
Reinforcement	Inspect condition, size, location, and spacing	Y	Chapter 17 ACI 530		
Protection	Inspect procedures for protection during cold and hot weather	Y	Chapter 17 ACI 530		
Anchorage	Inspection of anchorages	Y	Chapter 17 ACI 530		
Masonry operations & installations	Inspection of application and installation	Y	Chapter 17 ACI 530		
STRUCTURAL STEEL					
Quality Control	In-plant inspection of quality control procedures**	Y	Chapter 17 AISC LRFD ASTM AWS		
Bolts, nuts, and washers - materials	Material identification markings. Review of certificate of compliance	Y	Chapter 17 AISC LRFD ASTM AWS		
Bolts, nuts, and washers - installation	Inspection of in-place high-strength bolts, bearing type and slip critical connections	Y	Chapter 17 AISC LRFD ASTM AWS		
Structural steel - materials	Material identification markings and review of certificate of compliance	Y	Chapter 17 AISC LRFD ASTM AWS		
Structural steel - insulation	Inspection of member locations, structural details for bracing, connections, stiffening	Y	Chapter 17 AISC LRFD ASTM AWS		
Weld filler materials & welder certification	Review of identification markings, certificate of compliance, and welder certifications	Y	Chapter 17 AISC LRFD ASTM AWS		
Welds	Inspection and testing of welds	Y	Chapter 17 AISC LRFD ASTM AWS		
Structural details	Inspection of Structural details	Y	Chapter 17 AISC LRFD ASTM AWS		
WOOD					
Verify fabrication / quality control procedures	Review submittal and installation	N	Chapter 17		
High Load Diaphragms - Installation	Inspection of sheathing, framing size, nail and staple diameter and length, number of fastener lines and fastener spacing	N	Chapter 17		

*The qualifications of the Special Inspector and Testing Laboratories are subject to the approval of the Building Official

**Inspection of quality control procedures required only if fabricator is not regularly inspected by and independent inspection agency.

SCHEDULE OF SPECIAL INSPECTIONS

MATERIAL ACTIVITY	TYPE OF INSPECTION	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT/REFERENCE	AGENT	COMPLETED
SPRAYED CEMENTITIOUS AND MINERAL FIBER FIRE RESISTIVE MATERIALS					
Structural member surface conditions	Field review of surface conditions prior to application	N	Chapter 17		
Application	Field review of application operations	N	Chapter 17		
Thickness	Field review of applied thickness	N	Chapter 17		
EXTERIOR INSULATION AND FINISH SYSTEMS					
Application	Field review of application / installation	N	Chapter 17		
SPECIAL CASES					
Alternative materials and systems	As requested by Building Official, review system and installation	N	Chapter 17		
WIND AND SEISMIC QUALITY ASSURANCE PLANS					
Wind and/or seismic requirements	Review of the quality assurance plan and performance of the special inspections required	Y	Chapter 17		
SMOKE CONTROL					
Special inspection of smoke control systems	Leakage testing and recording of device location. Pressure difference testing, detection, and control verification	N	Chapter 17		

*The qualifications of the Special Inspector and Testing Laboratories are subject to the approval of the Building Official

**Inspection of quality control procedures required only if fabricator is not regularly inspected by and independent inspection agency.

INSPECTION AGENTS	*FIRM*	*ADDRESS*	*TELEPHONE #*
1. Special Inspector Agent 1			
2. Special Inspector			
3. Special Inspector			
4. Special Inspector			
5. Testing Laboratory			
6. Testing Laboratory			

FINAL REPORT OF SPECIAL INSPECTIONS

PROJECT

_____
_____
_____
_____

PERMIT APPLICANT

_____
_____
_____
_____

PRIMARY RDP OF RECORD

_____
_____
_____
_____

STRUCTURAL ENGINEER OF RECORD

_____
_____
_____
_____

To the best of my information, knowledge, and belief, the special inspections required for this project, and itemized in the statement of special inspections submitted for permit, have been completed.

The following discrepancies that were outstanding since the last interim report dated_____, have been corrected:

_____
_____
_____
_____.

Interim reports submitted prior to this final report, and numbered _____ to _____, form a basis for, and are to be considered an integral part of this final report.

Respectfully submitted,

_____
Signature

_____
Date

_____
Type of Print Name **(Agent 1)**

Upon completion of all special inspections and testing, the SI shall submit a Final Report of Special Inspections to the Building Official for review and approval. The Building Official review and approval is required to final building inspection approval or issuance of a Certificate of Occupancy.

Appendix B

A/E SEAL ON DRAWINGS

The purpose of these charts and notes is for quick reference to determine in accordance with § 54.1 - 402 of the Code of Virginia if an architect's or engineer's (A/E) seal is required on documents for proposed construction.

CHART A – GENERAL DESIGN

A proposed structure which is classified within any of the categories marked "Yes" requires an A/E seal on the documents. Separate requirements apply as to when the electrical, plumbing or mechanical systems in such structures require an A/E seal (see Charts B and C).

GROUP	BRIEF DESCRIPTION	AREA (SQ FT.)			HEIGHT (STORIES)	
		5,000 OR LESS	5,001 TO 15,000	OVER 15,000	3 OR LESS	OVER 3
A[1]	ASSEMBLY	YES	YES	YES	YES	YES
B	BUSINESS	-	YES	YES	-	YES
E	SCHOOLS & DAY CARE CENTERS	YES	YES	YES	YES	YES
F	FACTORY & INDUSTRIAL	-	-	YES	-	YES
H	HIGH HAZARD	YES	YES	YES	YES	YES
I	INSTITUTIONAL	YES	YES	YES	YES	YES
M	MERCANTILE	-	YES	YES	-	YES
R-1	HOTEL, MOTEL & DORMITORY	YES	YES	YES	YES	YES
R-2[7]	MULTI-FAMILY RESIDENTIAL	-	-	YES	-	YES
R-3	2 FAMILY ATTACHED	-	-	YES	-	YES
R-4	RESIDENTIAL ASSISTED LIVING	-	-	YES	-	YES
R-5	1 AND 2 FAMILY DWELLINGS	-	-	YES	-	YES
S	STORAGE (NON-FARM)	-	-	YES	-	YES
U	UTILITY & MISCELLANEOUS	-	-	YES	-	YES
ALL	INTERIOR DESIGN	SEE	NOTE	#4		

I. Churches are exempt if building does not exceed 5,000 square feet or three stories, and the occupant load does not exceed 100.

2. A local building code official may require an A/E seal even if not required to do so by this chart.

3. The law requires that, where an A/E seal is not present, the plans must have the name of the individual (not company) responsible for the design, including the individual's occupation and address.

4. Additions, remodeling or interior design defined under § 54.1-400 of the Code of Virginia might not require an *A/E* seal. For construction, additions or remodeling resulting In a change in occupancy, occupancy load, modification to the structural system, change in access or egress or an increase in the fire hazard an A/E seal is required in accordance with § 54.1-400, although notes 1 and 2 still apply.

5. Any unique design of structural elements for floors, walls, roofs or foundations requires an A/E seal, regardless of whether or not the remainder of the plans require such certification.

6. Buildings, structures, or electrical and mechanical installations which are not otherwise exempted but which are of standard design, provided they bear the certification of a professional engineer or architect registered or licensed In another state, and provided that the design is adapted for the specific location and conformity with local codes, ordinances and regulations, and is so certified by a professional engineer or architect licensed in Virginia may not require an A/E seal.

7. One exit and three stories or less Group R-2 buildings would normally be exempted from an A/E seal except where required by Note 2. Most all other three stories or less Group R-2 multi-family buildings are required by the building officials to have A/E seals for the construction documents.

Formation Thermal Conductivity
Test & Data Analysis

For Review

07/01/2024 9:15:54 AM

Test location **Albemarle High School**
Charlottesville, VA

Test Date June 17-19, 2024

Analysis For Connelly & Associates, Inc.
1513 Tilco Drive
Frederick, MD 21704
Phone: (301) 696-8820

Test Performed By Connelly & Associates, Inc.

WESTERN OFFICE
PO Box 256, Elkton, SD 57026
P: 866-991-4784 F: 605-542-3941

EASTERN OFFICE
6 William Warren Dr, Asheville, NC 28806
P: 828-275-7113

EXECUTIVE SUMMARY

A formation thermal conductivity test was performed on the geothermal test bore at Albemarle High School at 2775 Hydraulic Road in Charlottesville, Virginia. The vertical bore was completed on June 11, 2024 by Connelly & Associates, Inc. Geothermal Resource Technologies' (GRTI) test unit was attached to the vertical bore on the morning of June 17, 2024.

This report provides an overview of the test procedures and analysis process, along with plots of the loop temperature and input heat rate data. The collected data was analyzed using the "line source" method and the following average formation thermal conductivity was determined.

Formation Thermal Conductivity = 1.97 Btu/hr-ft-°F

Due to the necessity of a thermal diffusivity value in the design calculation process, an estimate of the average thermal diffusivity was made for the encountered formation.

Formation Thermal Diffusivity ≈ 1.31 ft^2/day

The undisturbed formation temperature for the tested bore was established from the initial loop temperature data collected at startup.

Undisturbed Formation Temperature ≈ 59.6-61.4°F

The formation thermal properties determined by this test do not directly translate into a loop length requirement (i.e. feet of bore per ton). These parameters, along with many others, are inputs to commercially available loop-field design software to determine the required loop length. Additional questions concerning the use of these results are discussed in the frequently asked question (FAQ) section at www.grti.com.

Test Procedures

The American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE) has published recommended procedures for performing formation thermal conductivity tests in the ASHRAE HVAC Applications Handbook, Geothermal Energy Chapter. The International Ground Source Heat Pump Association (IGSHPA) also lists test procedures in their Design and Installation Standards. GRTI's test procedures meet or exceed those recommended by ASHRAE and IGSHPA, with the specific procedures described below:

Grouting Procedure for Test Loops – To ensure against bridging and voids, it is recommended that the bore annulus is uniformly grouted from the bottom to the top via tremie pipe.

Time Between Loop Installation and Testing – A minimum delay of five days between loop installation and test startup is recommended for bores that are air drilled, and a minimum waiting period of two days for mud rotary drilling.

Undisturbed Formation Temperature Measurement – The undisturbed formation temperature should be determined by recording the loop temperature as the water returns from the u-bend at test startup.

Required Test Duration – A minimum test duration of 36 hours is recommended, with a preference toward 48 hours**.**

Data Acquisition Frequency - Test data is recorded at five minute intervals.

Equipment Calibration/Accuracy – Transducers and datalogger are calibrated per manufacturer recommendations. Manufacturer stated accuracy of power transducers is less than ±2%. Temperature sensor accuracy is periodically checked via ice water bath.

Power Quality – The standard deviation of the power should be less than or equal to 1.5% of the average power, with maximum power variation of less than or equal to 10% of the average power.

Input Heat Rate – The heat flux rate should be 51 Btu/hr (15 W) to 85 Btu/hr (25 W) per foot of installed bore depth to best simulate the expected peak loads on the u-bend.

Insulation – GRTI's equipment has 1 inch of foam insulation on the FTC unit and 1/2 inch of insulation on the hose kit connection. An additional 2 inches of insulation is provided for both the FTC unit and loop connections by insulating blankets.

Retesting in the Event of Failure – In the event that a test fails prematurely, a retest may not be performed until the bore temperature is within 0.5°F of the original undisturbed formation temperature or until a period of 14 days has elapsed.

Data Analysis

Geothermal Resource Technologies, Inc. (GRTI) uses the "line source" method of data analysis to determine the thermal conductivity of the formation. The line source method assumes an infinitely thin line source of heat in a continuous medium. A plot of the late-time temperature rise of the line source temperature versus the natural log of elapsed time will follow a linear trend. The linear slope is inversely proportional to the thermal conductivity of the medium. When a u-bend grouted in a borehole is used to inject heat into the ground at a constant rate in order to determine the average formation thermal conductivity, the test must be run long enough to allow the finite dimensions of the u-bend pipes and the grout to become insignificant. Experience has shown that approximately ten hours is required to allow the error of early test times and the effects of finite borehole dimensions to become insignificant.

In order to analyze real data from a formation thermal conductivity test, the average temperature of the water entering and exiting the u-bend heat exchanger is plotted versus the natural log of elapsed testing time. Using the Method of Least Squares, linear coefficients are then calculated to produce a line that fits the data. This procedure is repeated for various time intervals to ensure that variations in the power or other effects are not producing inaccurate results.

The calculated results are based on test bore information submitted by the driller/testing agency. GRTI is not responsible for inaccuracies in the results due to erroneous bore information. All data analysis is performed by personnel that have an engineering degree from an accredited university with a background in heat transfer and experience with line source theory. The test results apply specifically to the tested bore. Additional bores at the site may have significantly different results depending upon variations in geology and hydrology.

Through the analysis process, the collected raw data is converted to spreadsheet format (Microsoft Excel®) for final analysis. If desired, please contact GRTI and a copy of the data will be made available in either a hard copy or electronic format.

Contact: Chad Martin
Regional Managing Engineer
Asheville, NC
(828) 275-7133
cmartin@grti.com

Test Bore Details
(As Provided By Connelly & Associates, Inc.)

Site Name	Albemarle High School
Location	Charlottesville, VA
Driller	Connelly & Associates, Inc.
Installed Date	June 11, 2024
Borehole Diameter	10 inches
U-Bend Size	1-1/4 inch DR9 HDPE
Casing	Permanent 6 inch steel casing from 0-40 ft
U-Bend Depth Below Grade	500 ft
Grout Type	GeoPro TG Lite/PowerTEC
Grout Mixture	100 lb TG Lite, 32 lb PowerTEC, 30 gal water
Grouted Portion	Entire bore

Drill Log

Formation Description	Depth (ft)
Asphalt with gravel stone base	0'-1'
Silt: brown sand w/trace clay	1'-35'
Weathered rock	35'-40'
Bedrock: White, brown (Lynchburg Group, metagraywacke schist conglomerate); hard - med hard	40'-500'

Note: Approx. 3 gpm water encountered at 60 ft.

THERMAL CONDUCTIVITY TEST DATA

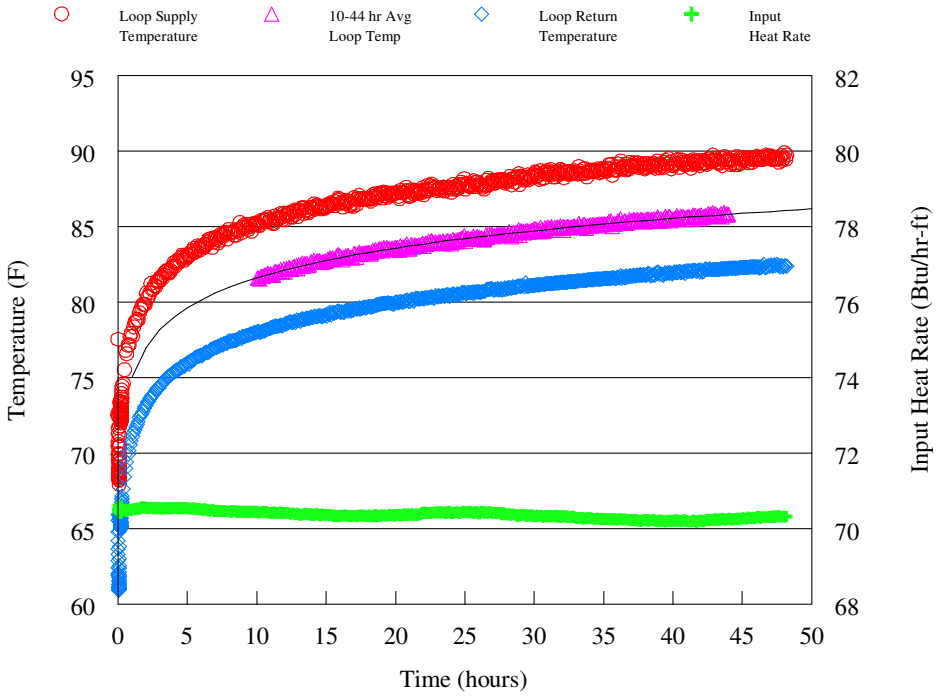


FIG. 1: TEMPERATURE & HEAT RATE DATA VS TIME

Figure 1 above shows the loop temperature and heat input rate data versus the elapsed time of the test. The temperature of the fluid supplied to and returning from the U-bend are plotted on the left axis, while the amount of heat supplied to the fluid is plotted on the right axis on a per foot of bore basis. In the test statistics below, calculations on the power data were performed over the analysis time period listed in the Line Source Data Analysis section.

SUMMARY TEST STATISTICS

Test Date	June 17-19, 2024
Undisturbed Formation Temperature	Approx. 59.6-61.4°F
Duration	48.2 hr
Average Voltage	239.8 V
Average Heat Input Rate	35,166 Btu/hr (10,303 W)
Avg Heat Input Rate per Foot of Bore	70.3 Btu/hr-ft (20.6 W/ft)
Circulator Flow Rate	9.7 gpm
Standard Deviation of Power	0.11%
Maximum Variation in Power	0.21%

LINE SOURCE DATA ANALYSIS

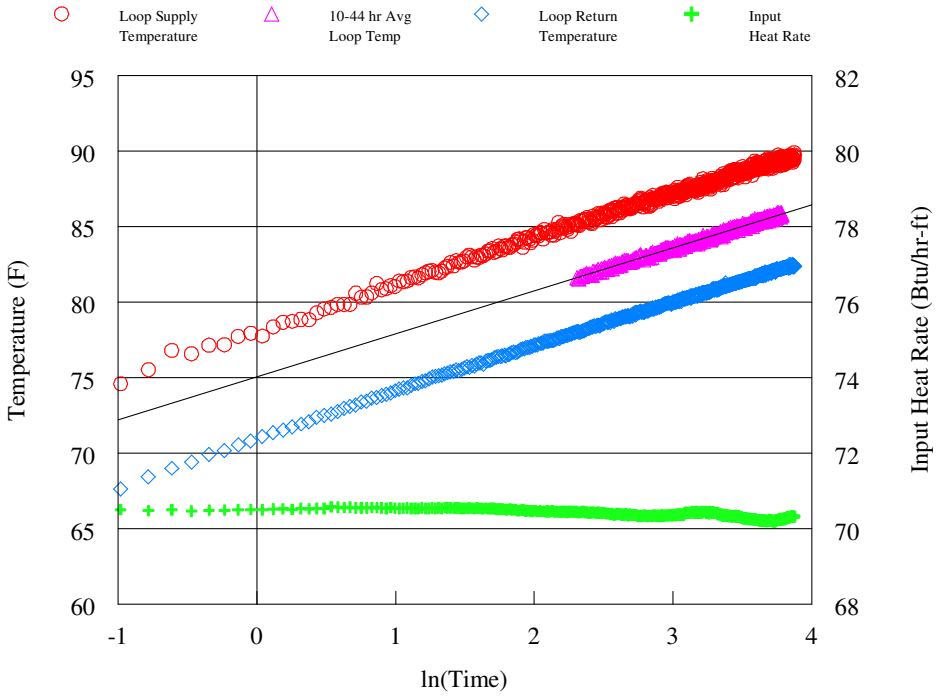


FIG. 2: TEMPERATURE & HEAT RATE VS NATURAL LOG OF TIME

The loop temperature and input heat rate data versus the natural log of elapsed time are shown above in Figure 2. The temperature versus time data was analyzed using the line source method (see page 3) in conformity with ASHRAE and IGSHPA guidelines. A linear curve fit was applied to the average of the supply and return loop temperature data between 10 and 44.0 hr. The slope of the curve fit was found to be 2.85. The resulting thermal conductivity was found to be **1.97 Btu/hr-ft-°F**.

Thermal Diffusivity

The reported drilling log for this test borehole indicated that the formation consisted of asphalt, gravel base, silt, sand, clay, weathered rock, and metagraywacke/schist/conglomerate bedrock. A weighted average of heat capacity values based on the indicated formation was used to determine an average heat capacity of 35.9 Btu/ft^3-°F for the formation. A diffusivity value was then found using the calculated formation thermal conductivity and the estimated heat capacity. The thermal diffusivity for this formation was estimated to be **1.31 ft^2/day**.

CERTIFICATE OF CALIBRATION

GRTI maintains calibration of the datalogger, current transducer and voltage transducer on a regular schedule. The components are calibrated by the manufacturer using recognized national or international measurement standards such as those maintained by the National Institute of Standards and Technology (NIST).

FTC Unit 212

DA Unit 55

PRIMARY EQUIPMENT	
COMPONENT	CALIBRATION DATE
Datalogger	3/6/2024
Current Transducer	3/18/2024
Voltage Transducer	3/18/2024

GRTI periodically verifies the combined temperature sensor/datalogger accuracy via an ice water bath. Temperature readings are simultaneously taken with a digital thermometer that has been calibrated using instruments traceable to NIST.

DATE	5/17/2024			
THERMOCOUPLE 1 (°F)	66.3 66.4 66.4			
THERMOCOUPLE 2 (°F)	66.3 66.4 66.4			
THERMOCOUPLE 3 (°F)	66.3 66.4 66.4			
THERMOCOUPLE 4 (°F)	66.3 66.4 66.4			
DIGITAL THERMOMETER (°F)	66.4 66.5 66.5			

WESTERN OFFICE
PO Box 256, Elkton, SD 57026
P: 866-991-4784 F: 605-542-3941

EASTERN OFFICE
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P: 828-275-7113

#1

Form GW-2
Revised 8/19/2016
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COMMONWEALTH OF VIRGINIA
UNIFORM WATER WELL COMPLETION REPORT

DEQ Well # _____
USGS Local # _____
VDH HDIN # 101-24-0194
VDH PWSID # _____

*Indicates required field or section
**Indicates required field or section, if applicable

1. Contact Information*

Contact:	Name	Address	Phone
Owner	County of Albemarle School	401 McIntire Rd. Charlottesville, Va.	
Driller	Connelly & Assoc. Inc.	1513 Tilco Dr. Frederick, Md. 21704	301.696.8820
System Provider	Stephen DeLosh	1513 Tilco Dr. Frederick, Md. 21704	301.696.8820

2. Well Location*

Physical Address: 2775 Hydraulic Rd. | County/City: Albemarle/Charlottesville
Subdivision Name: Jack Toulett / Greer Section: | Block: | Lot: 078A0
Tax Map/GPIN #: 60-78A
Latitude: 38.073989 N | Longitude: 78.499356 W
Datum Source | Horizontal: ☐ WGS84 ☐ NAD83 ☐ NAD27
Lat/Long Source (Check One): ☐ Map ☒ GPS ☐ PPDGPS ☐ Survey ☐ Imagery ☐ WAAS
Location Information Collected By: Hand Held GPS
Physical Location Description: Albemarle High School

3. Facility & Use*

Type of Facility (Check One):	Type of Use (Check All That Apply):		
☒ Private	☐ Drinking/Domestic Use	☐ Agricultural	☐ Food Processing
☐ Waterworks	☐ Manufacturing	☐ Irrigation	☐ Injection
☐ Observation/Monitoring Well	☒ Geothermal (Cooling/Heating) ☒ Closed ☐ Open: ☐ Returned to Surface ☐ Returned to Aquifer	☐ Fire Safety	

4. Well Construction*

Well designation, Name or Number: 101-24-0194 - Albemarle High School
Date Started: 6-6-2024 | Date Completed: 6/11/2024 | Type Rig: Schramm 450
Class Well (Check One): ☐ I ☐ IIA ☐ IIB ☐ IIIA ☐ IIIB ☐ IIIC ☐ IIID ☐ IIIE ☒ IV
Construction Type (Check One): ☒ New ☐ Existing-Modified: ☒ Well ☐ Pump: Date _____
Well Depth: 500 ft. | Total Hole (borehole) Depth: 500 ft. | Depth to Bedrock: 40 ft.
Hole Size (Include reamed zones): 10 inches from 0 to 40 ft. | Inches from to ft.
Height of Casing above Land Surface: 0 ft. 0 inches

Casing Size (I.D.) and Materials: (below)	Total Depth of Casing: 40 ft.		
6 inches from 0 to 40 ft. ☐ infilled	Material Steel	Weight per ft.	or wall thickness .188 in.
inches from to ft. ☐ infilled	Material	Weight per ft.	or wall thickness in.
inches from to ft. ☐ infilled	Material	Weight per ft.	or wall thickness in.

Screen Size & Mesh:		
inches from to ft. ☐ infilled	Mesh Size	Type
inches from to ft. ☐ infilled	Mesh Size	Type
inches from to ft. ☐ infilled	Mesh Size	Type
Water Zones: from 60 to 60 ft.	from to ft.	from to ft.

Gravel Pack:

Size: Type:	from to ft.	Size: Type:	from to ft.

Grout Type:		Grouting Method:	Type of Seal:
☒ Bentonite Slurry ☐ Neat Cement ☐ Bentonite pellets/chips ☐ Concrete ☐ Neat Cement (6% bentonite)	from 0 to 500 ft.	☐ Poured from surface ☒ Poured through tremmie pipe ☒ Pumped from bottom upward	☐ pitless adapter ☐ sanitary seal
	from to ft.		

Camera Survey: ☐ Yes ☒ No | Date Conducted:
Additional Well Construction Form Information Attached: ☒ Yes ☐ No

COMMONWEALTH OF VIRGINIA
UNIFORM WATER WELL COMPLETION REPORT

DEQ Well # _____
USGS Local # _____
VDH HDIN # 101-24-0194
VDH PWSID # _____

Well designation, Name or Number*: Albemarle High School

5. Disinfection

Well Disinfected: ☒ Yes ☐ No	Date: 6/7/2024

6. Abandonment (*When abandoning the well, Sections 1 thru 4 must be completed and/or attach original GW-2)

Date Started:	Date Completed:
Static Water Level (unpumped level measured):	ft.
Casing Size (I.D.) and Materials:	Casing Pulled: ☐ Yes ☐ No ☐ Uncased Well
Depth of Fill:	Type and Source of Fill:
Grout: From to Type:	From to Type:
Method of permanently marking location:	

7. Pump Test**

Static Water Level (unpumped level measured):	ft.
Date:	Method (Check One): ☐ Water Tape ☐ Airline ☐ Transducer ☐ Other
Stabilized measured pumping water level:	ft.
Date:	Method (Check One): ☐ Top of Well ☐ Top of Casing ☐ Surface Level
Test Pump Intake Depth: ft	Stabilized Yield: gpm after hours
Natural Flow: ☐ Yes ☐ No	Flow Rate gpm
Estimated Well Yield: gpm	

8. Pump Data**

Type: ☐ submersible ☐ Turbine ☐ Shallow Jet ☐ Deep Jet ☐ Other: _____	Motor HP:
Production Pump Intake Depth: ft	Rated Capacity: gpm at ft TDH

9. Geologic Information

Type Logs:	Aquifer Test Performed:
Water Quality Results Attached: Yes No	

Comments:

Formation _____ Lithology _____ Province _____ Geologic Map Used _____
Elevation _____

For Office Use

Form GW-2
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COMMONWEALTH OF VIRGINIA
UNIFORM WATER WELL COMPLETION REPORT

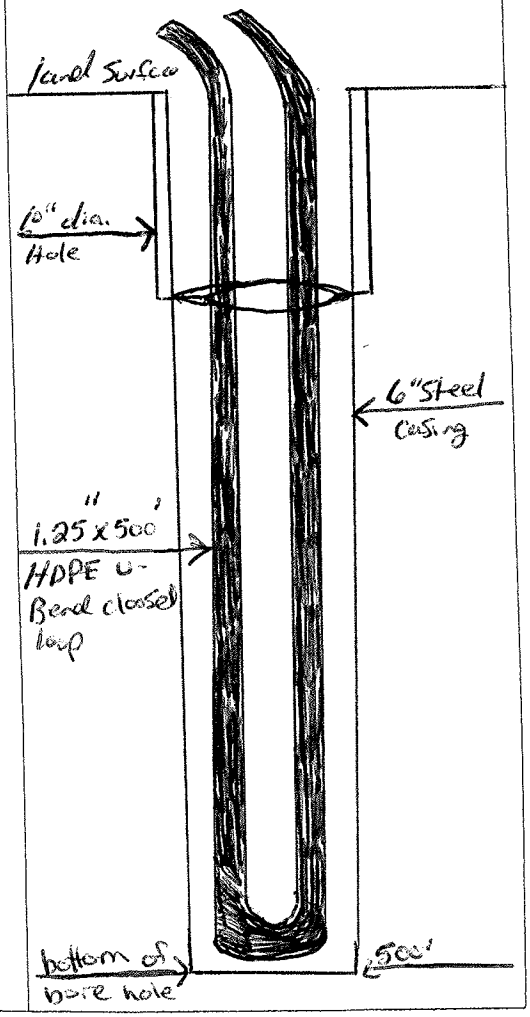
DEQ Well # _____
USGS Local # _____
VDH HDIN # 101-24-0194
VDH PWSID # _____

*Indicates required field or section
**Indicates required field or section, if applicable

10. Driller's Log (Use additional sheets if necessary)*

Well designation, Name or Number: Albemarle High School

Depth (feet) From	Depth (feet) To	Type of Rock or Soil (Color, material, fossils, hardness, etc.)	Remarks (Water, caving, cavities, etc.)	Drilling Time (Min.)	Diagram of Well Construction (with dimensions)
0	1'	Asphalt w/ stone base			
1'	35'	Silt: Brn. sand w/ tr. clay			
35'	40'	Wheath. Rock			
40'	500'	Bedrock: Brn. White Lynchburg Group Metagraywacke schist Conglomerate, hard - V. hard. Installed 1.25 x 500' HDPE U-Bend closed loop.	Enc. H_2O @ 60'		



11. Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment for knowing violations.

Signature*: Stephen DeKoch Date: 6/12/2024

License Number: 2719001126

COMMONWEALTH OF VIRGINIA
UNIFORM WATER WELL COMPLETION REPORT

DEQ Well # _____
USGS Local # _____
VDH HDIN # 101-24-0194
VDH PWSID # _____

*Indicates required field or section
**Indicates required field or section, if applicable

Additional Well Construction Data

(Use and submit only if additional space is needed)

12. Additional Well Construction Data

Well designation, Name or Number: Albemarle High School

Physical Location: 2775 Hydraulic Rd. Date Started: 6-6-24 Date Completed: 6/11/2024

Hole Size (Include reamed zones):

10 inches from 0 to 40 ft.	inches from to ft.	inches from to ft.
6 inches from 40 to 500 ft.	inches from to ft.	inches from to ft.
inches from to ft.	inches from to ft.	inches from to ft.

Casing Size (I.D.) and Materials:

6 inches from 0 to 40 ft. ☐ infilled	Material Steel	Weight per ft.	or wall thickness .188 in.
inches from to ft. ☐ infilled	Material	Weight per ft.	or wall thickness in.
inches from to ft. ☐ infilled	Material	Weight per ft.	or wall thickness in.
inches from to ft. ☐ infilled	Material	Weight per ft.	or wall thickness in.
inches from to ft. ☐ infilled	Material	Weight per ft.	or wall thickness in.
inches from to ft. ☐ infilled	Material	Weight per ft.	or wall thickness in.
inches from to ft. ☐ infilled	Material	Weight per ft.	or wall thickness in.
inches from to ft. ☐ infilled	Material	Weight per ft.	or wall thickness in.
inches from to ft. ☐ infilled	Material	Weight per ft.	or wall thickness in.
inches from to ft. ☐ infilled	Material	Weight per ft.	or wall thickness in.
inches from to ft. ☐ infilled	Material	Weight per ft.	or wall thickness in.

Screen Size & Mesh:

inches from to ft. ☐ infilled	Mesh Size	Type
inches from to ft. ☐ infilled	Mesh Size	Type
inches from to ft. ☐ infilled	Mesh Size	Type
inches from to ft. ☐ infilled	Mesh Size	Type
inches from to ft. ☐ infilled	Mesh Size	Type
inches from to ft. ☐ infilled	Mesh Size	Type
inches from to ft. ☐ infilled	Mesh Size	Type
inches from to ft. ☐ infilled	Mesh Size	Type
inches from to ft. ☐ infilled	Mesh Size	Type
inches from to ft. ☐ infilled	Mesh Size	Type
inches from to ft. ☐ infilled	Mesh Size	Type

Water Zones:

From to ft.	From to ft.	From to ft.	From to ft.
From to ft.	From to ft.	From to ft.	From to ft.
From to ft.	From to ft.	From to ft.	From to ft.
From to ft.	From to ft.	From to ft.	From to ft.

Gravel Pack:

Size: Type: From to ft.	Size: Type:	From to ft.
Size Type: From to ft.	Size: Type:	From to ft.
Size: Type: From to ft.	Size: Type:	From to ft.

Grout Type:
☐ Bentonite Slurry ☐ Neat Cement
☐ Bentonite pellets/chips ☐ Concrete
☐ Neat Cement (6% bentonite)

from to ft.
from to ft.
from to ft.

Grouting Method:
☐ Poured from surface
☐ Poured through tremmie pipe
☐ Pumped from bottom upward

#2

Form GW-2
Revised 8/19/2016
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COMMONWEALTH OF VIRGINIA
UNIFORM WATER WELL COMPLETION REPORT

DEQ Well # _____
USGS Local # _____
VDH HDIN # 101-24-0194
VDH PWSID # _____

*Indicates required field or section
**Indicates required field or section, if applicable

1. Contact Information*

Contact:	Name	Address	Phone
Owner	County of Albemarle School	401 McIntire Rd. charlottesville, VA.	
Driller*	Connelly & Assoc. Inc.	1513 Hilo Dr. Frederick, MD 21704	301-696-8820
System Provider	Stephen Delosh	1513 Hilo Dr. Frederick, MD 21704	301-696-8820

2. Well Location*

Physical Address: 2775 Hydraulic Rd.			County/City: Albemarle / charlottesville
Subdivision Name: Jack Jouett / Grees	Section:	Block:	Lot: 078A0
Tax Map/GPIN #: 60-78A			
Latitude: 38.073565 N		Longitude: 78.499454 W	
Datum Source	Horizontal: ☐ WGS84 ☐ NAD83 ☐ NAD27		
Lat/Long Source (Check One): ☐ Map ☒ GPS ☐ PPDGPS ☐ Survey ☐ Imagery ☐ WAAS			
Location Information Collected By: Hand held GPS			
Physical Location Description: Albemarle High School			

3. Facility & Use*

Type of Facility (Check One):	Type of Use (Check All That Apply):		
☒ Private	☐ Drinking/Domestic Use	☐ Agricultural	☐ Food Processing
☐ Waterworks	☐ Manufacturing	☐ Irrigation	☐ Injection
☐ Observation/Monitoring Well	☒ Geothermal (Cooling/Heating) ☒ Closed ☐ Open: ☐ Returned to Surface ☐ Returned to Aquifer	☐ Fire Safety	

4. Well Construction*

Well designation, Name or Number: 101-24-0194 - Albemarle High School		
Date Started: 6/8/2024	Date Completed: 6/11/2024	Type Rig: Schramm 450
Class Well (Check One): ☐ I ☐ IIA ☐ IIB ☐ IIIA ☐ IIIB ☐ IIIC ☐ IIID ☐ IIIE ☒ IV		
Construction Type (Check One): ☒ New ☐ Existing-Modified: ☒ Well ☐ Pump: Date_____		
Well Depth: 500 ft.	Total Hole (borehole) Depth: 500 ft.	Depth to Bedrock: 40 ft.
Hole Size (Include reamed zones): 10 inches from 0 to 40 ft.		Inches from to ft.
Height of Casing above Land Surface: 0 ft. 0 inches		

Casing Size (I.D.) and Materials: (below)	Total Depth of Casing: 40 ft.		
6 inches from 0 to 40 ft. ☐ infilled	Material Steel	Weight per ft.	or wall thickness .188 in.
inches from to ft. ☐ infilled	Material	Weight per ft.	or wall thickness in.
inches from to ft. ☐ infilled	Material	Weight per ft.	or wall thickness in.

Screen Size & Mesh:			
inches from to ft. ☐ infilled	Mesh Size	Type	
inches from to ft. ☐ infilled	Mesh Size	Type	
inches from to ft. ☐ infilled	Mesh Size	Type	
Water Zones: from 60 to 60 ft.	from to ft.	from to ft.	

Gravel Pack:					
Size:	Type:	from to ft.	Size:	Type:	from to ft.

Grout Type:		Grouting Method:	Type of Seal:
☒ Bentonite Slurry ☐ Neat Cement ☐ Bentonite pellets/chips ☐ Concrete ☐ Neat Cement (6% bentonite)	from 0 to 500 ft.	☐ Poured from surface ☒ Poured through tremmie pipe ☒ Pumped from bottom upward	☐ pitless adapter ☐ sanitary seal
	from to ft.		

Camera Survey: ☐ Yes ☒ No	Date Conducted:
Additional Well Construction Form Information Attached: ☒ Yes ☐ No	

COMMONWEALTH OF VIRGINIA
UNIFORM WATER WELL COMPLETION REPORT

DEQ Well # _____
USGS Local # _____
VDH HDIN # 101-24-0194
VDH PWSID # _____

Well designation, Name or Number*: Albemarle High School

5. Disinfection

Well Disinfected: ☒ Yes ☐ No	Date: 6/9/2024

6. Abandonment (*When abandoning the well, Sections 1 thru 4 must be completed and/or attach original GW-2)

Date Started:	Date Completed:
Static Water Level (unpumped level measured): ft.	
Casing Size (I.D.) and Materials:	Casing Pulled: ☐ Yes ☐ No ☐ Uncased Well
Depth of Fill:	Type and Source of Fill:
Grout: From to Type:	From to Type:
Method of permanently marking location:	

7. Pump Test**

Static Water Level (unpumped level measured): ft.	
Date:	Method (Check One): ☐ Water Tape ☐ Airline ☐ Transducer ☐ Other
Stabilized measured pumping water level: ft.	
Date:	Method (Check One): ☐ Top of Well ☐ Top of Casing ☐ Surface Level
Test Pump Intake Depth: ft	Stabilized Yield: gpm after hours
Natural Flow: ☐ Yes ☐ No	Flow Rate gpm
Estimated Well Yield: gpm	

8. Pump Data**

Type: ☐ submersible ☐ Turbine ☐ Shallow Jet ☐ Deep Jet ☐ Other: _____	Motor HP:
Production Pump Intake Depth: ft	Rated Capacity: gpm at ft TDH

9. Geologic Information

Type Logs:	Aquifer Test Performed:
Water Quality Results Attached: Yes No	

Comments:

Formation _____ Lithology _____ Province _____ Geologic Map Used _____
Elevation _____

For Office Use

Form GW-2
Revised 8/19/2016
Page 3 of 4

COMMONWEALTH OF VIRGINIA
UNIFORM WATER WELL COMPLETION REPORT

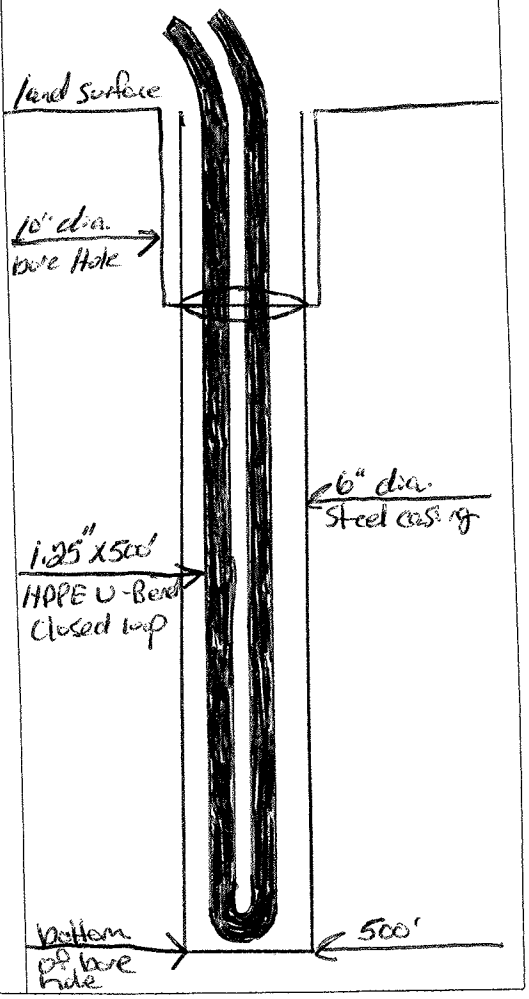
DEQ Well # _____
USGS Local # _____
VDH HDIN # 101-24-0194
VDH PWSID # _____

*Indicates required field or section
**Indicates required field or section, if applicable

10. Driller's Log (Use additional sheets if necessary)*

Well designation, Name or Number: Albemarle High School

Depth (feet) From	Depth (feet) To	Type of Rock or Soil (Color, material, fossils, hardness, etc.)	Remarks (Water, caving, cavities, etc.)	Drilling Time (Min.)	Diagram of Well Construction (with dimensions)
0'	1'	Asphalt w/ stone base			
1'	35'	Silt: Brn. Sand w/ tr. clay.			
35'	40'	Weathered rock			
40'	500'	Bed rock, Brown white Lynchburg Group metagray wacke schist conglomerate, hard - very hard.	H20 @ 60'		
		Installed 1.25 x 500' HDPE U-Bend closed loop			



11. Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment for knowing violations.

Signature*: Stephen DeRosh Date: 6/12/2024

License Number: 2719001126

Form GW-2
Revised 8/19/2016
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COMMONWEALTH OF VIRGINIA
UNIFORM WATER WELL COMPLETION REPORT

DEQ Well # _____
USGS Local # _____
VDH HDIN # 101-24-0194
VDH PWSID # _____

*Indicates required field or section
**Indicates required field or section, if applicable

Additional Well Construction Data

(Use and submit only if additional space is needed)

12. Additional Well Construction Data

Well designation, Name or Number: Albemarle High School

Physical Location: 2775 Hydraulic Rd. Date Started: 6/5/2024 Date Completed: 6/11/2024

Hole Size (Include reamed zones):

10	inches	from 0	to 40	ft.		inches	from	to	ft.	inches	from	to	ft.
6	inches	from 40	to 500	ft.		inches	from	to	ft.	inches	from	to	ft.
	inches	from	to	ft.		inches	from	to	ft.	inches	from	to	ft.

Casing Size (I.D.) and Materials:

6	inches	from 0	to 40	ft. ☐ infilled	Material Steel	Weight per ft.	or wall thickness .188	in.
	inches	from	to	ft. ☐ infilled	Material	Weight per ft.	or wall thickness	in.
	inches	from	to	ft. ☐ infilled	Material	Weight per ft.	or wall thickness	in.
	inches	from	to	ft. ☐ infilled	Material	Weight per ft.	or wall thickness	in.
	inches	from	to	ft. ☐ infilled	Material	Weight per ft.	or wall thickness	in.
	inches	from	to	ft. ☐ infilled	Material	Weight per ft.	or wall thickness	in.
	inches	from	to	ft. ☐ infilled	Material	Weight per ft.	or wall thickness	in.
	inches	from	to	ft. ☐ infilled	Material	Weight per ft.	or wall thickness	in.
	inches	from	to	ft. ☐ infilled	Material	Weight per ft.	or wall thickness	in.
	inches	from	to	ft. ☐ infilled	Material	Weight per ft.	or wall thickness	in.
	inches	from	to	ft. ☐ infilled	Material	Weight per ft.	or wall thickness	in.

Screen Size & Mesh:

	inches	from	to	ft. ☐ infilled	Mesh Size	Type
	inches	from	to	ft. ☐ infilled	Mesh Size	Type
	inches	from	to	ft. ☐ infilled	Mesh Size	Type
	inches	from	to	ft. ☐ infilled	Mesh Size	Type
	inches	from	to	ft. ☐ infilled	Mesh Size	Type
	inches	from	to	ft. ☐ infilled	Mesh Size	Type
	inches	from	to	ft. ☐ infilled	Mesh Size	Type
	inches	from	to	ft. ☐ infilled	Mesh Size	Type
	inches	from	to	ft. ☐ infilled	Mesh Size	Type
	inches	from	to	ft. ☐ infilled	Mesh Size	Type
	inches	from	to	ft. ☐ infilled	Mesh Size	Type

Water Zones:

From	to	ft.	From	to	ft.	From	to	ft.	From	to	ft.
From	to	ft.	From	to	ft.	From	to	ft.	From	to	ft.
From	to	ft.	From	to	ft.	From	to	ft.	From	to	ft.
From	to	ft.	From	to	ft.	From	to	ft.	From	to	ft.

Gravel Pack:

Size:	Type:		From	to	ft.	Size:	Type:		From	to	ft.
Size	Type:		From	to	ft.	Size:	Type:		From	to	ft.
Size:	Type:		From	to	ft.	Size:	Type:		From	to	ft.

Grout Type:
☐ Bentonite Slurry ☐ Neat Cement
☐ Bentonite pellets/chips ☐ Concrete
☐ Neat Cement (6% bentonite)

from	to	ft.
from	to	ft.
from	to	ft.

Grouting Method:
☐ Poured from surface
☐ Poured through tremmie pipe
☐ Pumped from bottom upward

HUDSON-PAYNE ELECTRONICS CORPORATION

5174 SOUTH AMHERST HWY, BOX 780,MADISON HEIGHTS,VA.24572
TELEPHONE (434)847-5583 FAX (434)847-8812 DCJS11-2167

QUOTE

DATE: **9-11-24**

FILE #: 16595

TO: Albemarle County Schools

EMAIL: **Kagan Squire <ksquire2@k12albemarle.org>**

ATT: **Kagan Squire**

PROJECT ACPS High School Center II

Hudson Payne Electronics presents the following quotation for your consideration.

This quote is based on documents received designed by Quinn Evans dated 6-21-24. We are in receipt of no specifications or addenda.

The following quote is for the security system at the new ACPS High School Center II project. The security system will include motion detectors and door contacts. The devices will be located on the 1st floor only. No security devices are included on the 2nd level.

All door contacts will be recessed mounted in the door frames. Motion detectors will be both wall and ceiling mounted.

All wiring above accessible ceilings will be ran open and supported in J Hooks. All exposed areas and mechanical rooms will be in conduit.

All conduit, stub-ups, and electric boxes will be by others.

The panel will consist of:

1 Security Fire/Burglar Panel
1 IP/Cellular Communicator
4 Keypads
18 Motion Detectors
25 Door contacts
3 Roll-up Door Contacts
Wiring, Installation, and Programming

This quote does not include:

Conduit, Electrical Boxes, Sleeves, or Caddy Hangers
Patching and Painting
Fire Caulk
Lifts
120VAC Power
Voice Evacuation
Prevailing Wages

The cost for this work will be $21,900.00.

If you have any questions, please feel free to give me a call.

Greg Yeatts
434-847-5583 office
434-660-0281 cell

LEED v4 for BD+C: Schools

Project Scorecard

Project Name: 41911390 Albemarle High School Center II
Date: 10/1/2024

Y	?	N			
1			Credit	Integrative Process	1

5	0	10	Location and Transportation		16
			Credit	LEED for Neighborhood Development Location	16
1			Credit	Sensitive Land Protection	1
		2	Credit	High Priority Site	2
2		3	Credit	Surrounding Density and Diverse Uses	5
		4	Credit	Access to Quality Transit	5
		1	Credit	Bicycle Facilities	1
1			Credit	Reduced Parking Footprint	1
1			Credit	Green Vehicles	1

3	7	2	Sustainable Sites		12
Y			Prereq	Construction Activity Pollution Prevention	Required
Y			Prereq	Environmental Site Assessment	Required
1			Credit	Site Assessment	1
		2	Credit	Site Development - Protect or Restore Habitat	2
1			Credit	Open Space	1
	3		Credit	Rainwater Management	3
	2		Credit	Heat Island Reduction	2
	1		Credit	Light Pollution Reduction	1
	1		Credit	Site Master Plan	1
1			Credit	Joint Use of Facilities	1

5	3	4	Water Efficiency		11
Y			Prereq	Outdoor Water Use Reduction	Required
Y			Prereq	Indoor Water Use Reduction	Required
Y			Prereq	Building-Level Water Metering	Required
2			Credit	Outdoor Water Use Reduction	2
2	3	2	Credit	Indoor Water Use Reduction	6
		2	Credit	Cooling Tower Water Use	2
1			Credit	Water Metering	1

16	4	13	Energy and Atmosphere		33
Y			Prereq	Fundamental Commissioning and Verification	Required
Y			Prereq	Minimum Energy Performance	Required
Y			Prereq	Building-Level Energy Metering	Required
Y			Prereq	Fundamental Refrigerant Management	Required
5	1		Credit	Enhanced Commissioning	6
5		11	Credit	Optimize Energy Performance	18
1			Credit	Advanced Energy Metering	1
		2	Credit	Demand Response	2
5			Credit	Renewable Energy Production	3
	1		Credit	Enhanced Refrigerant Management	1
	2		Credit	Green Power and Carbon Offsets	2

6	3	4	Materials and Resources		13
Y			Prereq	Storage and Collection of Recyclables	Required
Y			Prereq	Construction and Demolition Waste Management Planning	Required
1		4	Credit	Building Life-Cycle Impact Reduction	5
1	1		Credit	Building Product Disclosure and Optimization - Environmental Product Declarations	2
1	1		Credit	Building Product Disclosure and Optimization - Sourcing of Raw Materials	2
1	1		Credit	Building Product Disclosure and Optimization - Material Ingredients	2
2			Credit	Construction and Demolition Waste Management	2

12	4		Indoor Environmental Quality		16
Y			Prereq	Minimum Indoor Air Quality Performance	Required
Y			Prereq	Environmental Tobacco Smoke Control	Required
Y			Prereq	Minimum Acoustic Performance	Required
2			Credit	Enhanced Indoor Air Quality Strategies	2
2	1		Credit	Low-Emitting Materials	3
1			Credit	Construction Indoor Air Quality Management Plan	1
2			Credit	Indoor Air Quality Assessment	2
1			Credit	Thermal Comfort	1
1	1		Credit	Interior Lighting	2
2	1		Credit	Daylight	3
1			Credit	Quality Views	1
	1		Credit	Acoustic Performance	1

6	0		Innovation		6
1			Credit	Innovation: Purchasing Lamps	1
1			Credit	Innovation: Occupant Comfort Survey	1
1			Credit	Pilot: Community Contaminant Prevention - Airborne Releases	1
1			Credit	Pilot: All-Gender Restrooms	1
1			Credit	Pilot: Designing with Nature Biophilic Design	1
1			Credit	LEED Accredited Professional	1

2	1	1	Regional Priority		4
1			Credit	Regional Priority: Advanced Energy Metering	1
		1	Credit	Regional Priority: Site Development - Protect or Restore Habitat	1
1			Credit	Regional Priority: Renewable Energy Production	1
	1		Credit	Regional Priority: Building Life Cycle	1

56	22	34	TOTALS	Possible Points:	112

Certified: 40 to 49 points, **Silver:** 50 to 59 points, **Gold:** 60 to 79 points, **Platinum:** 80 to 110

Construction Phase Credit
ACPS High Priority
ACPS Low Priority

Albemarle County Public Schools

COMMISSIONING PLAN

High School Center II

PROJECT NO. 24-047

THOMPSON
Consulting Engineers
Mechanical and Electrical Engineering
22 Enterprise Parkway, Suite 200, Hampton, VA 23666

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- B - Functional Checklists
- C - Pre-Functional Checklists
- D - Startup Reports
- E - Test and Balance Report

COMMISSIONING OVERVIEW

The purpose of this Commissioning Plan is to provide a clear and concise roadmap for the implementation of the commissioning process. The systems to be commissioned are identified in the Project Specifications.

This Commissioning Plan is a living document. The basic process and procedures for commissioning this project are detailed below. As the project develops appendices will be added to organize test reports, startup technician reports, issues logs, and completed checklists. Test documentation will be added throughout the construction project. At the end of the project the resulting compilation of information will become the Final Commissioning Report.

Integrating commissioning into a fast-moving construction project can be a challenge. The points below describe how our firm performs Commissioning.

- Commissioning begins during the design stage when our Commissioning Agent (CxA) reviews the project documents and makes comments to the designers. A Commissioning Plan is prepared for inclusion in the Bid Documents.

- After the construction contract is awarded and prior to the start of system rough-in, a Kick Off Meeting is held with the construction team. This will include the Project Managers and Foremen for the General, Mechanical, Electrical, TABs, and Controls Contractors; Equipment Representatives; and the Owner.

- The General Contractor (GC) is asked to maintain the Prefunctional Checklist. This document is a part of the Commissioning Plan and has a checklist for every unit on the drawing HVAC equipment schedule. The installing trade Foreman is asked to review the Prefunctional Checklist and confirm completion by initialing each item. When the Prefunctional Checklist is complete, the GC requests a CxA site visit.

- The GC is requested to not start HVAC equipment until receiving concurrence from the Engineer, CxA and Owner. Prior to granting concurrence, the CxA will confirm the Prefunctional Checklist is complete and discuss the building conditions with the GC. The goal being to prevent permanent damage to the equipment.

- Equipment startup is required to be performed by Factory Authorized technicians and documented on standardized report forms.

- After startup, the Test and Balance Contractor (TABs) may begin his work.

- The Design Engineer and CxA will review all startup and testing, adjusting, and balancing (TABs) reports.

- When the TABs report has been submitted and approved by the Design Engineer and the control system is complete; Functional Commissioning may begin.

- Typically, Functional Commissioning occurs between Substantial and Final Completion of the Project. As such, design weather conditions may not be available when the project has achieved Substantial Completion. To address this issue, we follow the following guidelines.

    - Refrigerant based systems which reject heat to the atmosphere can be properly verified only when near design conditions are present. For these systems, second season testing is sometimes required.

    - Gas and electric heating sources and geothermal water source heat pumps can typically be verified by measuring the temperature differential across the appliance. For cases when this is not possible, second season commissioning will be performed.

    - Equipment shall not be forced to operate in the cooling or heating mode other than through the raising or lowering of coil discharge or indoor space temperature setpoints.

    - If there is insufficient time to perform the functional testing during the construction period, seasonal commissioning may have to be performed the following year.

    - When the building must be occupied prior to Functional Commissioning, the testing occurs after normal hours for the occupants.

- The Engineer shall review all as-built record drawings, control drawings, and sequences of operation. Any changes to the electrical design to accommodate a substitute piece of equipment shall be reflected in the Record Drawings.

- The CxA will review the O&M manuals and Training Agenda.

- A Final Commissioning Report will be prepared and issued by the CxA along with a recommendation on Final Acceptance after all the Issues Log items have been resolved.

DESIGN PHASE

During the design phase, the CxA performs the following activities:

- Review and Modify Project Specifications
- Develop Initial Commissioning Plan
- Attend Pre-Bid Meeting (if requested)

Review and Modify Project Specifications

There are specific commissioning requirements located throughout the project specifications. During design, the CxA will review the specifications and suggest changes to the Design Engineer.

The specifications include the format in which contractor submittals will be presented, pressure testing of piping and duct systems, startup requirements, training requirements, system manual requirements, and so on.

The CxA will include the quality related items from the specifications in the commissioning checklists.

Develop Initial Commissioning Plan

The initial commissioning plan is similar to many other projects. It is intended to clarify individual roles and responsibilities relative to the commissioning process, identify the systems to be commissioned, and include a few typical commissioning checklists.

The commissioning plan will be distributed as a part of the project specifications.

Attend Pre-Bid Meeting

A representative of Thompson Consulting Engineering will attend the Pre-Bid Meeting, if requested.

CONSTRUCTION PHASE

During construction phase, the CxA tasks include:

- Attend the Pre-Construction Meeting (if requested).
- Conduct the Commissioning Kickoff Meeting.
- Back check Prefunctional Checklists maintained by the Installing Contractors.
- Monitor system startup
- Maintain and distribute the Issues Log.
- Conduct Functional Testing.
- Review the Owner Training Agenda.
- Review the Operation and Maintenance (O&M) manual.

Pre-Construction Meeting

Once the contractor is selected, the commissioning authority will attend and participate in the pre-construction meeting if requested. The role of CxA during the meeting will be to review and discuss the commissioning and the communication protocols the project team has developed.

Commissioning Kickoff Meeting

Prior to the start of Pre-Functional testing, the CxA will lead a kickoff meeting. This will include the Project Managers and Foremen for the General, Mechanical, Electrical, TABs, and Controls Contractors; Equipment Representatives; and the Owner.

The meeting will review the goals of commissioning, establish a schedule, and assign responsibilities to specific individuals. Once an individual is assigned to be a part of the commissioning team, they cannot be removed with out prior concurrence of the commissioning authority to preserve continuity.

Prefunctional Checklists

The Prefunctional Checklists are developed by the commissioning authority. They are to be completed by the General Contractor and Subcontractors. The intent of the checklists is to provide an organized method to verify the equipment is properly installed and requirements of the Project Documents are met.

System Startup

When the Prefunctional Checklists are complete, and the building cleanliness is adequate, equipment startup can proceed. The specifications contain specific requirements for startup. A field report for each unit is required to be submitted for review and inclusion in the final commissioning report.

Issues Log

The CxA will maintain an Issues Log to track items of concern. Each item will stay open until it is resolved; either by correcting the construction, demonstrating compliance as-is; or Owner acceptance.

Functional Testing

Functional testing occurs after all construction and startup is complete, the TABs report is approved by the Engineer, and DDC graphics are finished. A small team consisting of the CxA, Controls Technician, Mechanical Contractor, Equipment Startup Technicians, TABs Agent, and Owners Representative will exercise all the systems in the project scope.

Review Training

The CxA will review the contractor's submitted training agenda to ensure the specification requirements are covered and the contractor understands the expectations of training.

O&M Systems Manual

The Construction Administrator or the CxA will review the final manual for completeness and clarity.

Warranty Review

The Construction Administrator or CxA will review the warranty certificates provided by the Contractor.

CONTACT INFORMATION

Owners Representative

Kagan Squire
Albemarle County Public Schools
2751 Hydraulic Road
Charlottesville, VA 22902

Architect

Quinn Evans
1840 West Broad Street
Suite 400
Richmond, Virginia 23220
(804) 788-4774

Mechanical Engineer

2RW
100 10th St NE
Charlottesville, VA 22902
(434) 296-2116

General Contractor

TO BE DETERMINED

Mechanical Contractor

TO BE DETERMINED

Controls Contractor

TO BE DETERMINED

TABs Contractor

TO BE DETERMINED

APPENDIX A

Site Visit Reports and Issues Log

THOMPSON
Consulting Engineers
Mechanical and Electrical Engineering

MJT Job Name: ACPS HS Center II
MJT Job Number: 24-047
Date/Update:

Location/ID	Commissioning Deficiency	Responsible Party	Open Date	Reported By	Closed Date	Closed By

APPENDIX B

Functional Checklists

EQUIPMENT COMMISSIONED			Hydronic Piping Controls
SPEC	**SEQUENCE**	**ACCEPT**	**COMMENTS**
	Sequence not yet written - See M802		

EQUIPMENT COMMISSIONED			OAU-1
SPEC	**SEQUENCE**	**ACCEPT**	**COMMENTS**
	THE BAS CONTRACTOR SHALL PROVIDE A MICROPROCESSOR-BASED CONTROLLER WHICH SHALL MONITOR AND CONTROL THE SYSTEM IN A		
	STANDALONE MODE OR AS DIRECTED BY THE BAS. THE BAS SHALL BE RESPONSIBLE FOR COMMUNICATING WITH THE CONTROLLER AND		
	PROVIDING STATUS AND DIAGNOSTICS OF THE UNIT TO THE OPERATOR.		
	2. UNOCCUPIED OPERATION:		
	a. THE UNIT SHALL BE DISABLED.		
	b. AFTER A 5 MINUTE DELAY (ADJ) THE PREHEAT VALVE, AND CHILLED WATER VALVE SHALL CLOSE.		
	c. AFTER A 5 MINUTE DELAY (ADJ) ALL FANS AND ENERGY RECOVERY WHEELS SHALL BE COMMANDED OFF.		
	d. AFTER A 5 MINUTE DELAY (ADJ) ALL OUTSIDE AIR AND EXHAUST AIR DAMPER ACTUATORS SHALL BE DE-ENERGIZED AND SPRING RETURN TO		
	THEIR FAIL POSITION.		
	3. OCCUPIED OPERATION: ALL UNIT FUNCTIONS SHALL BE ENABLED. THE SYSTEM SHALL OPERATE TO MAINTAIN SUPPLY AIR TEMPERATURE AND		
	DEHUMIDIFICATION SET POINTS.		
	a. OUTSIDE AIR AND EXHAUST AIR DAMPERS SHALL OPEN.		
	b. AFTER OUTSIDE AIR AND EXHAUST AIR DAMPERS ARE PROVED OPEN FOR 20 SECONDS, SUPPLY FANS AND EXHAUST FANS ARE ENERGIZED.		
	c. THE ENTHALPY WHEEL AND SENSIBLE WHEEL SHALL OPERATE AT 100% FOR THE FIRST 5 MINUTES.		
	d. AFTER A 5 MINUTE DELAY (ADJ) AND FANS ARE PROVED RUNNING, ALL CONTROL PROCESSES SHALL OPERATE AS DESCRIBED BELOW TO		
	MAINTAIN SUPPLY AIR TEMPERATURE AND DEHUMIDIFICATION SET POINTS.		
	4. SUPPLY FAN DUCT STATIC PRESSURE CONTROL:		

	a. THE BAS SHALL CONTINUOUSLY MONITOR THE DAMPER POSITIONS OF ALL ATU-O ASSOCIATED WITH THE UNIT.		
	b. WHEN ANY ATU-O DAMPER IS MORE THAN 95% (ADJ) OPEN, THE SUPPLY FAN DUCT STATIC PRESSURE SET POINT SHALL BE RESET UPWARD		
	BY 0.1 IWC (ADJ), UNTIL NO DAMPER IS MORE THAN 95% OPEN, THE SYSTEM MAXIMUM DUCT PRESSURE SET POINT IS AT THE MAXIMUM		
	SETTING, OR THE SUPPLY FAN VFD IS AT THE MAXIMUM SETTING.		
	c. WHEN ALL ATU-O DAMPERS ARE LESS THAN 75% (ADJ) OPEN, THE SUPPLY FAN DUCT STATIC PRESSURE SET POINT SHALL BE RESET		
	DOWNWARD BY 0.1 IWC (ADJ), AT A FREQUENCY OF 15 (ADJ) MINUTES, UNTIL AT LEAST 1 DAMPER IS MORE THAN 75% OPEN, THE SYSTEM		
	MINIMUM DUCT PRESSURE SET POINT IS AT THE MINIMUM SETTING, OR THE SUPPLY FAN VFD IS AT THE MINIMUM SETTING.		
	d. THE BAS SHALL HAVE THE CAPABILITY TO ALLOW THE OPERATOR TO EASILY EXCLUDE 'NON-CRITICAL' ZONES THAT SHOULD NOT BE		
	CONSIDERED WHEN DETERMINING THE STATIC PRESSURE SET POINT.		
	e. HIGH STATIC LIMIT: AN INCREASE IN FAN DISCHARGE STATIC PRESSURE ABOVE THE HIGH STATIC LIMIT POINT (3.0 IWC) SHALL CAUSE THE		
	UNIT TO PERFORM AN EMERGENCY DISABLE AND AN ALARM SHALL BE SENT TO THE BAS TO INDICATE HIGH STATIC PRESSURE DISABLE. THIS		
	ALARM SHALL BE MANUALLY RESET AT THE UNIT.		
	5. EXHAUST FAN DUCT STATIC PRESSURE CONTROL:		
	a. THE BAS SHALL MODULATE THE EXHAUST FAN AIRFLOW TO BE PROPORTIONAL TO THE SUPPLY AIRFLOW. PROVIDE 0.8 CFM (ADJ) OF		
	EXHAUST AIR PER 1 CFM OF SUPPLY AIR TO MAINTAIN A POSITIVE OVERALL BUILDING PRESSURE.		
	b. LOW STATIC LIMIT: A DECREASE IN FAN DISCHARGE STATIC PRESSURE BELOW THE LOW STATIC LIMIT POINT (-3.0 IWC) SHALL CAUSE THE UNIT		
	TO PERFORM AN EMERGENCY DISABLE AND AN ALARM SHALL BE SENT TO THE BAS TO INDICATE LOW STATIC PRESSURE DISABLE. THIS		

	ALARM SHALL BE MANUALLY RESET AT THE UNIT.		
	6. ENTHALPY WHEEL: THE TOTAL ENTHALPY WHEEL SHALL BE IN ECONOMIZER MODE (DISABLED) WHEN THE OUTDOOR AIR TEMPERATURE IS		
	BETWEEN 65ºF AND 74ºF DB, AND BELOW 55°F WB. THE ENTHALPY WHEEL SHALL OPERATE AT 100% SPEED WHEN NOT IN ECONOMIZER MODE.		
	7. HEATING: THE HEATING WATER VALVE SHALL MODULATE TO MAINTAIN DISCHARGE AIR TEMPERATURE WHEN THE TE WHEEL DISCHARGE AIR		
	TEMPERATURE IS MORE THAN 4°F DB BELOW THE SUPPLY AIR TEMPERATURE SETPOINT (BASED ON THE SUPPLY AIR TEMPERATURE RESET		
	SCHEDULE) AND BELOW 60°F WB.		
	8. COOLING: THE CHILLED WATER VALVE SHALL USE A PI LOOP TO MODULATE TO MAINTAIN UNIT DISCHARGE AIR TEMPERATURE SETPOINT (BASED		
	ON THE SUPPLY AIR TEMPERATURE RESET SCHEDULE) WHEN THE TE WHEEL DISCHARGE AIR TEMPERATURE IS ABOVE THE SUPPLY AIR		
	TEMPERATURE SETPOINT.		
	9. DEHUMIDIFICATION: THE CHILLED WATER VALVE SHALL USE A PI LOOP TO MODULATE TO MAINTAIN 55°F DP UNIT DISCHARGE AIR TEMPERATURE		
	WHEN THE TE WHEEL DISCHARGE AIR TEMPERATURE IS ABOVE 60°F WB.		
	10. SENSIBLE WHEEL: THE SENSIBLE WHEEL SHALL MODULATE TO MAINTAIN DISCHARGE AIR TEMPERATURE DIRECTLY DOWNSTREAM OF THE UNIT		
	WHEN DEHUMIDIFICATION IS ENABLED.		
	11. SUPPLY AIR TEMPERATURE CONTROL:		
	a. THE BAS SHALL RESET THE SUPPLY TEMPERATURE INVERSELY WITH THE AMBIENT TEMPERATURE.		
	b. THE LINEAR RELATIONSHIP SHALL BE SUPPLY TEMPERATURE OF 74°F DB AT 60°F DB AMBIENT TEMPERATURE OR LOWER AND 65°F DB AT 90°		

	F DB AMBIENT TEMPERATURE OR ABOVE (ALL VALUES ADJUSTABLE).		
	c. SUPPLY AIR TEMPERATURE SHALL BE RESET IN INCREMENTS OF 1°F (ADJ) EVERY 5 MINUTES (ADJ).		
	12. TIMED OVERRIDE: WHEN A USER TIMED OVERRIDE IS INITIATED AT A TERMINAL UNIT TEMPERATURE/HUMIDITY SENSOR WITHIN THE SPACES		
	SERVED BY THE ASSOCIATED OAU, THE SYSTEM SHALL RETURN TO ITS NORMAL OCCUPIED OPERATION FOR 2 HOURS (ADJ). WHEN THE TIMED		
	OVERRIDE PERIOD HAS ENDED, THE SYSTEM SHALL AUTOMATICALLY RETURN TO ITS UNOCCUPIED OPERATION.		
	13. FREEZE PROTECTION: A HARDWIRED, FREEZSTAT SHALL BE ELECTRICALLY INTERLOCKED WITH THE UNIT OPERATION. IF THE FREEZSTAT SET		
	POINT OF 38 (ADJ) °F IS TRIPPED, ALL FANS SHALL DISABLE, ALL DAMPERS SHALL CLOSE, ALL VALVES SHALL OPEN TO 100%, AND AN ALARMSHALL		
	BE GENERATED AT THE BAS. A MANUAL RESET OF THE LOW LIMIT TEMPERATURE SWITCH SHALL BE REQUIRED TO RESTART THE UNIT.		
	14. SMOKE DETECTION SHUTDOWN: SHOULD THE DUCT SMOKE DETECTORS DETECT SMOKE, THE OAU SHALL SHUT DOWN AND AN ALARM SHALL BE		
	GENERATED AT THE BAS AND FIRE ALARM CONTROL PANEL.		
	15. IF CONDENSATE BEGINS TO BUILD UP IN THE CONDENSATE PAN, THE WATER LEVEL DETECTION DEVICE SHALL DISABLE THE UNIT, CLOSE ALL CHW		
	VALVES, AND SEND AN ALARM TO THE BAS.		
	16. PREHEAT COIL PUMP: WHEN THE OUTSIDE AIR TEMPERATURE FALLS BELOW 38° F, THE COIL PUMP SHALL START. SHOULD THE PUMP FAIL TO		
	START WITHIN 30 SECONDS OF A START COMMAND, AN ALARM SHALL BE GENERATED AT THE BAS.		

	17. PUMP DISABLE: THE BAS GRAPHIC INTERFACE DISPLAY SHALL INCLUDE ANICON FOR THE PUMP, WHICH SHALL DISABLE THE PUMP FOR COIL		
	DRAINAGE AND SERVICING.		
	18. SYSTEM GRAPHIC DISPLAY:		
	a. OUTSIDE AIR TEMPERATURE AND HUMIDITY -GLOBAL.		
	b. UNIT ENABLE/DISABLE, SCHEDULING, AND OCCUPIED MODE OVERRIDE.		
	c. SUPPLY AND EXHAUST AIRFLOW.		
	d. ALL DAMPERS -POSITION AND STATUS.		
	e. ALL TEMPERATURE, HUMIDITY AND PRESSURE SENSORS.		
	f. TE WHEEL ECONOMIZER SET POINTS.		
	g. TE WHEEL -MODULATION AND ROTATION SENSOR.		
	h. ALL VFDS -ENABLE, SPEED, STATUS, FAULT.		
	i. SUPPLY DUCT STATIC PRESSURE CONTROL -ATU CRITICAL ZONE AND DAMPER POSITION, STATIC PRESSURE SET POINT, MINIMUM, MAXIMUM,		
	AND DURATION.		
	j. EXHAUST DUCT STATIC PRESSURE CONTROL -AIRFLOW SETPOINT, DOWN DUCT STATIC PRESSURE, MINIMUM AIRFLOW, AND MAXIMUM		
	AIRFLOW.		
	k. HEATING WATER VALVE MODULATION.		
	l. CHILLED WATER VALVE MODULATION.		
	m. ALL COILS -DISCHARGE TEMPERATURE AND SET POINT.		
	n. SE WHEEL TEMPERATURE SET POINT AND SPEED.		
	o. SE WHEEL -MODULATION AND ROTATION SENSORS.		
	p. UNIT -DISCHARGE TEMPERATURE, SET POINTS, AND RESET SCHEDULE.		
	q. ALL SMOKE DETECTORS -STATUS.		
	r. ALL HIGH STATIC STATS -STATUS.		
	s. FREEZESTAT STATUS.		
	t. WATER LEVEL DETECTION DEVICE STATUS.		
	u. PREHEAT COIL PUMP -ENALBE AND STATUS.		

EQUIPMENT COMMISSIONED			RTU-COMMONS
SPEC	**SEQUENCE**	**ACCEPT**	**COMMENTS**
	Sequence not yet written - See M804		

EQUIPMENT COMMISSIONED			RTU-KITCHEN
SPEC	**SEQUENCE**	**ACCEPT**	**COMMENTS**
	Sequence not yet written - See M804		

EQUIPMENT COMMISSIONED			Outside Air Terminal Unit (ATO)
SPEC	**SEQUENCE**	**ACCEPT**	**COMMENTS**
	1. THE BAS CONTRACTOR SHALL PROVIDE A MICROPROCESSOR-BASED CONTROLLER WHICH SHALL MONITOR AND CONTROL THE UNIT IN A STAND-ALONE		
	MODE OR AS DIRECTED BY THE BAS. VARIABLE AIR VOLUME TERMINALS SHALL BE CONTROLLED BY THE BAS FOR VENTILATION		
	REQUIREMENTS OF THE ZONE OCCUPANTS. PRESSURE INDEPENDENT CONTROL SHALL SHUT OFF AND MODULATE AIRFLOW BETWEEN VENTILATION		
	MINIMUMS AND MAXIMUMS.		
	2. THE UNIT SHALL BE PROVIDED WITH A TIME OF DAY OCCUPANCY SCHEDULE AND THE CAPABILITY FOR AN OCCUPANT TO OVERRIDE THE SCHEDULE.		
	OCCUPANCY STATUS SHALL BE COMMUNICATED TO THE ASSOCIATED OAU.		
	3. SPACES WITH OCCUPANCY SENSORS SHALL BE PROVIDED WITH VACANCY CONTROL. VACANCY IS 30 MINUTES (ADJ) WITHOUT DETECTION OF		
	MOTION.		
	4. SPACE OR UNIT SERVED BY MORE THAN (1) CO2 SENSOR: THE BAS SHALL AVERAGE THE INDIVIDUAL SENSOR INPUTS. REFER TO FLOOR PLANS FOR		
	FURTHER DETAIL.		
	5. UNOCCUPIED OPERATION: WHEN THE ATO IS SCHEDULED UNOCCUPIED OR THE OCCUPANCY SENSOR DETECTS VACANCY, OPERATION SHALL BE AS		
	FOLLOWS:		
	a. THE DAMPER SHALL MODULATE TO THE MINIMUM AIRFLOW SETPOINT SHOWN IN THE VENTIALTION TABLE.		

	6. UNOCCUPIED OPERATION OVERRIDE: WHEN ATO IS SCHEDULED UNOCCUPIED, UNOCCUPIED OPERATION SHALL BE OVERRIDDEN AS FOLLOWS:		
	a. CO2 SENSOR OCCUPANCY OVERRIDE: IF ZONE CO2 LEVEL RISES ABOVE MAX CO2 LEVEL SCHEDULED IN THE VENTILATION TABLES (ADJ), ATO		
	SHALL TRANSITION INTO OCCUPANCY OVERRIDE UNTIL ZONE CO2 LEVEL FALL BELOW 500 PPM (ADJ) OR 30 MINUTES (ADJ), WHICHEVER IS		
	LONGER.		
	b. TIMED OVERRIDE: WHEN A TIMED OVERRIDE IS INITIATED BY THE USER AT AN ASSOCIATED TERMINAL HEAT TRANSFER UNIT TEMPERATURE		
	SENSOR, THE ZONE SHALL RETURN TO ITS NORMAL OCCUPIED OPERATION FOR A PERIOD OF 2 HOURS. WHEN THE TIMED OVERRIDE PERIOD		
	HAS ENDED, THE ZONE SHALL AUTOMATICALLY RETURN TO ITS UNOCCUPIED OPERATION. THE BAS SHALL ENSURE MINIUM OAU AIRFLOW IS		
	MAINUTAINED AT ALL TIMES.		
	c. SPACE OCCUPANCY SENSOR OVERRIDE: WHEN AN OCCUPANCY SENSOR DETECTS MOTION, THE ZONE SHALL RETURN TO ITS NORMAL		
	OCCUPIED OPERATION. WHEN THE OCCUPANCY SENSOR DETECTS VACANCY, THE ZONE SHALL AUTOMATICALLY RETURN TO ITS UNOCCUPIED		
	OPERATION. THE BAS SHALL ENSURE MINIUM OAU AIRFLOW IS MAINUTAINED AT ALL TIMES.		
	d. INTERLOCKED ATE'S AND ATO'S SHALL OPERATE ON THE SAME SCHEDULE AS ASSOCIATED ATO. REFER TO VENTILATION TABLES FOR SPECIFIC		
	COMBINATIONS OF INTERLOCKED ATO'S AND ATE'S.		
	e. ASSOCIATED OAU SHALL COMMAND ATO'S OPEN TO MININUM AIRFLOWS IN SEQUENTIAL ORDER LISTED IN VENTILATION TABLES UNTIL THE		

	MINIMUM AIRFLOW LISTED ON THE MECHANICAL SCHEDULES IS MET.		
	f. IF OVERRIDE PERIOD EXTENDS INTO NEXT SCHEDULED OCCUPIED PERIOD, UNIT SHALL AUTOMATICALLY TRANSITION TO OCCUPIED MODE.		
	7. OCCUPIED OPERATION: PI LOOP SHALL MODULATE ZONE DAMPER TO MAINTAIN CFM SETPOINT. CFM SETPOINT DETERMINED AS FOLLOWS:		
	a. ATO SCHEDULED CONSTANT VOLUME: THE UNIT DAMPER SHALL MODULATE TO PROVIDE THE SCHEDULED CONSTANT OUTSIDE AIR CFM. REFER		
	TO VENTILATION TABLES FOR FURTHER DETAIL.		
	b. ATU MODULATING VOLUME (CO2): THE UNIT DAMPER SHALL MODULATE BETWEEN THE SCHEDULED MINIMUM AND MAXIMUM OUTSIDE AIR		
	QUANTITIES BASED ON THE CORRESPONDING CO2 SENSOR SET POINT. WHEN THE CO2 SENSOR INDICATES THE SPACE IS 100 PPM BELOW SET		
	POINT, THE DAMPER SHALL MODULATE CLOSED TO MAINTAIN THE SCHEDULED MINIMUM CFM. WHEN THE SENSOR INDICATES THE CO2 LEVEL IN		
	THE SPACE EXCEEDS SET POINT, THE DAMPER SHALL MODULATE OPEN TO MAINTAIN THE SCHEDULED MAXIMUM CFM UNTIL THE SENSOR		
	INDICATES THE SPACE IS 100 PPM BELOW SET POINT. REFER TO VENTILATION TABLES FOR CO2 SET POINTS AND SCHEDULED MINIMUM AND		
	MAXIMUM OUTSIDE AIR QUANTITIES.		
	c. ATO SHALL OUTPUT THE CURRENT DAMPER POSITION TO THE ASSOCIATED OAU FOR USE IN DETERMINING DOWN DUCT STATIC PRESSURE		
	SETPOINT.		
	8. SYSTEM GRAPHIC DISPLAY:		
	a. OUTSIDE AIR TEMPERATURE AND HUMIDITY -GLOBAL		
	b. UNIT MARK, TYPE, SIZE, ENABLE/DISABLE, OCCUPANCY SCHEDULE, OVERRIDE STATUS, AND CRITICAL/ NON-CRITICAL DESIGNATION		
	c. CONSTANT VOLUME ATO: SET POINT		

	d. MODULATING VOLUME ATO: CURRENT SPACE CO2 LEVEL AND MAX ALLOWABLE CO2 CONCENTRATION LEVEL		
	e. MODULATING VOLUME ATO: CURRENT AIRFLOW SETPOINT, MINIMUM AND MAXIMUM AIRFLOW SET POINTS		
	f. DAMPER POSITION		
	g. SUPPLY AIRFLOW		
	h. OCCUPANCY SENSOR: STATUS		

EQUIPMENT COMMISSIONED			FAN COIL UNIT (FCU)
SPEC	**SEQUENCE**	**ACCEPT**	**COMMENTS**
	FAN COIL UNIT (FCU)		
	1. THE BAS CONTRACTOR SHALL PROVIDE A MICROPROCESSOR-BASED CONTROLLER WHICH SHALL MONITOR AND CONTROL THE UNIT IN A STAND-ALONE MODE OR AS DIRECTED BY THE BAS. THE UNIT SHALL OPERATE IN		
	OCCUPIED AND UNOCCUPIED MODE ACCORDING TO BAS SCHEDULING. THE BAS SHALL BE RESPONSIBLE FOR COMMUNICATING WITH THE CONTROLLER AND PROVIDING STATUS AND DIAGNOSTICS OF THE UNIT TO THE		
	OPERATOR.		
	2. UNITS SERVING MORE THAN (1) SPACE: THE BAS SHALL AVERAGE THE INDIVIDUAL SPACE TEMPERATURE AND RELATIVE HUMIDITY SET POINTS. REFER TO FLOOR PLANS FOR FURTHER DETAIL.		
	3. SPACES SERVED BY MORE THAN (1) UNIT: THE BAS SHALL CONTROL THE UNITS SIMILARLY. REFER TO FLOOR PLANS FOR FURTHER DETAIL.		
	4. OCCUPIED OPERATION:		
	a. ALL FUNCTIONS SHALL BE ENABLED.		
	b. THE SYSTEM SHALL OPERATE TO MAINTAIN OCCUPIED SPACE SET POINTS.		
	c. COOLING: TO MAINTAIN SPACE TEMPERATURE COOLING SET POINT (ADJ), THE CHILLED WATER VALVE SHALL BE MODULATED TO MAINTAIN THE SCHEDULED CHILLED WATER COIL LEAVING AIR SET POINT (ADJ). THE HEATING		
	WATER VALVE SHALL BE CLOSED.		
	d. HEATING: TO MAINTAIN SPACE TEMPERATURE HEATING SET POINT (ADJ), THE HEATING WATER VALVE SHALL BE MODULATED TO GRADUALLY INCREASE LEAVING AIR TEMPERATURE UP TO THE SCHEDULED HEATING WATER		
	COIL LEAVING AIR SET POINT (ADJ). THE CHILLED WATER VALVE SHALL BE CLOSED.		

	e. DEHUMIDIFICATION: IF THE SPACE TEMPERATURE IS SATISFIED AND THE SPACE DEHUMIDIFICATION SET POINT OF 50% (ADJ) IS NOT, THE CHILLED WATER VALVE SHALL OPEN FULLY AND THE HEATING WATER VALVE SHALL		
	MODULATE TO MAINTAIN UNIT DISCHARGE AIR TEMPERATURE SET POINT OF 70 (ADJ) °F.		
	5. UNOCCUPIED OPERATION:		
	a. WHEN THE BAS INITIATES UNOCCUPIED OPERATION, THE UNIT SHALL TURN OFF AND CLOSE ITS OUTSIDE AIR DAMPER.		
	b. THE UNIT SHALL CYCLE ON, AS DIRECTED BY THE BAS, TO MAINTAIN UNOCCUPIED SPACE'S HEATING, COOLING, DEHUMIDIFICATION, AND HUMIDIFICATION SET POINTS. THE HEATING WATER AND CHILLED WATER VALVES		
	SHALL MODULATE TO MAINTAIN UNIT SCHEDULED DISCHARGE AIR TEMPERATURE SET POINTS (ADJ).		
	6. SUPPLY FAN:		
	a. UNITS WITH DUCTED VENTILATION AIR: THE SUPPLY FAN SHALL RUN CONTINUOUSLY DURING OCCUPIED AND OVERRIDE MODE.		
	b. UNITS WITHOUT DUCT VENTILATION AIR: THE SUPPLY FAN SHALL CYCLE WITH THE CHILLED AND HEATING WATER VALVES AS REQUIRED TO MAINTAIN OCCUPIED SET POINTS.		
	c. UNOCCUPIED MODE ALL UNITS: THE SUPPLY FAN SHALL CYCLE WITH THE CHILLED AND HEATING WATER VALVES AS REQUIRED TO MAINTAIN OCCUPIED SET POINTS.		
	7. HUMIDIFIER INTERLOCK: ON A CALL FOR HUMIDIFICATION, THE ASSOCIATED TERMINAL UNIT SUPPLY FAN SHALL BE ENABLED AND THE HEATING WATER VALVE SHALL MODULATE TO PROVIDE 70° DB DISCHARGE AIR.		
	8. IF THE WATER LEVEL DETECTION DEVICE DETECTS BUILD-UP OF CONDENSATE THE DEVICE SHALL STOP WATER FLOW TO THE COILS, SHUT OFF THE UNIT FAN AND AN ALARM SHALL BE GENERATED AT THE BAS.		
	9. SYSTEM GRAPHIC DISPLAY:		
	a. OUTSIDE AIR TEMPERATURE AND HUMIDITY -GLOBAL.		

	b. UNIT MARK, TYPE, SIZE, OCCUPANCY SCHEDULE, AND OVERRIDE STATUS.		
	c. SPACE TEMPERATURES AND RELATIVE HUMIDITIES.		
	d. SPACE TEMPERATURE AND RELATIVE HUMIDITY SET POINTS.		
	e. FAN ENABLE AND STATUS.		
	f. HEATING WATER VALVE MODULATION.		
	g. CHILLED WATER VALVE MODULATION.		
	h. SUPPLY AIR TEMPERATURE.		
	i. HUMIDIFIER STATUS AND TERMINAL UNIT INTERLOCK (WHERE APPLICABLE).		
	j. WATER LEVEL DETECTION STATUS.		

EQUIPMENT COMMISSIONED			FAN COIL (HEATING ONLY)
SPEC	**SEQUENCE**	**ACCEPT**	**COMMENTS**
	1. EACH UNIT SHALL HAVE A BAS MICROPROCESSOR-BASED CONTROLLER WHICH SHALL MONITOR AND CONTROL THE UNIT IN A STANDALONE MODE OR AS DIRECTED BY THE BAS.		
	THE BAS SHALL BE RESPONSIBLE FOR COMMUNICATING WITH THE CONTROLLER AND PROVIDING STATUS AND DIAGNOSTICS OF THE UNIT TO THE OPERATOR.		
	2. SPACE TEMPERATURE CONTROL: DURING PERIODS OF OCCUPIED OPERATION (SPACE IS OCCUPIED, SCHEDULED TO BE OCCUPIED OR OCCUPANCY IS DETECTED) THE OPERATOR		
	MAY ADJUST THE OCCUPIED SET POINT TEMPERATURES AS INDICATED ON DESIGN CONDITIONS. OCCUPANTS MAY FURTHER ADJUST THE OCCUPIED SET POINT VIA THE LOCAL		
	SENSOR SET POINT ADJUSTMENT (THE RANGE OF ADJUSTMENT SHALL BE CONFIGURABLE VIA THE BAS, INITIALLY +/-2°F). THE BAS SHALL AUTOMATICALLY APPLY AN OFFSET FOR		
	COOLING AND HEATING SET POINTS DURING OCCUPIED PERIODS AS INDICATED ON DESIGN CONDITIONS.		
	3. DURING PERIODS OF UNOCCUPIED OPERATION (SPACE IS SCHEDULED UNOCCUPIED OR NO OCCUPANCY IS DETECTED FOR A PRESET PERIOD) THE OPERATOR MAY ADJUST		
	SETBACK HEATING (62°F ADJ.) SET POINTS. THE BAS WILL PREVENT THE OPERATOR FROM ENTERING A SETBACK HEATING SET POINT HIGHER THAN THE SPACE HEATING SET		
	POINT.		
	4. OCCUPANCY OVERRIDE: OCCUPANCY OVERRIDE SHALL BE INITIATED AT THE LOCAL ZONE SENSOR OR VIA THE OCCUPANCY SENSOR. UNIT SHALL CHANGE TO THE OCCUPIED		
	MODE WHENEVER THE OVERRIDE BUTTON IS DEPRESSED (OR SIGNAL IS RECEIVED FROM THE OCCUPANCY SENSOR) FOR A PERIOD OF 2 HOURS (ADJ.) AND RESET TO NORMAL		

	OPERATION AT THE END OF THE PERIOD OR WHENEVER THE OVERRIDE BUTTON IS HELD FOR MORE THAN 5 SECONDS (ADJ.).		
	5. OCCUPIED OPERATION: HEATING		
	a. HEATING SHALL BE ENABLED IF THE SPACE IS REQUESTING HEATING VOTES.		
	b. HEATING OPERATION RESETS SUPPLY AIR TEMPERATURE AND SUPPLY FAN SPEED BASED ON SPACE TEMPERATURE VARIANCE FROM HEATING SETPOINT. SUPPLY AIR		
	TEMPERATURE IS RESET UP FIRST WITH FAN SPEED INCREASING UPON REACHING MAXIMUM SUPPLY AIR TEMPERATURE SETPOINT AND CONTINUED SPACE TEMPERATURE		
	VARIANCE FROM SPACE TEMPERATURE SETPOINT GENERATING HEATING REQUESTS.		
	1. ONE HEATING REQUEST SHALL BE GENERATED FOR EACH 0.5°F (ADJ) VARIANCE BETWEEN ZONE TEMPERATURE AND ZONE HEATING TEMPERATURE SETPOINTS.		
	2. SUPPLY AIR TEMPERATURE RESET (INCREASE): INITIAL SUPPLY AIR TEMPERATURE SETPOINT SHALL BE 70°F (ADJ). HEATING REQUEST SHALL FIRST BE USED TO RESET		
	THE SUPPLY AIR TEMPERATURE UP BY RESPONDING TO EACH REQUEST WITH A 1°F (ADJ) INCREASE TO SUPPLY AIR TEMPERATURE SETPOINT, NOT RESPONDING		
	QUICKER THAN 2°F EVERY FIVE MINUTES UP TO MAXIMUM SUPPLY AIR TEMPERATURE FOUND IN MECHANICAL SCHEDULES (ADJ).		
	3. SUPPLY FAN SPEED RESET (INCREASE): INITIAL FAN SPEED SHALL BE THE MINIMUM (30% OF MAX FAN SPEED, ESTABLISHED DURING TAB, ADJ). UPON SUPPLY AIR		
	TEMPERATURE RESETTING TO MAXIMUM SETPOINT, CONTINUED HEATING REQUESTS SHALL BE USED TO INCREASE FAN SPEED 10% PER REQUEST UP TO A MAXIMUM		
	OF 30% EVERY FIVE MINUTES. MAXIMUM FAN SPEED SHALL BE ESTABLISHED DURING TAB AS THE SPEED REQUIRED TO PROVIDE THE SCHEDULED CFM. MAXIMUM FAN		

	SPEED SETTING (ADJ) SHALL BE INCLUDED IN THE BAS GRAPHIC DISPLAY FOR EACH BC/FC INSTANCE.		
	4. UPON ELIMINATION OF HEATING REQUESTS, SUPPLY FAN SPEED SHALL BE TRIMMED (DECREASED) BY 20% EVERY FIVE MINUTES (ADJ). UPON REACHING MINIMUM		
	SUPPLY FAN SPEED, SUPPLY AIR TEMPERATURE SETPOINT SHALL BE TRIMMED BY 1°F EVERY FIVE MINUTES.		
	6. OCCUPIED OPERATION: SUPPLY FAN		
	a. THE SUPPLY FAN SHALL CYCLE ON AND MODULATE AS DESCRIBED IN HEATING SECTION.		
	7. UNOCCUPIED MODE		
	a. UNIT SHALL ENABLE DURING UNOCCUPIED HOURS TO MAINTAIN UNOCCUPIED TEMPERATURE SETPOINTS.		
	8. UNOCCUPIED OPERATION: HEATING		
	a. TO MEET UNOCCUPIED HEATING SETPOINT, SUPPLY FAN SHALL CYCLE ON AND OPERATE AT MAXIMUM SPEED.		
	b. HEATING COIL COIL SHALL MODULATE USING PI LOOP TO MAINTAIN A HEATING COIL LEAVING AIR TEMPERATURE FOUND IN MECHANICAL SCHEDULES (ADJ).		
	c. UNIT SHALL REMAIN OPERATIONAL DURING UNOCCUPIED WARM-UP MODE AS FOLLOWS:		
	1. MINIMUM RUN TIME TIMER OF 30 MINUTES (ADJ) HAS EXPIRED AND		
	2. ZONE TEMPERATURE IS 4°F (ADJ) ABOVE UNOCCUPIED HEATING SETPOINT OR		
	3. SCHEDULED OR OCCUPANT OVERRIDDEN OCCUPANCY IS ENABLED		
	9. SYSTEM GRAPHIC DISPLAY:		
	a. OUTSIDE AIR TEMPERATURE AND HUMIDITY -GLOBAL.		
	b. UNIT MARK, TYPE, SIZE, OCCUPANCY SCHEDULE, AND OVERRIDE STATUS.		
	c. SPACE TEMPERATURES AND SETPOINTS.		
	d. FAN ENABLE AND STATUS.		
	e. MIN FAN SPEED SETTING (ESTABLISHED DURING TAB)		
	f. MAX FAN SPEED SETTING (ESTABLISHED DURING TAB)		
	g. CURRENT FAN SPEED		

	h. HEATING WATER VALVE MODULATION.		
	i. SUPPLY AIR TEMPERATURE.		

EQUIPMENT COMMISSIONED			DX CRAC UNIT
SPEC	**SEQUENCE**	**ACCEPT**	**COMMENTS**
	Sequence not yet written - See M806		

EQUIPMENT COMMISSIONED			HYDRONIC CRAC UNIT
SPEC	**SEQUENCE**	**ACCEPT**	**COMMENTS**
	Sequence not yet written - See M806		

EQUIPMENT COMMISSIONED			GENERAL EXHAUST FAN
SPEC	**SEQUENCE**	**ACCEPT**	**COMMENTS**
	Sequence not yet written - See M806		

EQUIPMENT COMMISSIONED			LAB VENTILATION
SPEC	**SEQUENCE**	**ACCEPT**	**COMMENTS**
	Sequence not yet written - See M807		

EQUIPMENT COMMISSIONED			MAINTENANCE ROOM EXHAUST
SPEC	**SEQUENCE**	**ACCEPT**	**COMMENTS**
	Sequence not yet written - See M807		

EQUIPMENT COMMISSIONED			WATER MONITORING
SPEC	**SEQUENCE**	**ACCEPT**	**COMMENTS**
	Sequence not yet written - See M807		

EQUIPMENT COMMISSIONED			KITCHEN EF & KMAU
SPEC	**SEQUENCE**	**ACCEPT**	**COMMENTS**
	Sequence not yet written - See M807		

EQUIPMENT COMMISSIONED			KITCHEN TEMP MONITORING
SPEC	**SEQUENCE**	**ACCEPT**	**COMMENTS**
	Sequence not yet written - See M807		

EQUIPMENT COMMISSIONED			DISHWASHER EXHAUST
SPEC	**SEQUENCE**	**ACCEPT**	**COMMENTS**
	Sequence not yet written - See M807		

APPENDIX C

Prefunctional Checklists

DX COMPUTER ROOM AIR CONDITIONING UNIT **UNIT** CRAC-1

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Serial Number			
Voltage / Phase / Frequency			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is free from physical damage			
Coil surface areas are clean and free from damage			
Unit tags affixed			
Manufacturers recommended clearance is provided			
Unit can be removed if necessary			
Cooling coil drain pan is installed level			
Local disconnect provided			
Wall mounted wired controller provided			
Condensate drain is installed properly			
Condensing Unit installed properly			
Condensing Unit piping installed and insulated			
Condensing Unit disconnect installed in sight of unit			
Condensing Unit labled			

DX COMPUTER ROOM AIR CONDITIONING UNIT **UNIT** CRAC-2

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Serial Number			
Voltage / Phase / Frequency			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is free from physical damage			
Coil surface areas are clean and free from damage			
Unit tags affixed			
Manufacturers recommended clearance is provided			
Unit can be removed if necessary			
Cooling coil drain pan is installed level			
Local disconnect provided			
Wall mounted wired controller provided			
Condensate drain is installed properly			
Condensing Unit installed properly			
Condensing Unit piping installed and insulated			
Condensing Unit disconnect installed in sight of unit			
Condensing Unit labled			

FAN COIL UNIT **UNIT** FC-04C

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Serial Number			
Voltage / Phase / Frequency			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is free from physical damage			
Coil surface areas are clean and free from damage			
Air filters clean			
Installation and startup manual provided			
Unit tags affixed			
Unit is secured as required by project documents			
Manufacturers recommended clearance is provided			
Unit can be removed if necessary			
Cooling coil drain pan is installed level			
Internal vibration isolators in good condition			
Shipping bolts on isolators are removed			
Belts are tight and pulleys aligned			
All piping components are installed as per project documents			
Piping is arrange for ease of unit/coil removal			
Piping supported as per project documents			
All valves and test ports are easily accessible			

PHYSICAL CHECKS			
	CxA	Others	Comments
Valve tags are attached			
Piping insulation installed as per project documents			
Ductwork flex connectors are properly installed			
Local disconnect installed in accessible location			
Motor rotation correct			
Control panel accessible			
Access doors operable			
Unit internals are clean and free from loose material			
Condensate drain is installed properly			

FAN COIL UNIT **UNIT** FC-04H

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Serial Number			
Voltage / Phase / Frequency			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is free from physical damage			
Coil surface areas are clean and free from damage			
Air filters clean			
Installation and startup manual provided			
Unit tags affixed			
Unit is secured as required by project documents			
Manufacturers recommended clearance is provided			
Unit can be removed if necessary			
Cooling coil drain pan is installed level			
Internal vibration isolators in good condition			
Shipping bolts on isolators are removed			
Belts are tight and pulleys aligned			
All piping components are installed as per project documents			
Piping is arrange for ease of unit/coil removal			
Piping supported as per project documents			
All valves and test ports are easily accessible			

PHYSICAL CHECKS			
	CxA	Others	Comments
Valve tags are attached			
Piping insulation installed as per project documents			
Ductwork flex connectors are properly installed			
Local disconnect installed in accessible location			
Motor rotation correct			
Control panel accessible			
Access doors operable			
Unit internals are clean and free from loose material			
Condensate drain is installed properly			

FAN COIL UNIT **UNIT** FC-12

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Serial Number			
Voltage / Phase / Frequency			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is free from physical damage			
Coil surface areas are clean and free from damage			
Air filters clean			
Installation and startup manual provided			
Unit tags affixed			
Unit is secured as required by project documents			
Manufacturers recommended clearance is provided			
Unit can be removed if necessary			
Cooling coil drain pan is installed level			
Internal vibration isolators in good condition			
Shipping bolts on isolators are removed			
Belts are tight and pulleys aligned			
All piping components are installed as per project documents			
Piping is arrange for ease of unit/coil removal			
Piping supported as per project documents			
All valves and test ports are easily accessible			

PHYSICAL CHECKS			
	CxA	Others	Comments
Valve tags are attached			
Piping insulation installed as per project documents			
Ductwork flex connectors are properly installed			
Local disconnect installed in accessible location			
Motor rotation correct			
Control panel accessible			
Access doors operable			
Unit internals are clean and free from loose material			
Condensate drain is installed properly			

Fan Pre-Functional Checklist **Unit** EF-FUME

MODEL VERIFICATION			
	Design	**Delivered**	**Data**
Manufacturer			
Model			
Serial Number			
Voltage / Phase / Frequency	120/1/60		
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit tags affixed			
Unit is clean and free from damage			
Unit is supported reqd by project documents			
Clearance is provided			
Unit can be removed if necessary			
10-ft clearance to roof edge if roof mounted			
Vibration isolators installed if interior fan			
Back draft damper installed			
Voltage / Phase / Frequency			
Disconnect located within sight of fan			
Speed controller installed			

Fan Pre-Functional Checklist **Unit** EF-FAB1

MODEL VERIFICATION			
	Design	**Delivered**	**Data**
Manufacturer			
Model			
Serial Number			
Voltage / Phase / Frequency	120/1/60		
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit tags affixed			
Unit is clean and free from damage			
Unit is supported reqd by project documents			
Clearance is provided			
Unit can be removed if necessary			
10-ft clearance to roof edge if roof mounted			
Vibration isolators installed if interior fan			
Back draft damper installed			
Voltage / Phase / Frequency			
Disconnect located within sight of fan			
Speed controller installed			

Fan Pre-Functional Checklist **Unit** EF-FAB2

MODEL VERIFICATION			
	Design	**Delivered**	**Data**
Manufacturer			
Model			
Serial Number			
Voltage / Phase / Frequency	120/1/60		

PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit tags affixed			
Unit is clean and free from damage			
Unit is supported reqd by project documents			
Clearance is provided			
Unit can be removed if necessary			
10-ft clearance to roof edge if roof mounted			
Vibration isolators installed if interior fan			
Back draft damper installed			
Voltage / Phase / Frequency			
Disconnect located within sight of fan			
Speed controller installed			

Fan Pre-Functional Checklist **Unit** EF-ELEV

MODEL VERIFICATION			
	Design	**Delivered**	**Data**
Manufacturer			
Model			
Serial Number			
Voltage / Phase / Frequency	120/1/60		
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit tags affixed			
Unit is clean and free from damage			
Unit is supported reqd by project documents			
Clearance is provided			
Unit can be removed if necessary			
10-ft clearance to roof edge if roof mounted			
Vibration isolators installed if interior fan			
Back draft damper installed			
Voltage / Phase / Frequency			
Disconnect located within sight of fan			
Speed controller installed			

Fan Pre-Functional Checklist **Unit** EF-MECH

MODEL VERIFICATION			
	Design	**Delivered**	**Data**
Manufacturer			
Model			
Serial Number			
Voltage / Phase / Frequency	120/1/60		

PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit tags affixed			
Unit is clean and free from damage			
Unit is supported reqd by project documents			
Clearance is provided			
Unit can be removed if necessary			
10-ft clearance to roof edge if roof mounted			
Vibration isolators installed if interior fan			
Back draft damper installed			
Voltage / Phase / Frequency			
Disconnect located within sight of fan			
Speed controller installed			

Fan Pre-Functional Checklist **Unit** EF-ELEC

MODEL VERIFICATION			
	Design	**Delivered**	**Data**
Manufacturer			
Model			
Serial Number			
Voltage / Phase / Frequency	120/1/60		
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit tags affixed			
Unit is clean and free from damage			
Unit is supported reqd by project documents			
Clearance is provided			
Unit can be removed if necessary			
10-ft clearance to roof edge if roof mounted			
Vibration isolators installed if interior fan			
Back draft damper installed			
Voltage / Phase / Frequency			
Disconnect located within sight of fan			
Speed controller installed			

Fan Pre-Functional Checklist **Unit** EF-TOILET

MODEL VERIFICATION			
	Design	**Delivered**	**Data**
Manufacturer			
Model			
Serial Number			
Voltage / Phase / Frequency	120/1/60		
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit tags affixed			
Unit is clean and free from damage			
Unit is supported reqd by project documents			
Clearance is provided			
Unit can be removed if necessary			
10-ft clearance to roof edge if roof mounted			
Vibration isolators installed if interior fan			
Back draft damper installed			
Voltage / Phase / Frequency			
Disconnect located within sight of fan			
Speed controller installed			

Fan Pre-Functional Checklist **Unit** DF-1

MODEL VERIFICATION			
	Design	**Delivered**	**Data**
Manufacturer			
Model			
Serial Number			
Voltage / Phase / Frequency	120/1/60		
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit tags affixed			
Unit is clean and free from damage			
Unit is supported reqd by project documents			
Clearance is provided			
Unit can be removed if necessary			
10-ft clearance to roof edge if roof mounted			
Vibration isolators installed if interior fan			
Back draft damper installed			
Voltage / Phase / Frequency			
Disconnect located within sight of fan			
Speed controller installed			

GROUND SOURCE WATER TO WATER HEAT PUMP CHILLER **Unit HRCH-1**

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Capacity (mbh)			
Refrigerant			
Voltage / Phase / Frequency			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Installation and startup manual provided			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Local disconnect installed in accessible location			
Control panel accessible			
Access doors operable			
Flow switch factory installed			
Piping supported prior to connection to keep weightoff unit			
Flexible connections installed			
Pressure and temperature guages installed			
Power wiring complete			
Control wiring complete			
Piping flushed prior to admitting water to chiller braze plate Htx			

HYDRONIC COMPUTER ROOM AIR CONDITIONING UNIT **UNIT** CRAC-1

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Serial Number			
Voltage / Phase / Frequency			

PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is free from physical damage			
Coil surface areas are clean and free from damage			
Unit tags affixed			
Manufacturers recommended clearance is provided			
Unit can be removed if necessary			
Cooling coil drain pan is installed level			
Piping is arrange for ease of unit removal			
Piping supported as per project documents			
Piping insulation installed as per project documents			
Local disconnect provided			
Wall mounted wired controller provided			
Condensate drain is installed properly			
Condensing Unit installed properly			
Condensing Unit piping installed and insulated			
Condensing Unit disconnect installed in sight of unit			
Condensing Unit labled			

OUTDOOR AIR UNIT **UNIT** OAU-1

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Serial Number			
Voltage / Phase / Frequency			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is free from physical damage			
Coil surface areas are clean and free from damage			
Air filters clean			
Installation and startup manual provided			
Unit tags affixed			
Unit is secured as required by project documents			
Manufacturers recommended clearance is provided			
Unit can be removed if necessary			
Cooling coil drain pan is installed level			
Internal vibration isolators in good condition			
Shipping bolts on isolators are removed			
Belts are tight and pulleys aligned			
All piping components are installed as per project documents			
Piping is arrange for ease of unit/coil removal			
Piping supported as per project documents			
All valves and test ports are easily accessible			

PHYSICAL CHECKS			
	CxA	Others	Comments
Valve tags are attached			
Piping insulation installed as per project documents			
Ductwork flex connectors are properly installed			
Roof curb isolation rail properly installed			
Roof curb flashing properly installed			
Local disconnect installed in accessible location			
Motor rotation correct			
Control panel accessible			
Access doors operable			
Unit internals are clean and free from loose material			
Condensate drain is installed properly			
Energy wheel clean and in good condition			
Energy wheel belt tight			
Bypass dampers close tightly			
Bypass dampers have rubber seals for low air leakage			

Base Mounted Pump **UNIT** CHWP-1

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Head (ft)			
Flowrate (gpm)			
Impeller diameter (in)			
Voltage / Phase / Frequency			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Installation and startup manual provided			
Unit tags affixed			
Unit is clean and free from damage			
Unit is supported and base grouted as reqd by project documents			
Clearance is provided			
Unit can be removed if necessary			
Piping is supported to prevent weight from resting on pump			
Flex connectors are installed and free from compression			
Support under suction diffuser if provided			
Pump alignment checked			
Coupling guard installed			
Differential pressure guage provided			

Base Mounted Pump **UNIT** CHWP-2

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Head (ft)			
Flowrate (gpm)			
Impeller diameter (in)			
Voltage / Phase / Frequency			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Installation and startup manual provided			
Unit tags affixed			
Unit is clean and free from damage			
Unit is supported and base grouted as reqd by project documents			
Clearance is provided			
Unit can be removed if necessary			
Piping is supported to prevent weight from resting on pump			
Flex connectors are installed and free from compression			
Support under suction diffuser if provided			
Pump alignment checked			
Coupling guard installed			
Differential pressure guage provided			

Base Mounted Pump **UNIT** GSW-1

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Head (ft)			
Flowrate (gpm)			
Impeller diameter (in)			
Voltage / Phase / Frequency			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Installation and startup manual provided			
Unit tags affixed			
Unit is clean and free from damage			
Unit is supported and base grouted as reqd by project documents			
Clearance is provided			
Unit can be removed if necessary			
Piping is supported to prevent weight from resting on pump			
Flex connectors are installed and free from compression			
Support under suction diffuser if provided			
Pump alignment checked			
Coupling guard installed			
Differential pressure guage provided			

Base Mounted Pump **UNIT** GSW-2

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Head (ft)			
Flowrate (gpm)			
Impeller diameter (in)			
Voltage / Phase / Frequency			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Installation and startup manual provided			
Unit tags affixed			
Unit is clean and free from damage			
Unit is supported and base grouted as reqd by project documents			
Clearance is provided			
Unit can be removed if necessary			
Piping is supported to prevent weight from resting on pump			
Flex connectors are installed and free from compression			
Support under suction diffuser if provided			
Pump alignment checked			
Coupling guard installed			
Differential pressure guage provided			

Base Mounted Pump **UNIT** HWP-1

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Head (ft)			
Flowrate (gpm)			
Impeller diameter (in)			
Voltage / Phase / Frequency			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Installation and startup manual provided			
Unit tags affixed			
Unit is clean and free from damage			
Unit is supported and base grouted as reqd by project documents			
Clearance is provided			
Unit can be removed if necessary			
Piping is supported to prevent weight from resting on pump			
Flex connectors are installed and free from compression			
Support under suction diffuser if provided			
Pump alignment checked			
Coupling guard installed			
Differential pressure guage provided			

Base Mounted Pump **UNIT** HWP-2

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Head (ft)			
Flowrate (gpm)			
Impeller diameter (in)			
Voltage / Phase / Frequency			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Installation and startup manual provided			
Unit tags affixed			
Unit is clean and free from damage			
Unit is supported and base grouted as reqd by project documents			
Clearance is provided			
Unit can be removed if necessary			
Piping is supported to prevent weight from resting on pump			
Flex connectors are installed and free from compression			
Support under suction diffuser if provided			
Pump alignment checked			
Coupling guard installed			
Differential pressure guage provided			

Base Mounted Pump **UNIT** SCHWP-1

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Head (ft)			
Flowrate (gpm)			
Impeller diameter (in)			
Voltage / Phase / Frequency			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Installation and startup manual provided			
Unit tags affixed			
Unit is clean and free from damage			
Unit is supported and base grouted as reqd by project documents			
Clearance is provided			
Unit can be removed if necessary			
Piping is supported to prevent weight from resting on pump			
Flex connectors are installed and free from compression			
Support under suction diffuser if provided			
Pump alignment checked			
Coupling guard installed			
Differential pressure guage provided			

Base Mounted Pump **UNIT** SCHWP-2

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Head (ft)			
Flowrate (gpm)			
Impeller diameter (in)			
Voltage / Phase / Frequency			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Installation and startup manual provided			
Unit tags affixed			
Unit is clean and free from damage			
Unit is supported and base grouted as reqd by project documents			
Clearance is provided			
Unit can be removed if necessary			
Piping is supported to prevent weight from resting on pump			
Flex connectors are installed and free from compression			
Support under suction diffuser if provided			
Pump alignment checked			
Coupling guard installed			
Differential pressure guage provided			

SKID Mounted Pump **UNIT** SSF-1

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Head (ft)			
Flowrate (gpm)			
Impeller diameter (in)			
Voltage / Phase / Frequency			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Installation and startup manual provided			
Unit tags affixed			
Unit is clean and free from damage			
Unit is supported and base grouted as reqd by project documents			
Clearance is provided			
Unit can be removed if necessary			
Piping is supported to prevent weight from resting on pump			
Flex connectors are installed and free from compression			
Support under suction diffuser if provided			
Pump alignment checked			
Coupling guard installed			
Differential pressure guage provided			

ROOF TOP UNIT **UNIT** RTU-KITCHEN

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Serial Number			
Voltage / Phase / Frequency			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is free from physical damage			
Coil surface areas are clean and free from damage			
Air filters clean			
Installation and startup manual provided			
Unit tags affixed			
Unit is secured as required by project documents			
Manufacturers recommended clearance is provided			
Unit can be removed if necessary			
Cooling coil drain pan is installed level			
Internal vibration isolators in good condition			
Shipping bolts on isolators are removed			
Belts are tight and pulleys aligned			
All piping components are installed as per project documents			
Piping is arrange for ease of unit/coil removal			
Piping supported as per project documents			
All valves and test ports are easily accessible			

PHYSICAL CHECKS			
	CxA	Others	Comments
Valve tags are attached			
Piping insulation installed as per project documents			
Ductwork flex connectors are properly installed			
Roof curb isolation rail properly installed			
Roof curb flashing properly installed			
Local disconnect installed in accessible location			
Motor rotation correct			
Control panel accessible			
Access doors operable			
Unit internals are clean and free from loose material			
Condensate drain is installed properly			
Energy wheel clean and in good condition			
Energy wheel belt tight			
Bypass dampers close tightly			
Bypass dampers have rubber seals for low air leakage			

ROOF TOP UNIT **UNIT** RTU-COMMONS

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Serial Number			
Voltage / Phase / Frequency			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is free from physical damage			
Coil surface areas are clean and free from damage			
Air filters clean			
Installation and startup manual provided			
Unit tags affixed			
Unit is secured as required by project documents			
Manufacturers recommended clearance is provided			
Unit can be removed if necessary			
Cooling coil drain pan is installed level			
Internal vibration isolators in good condition			
Shipping bolts on isolators are removed			
Belts are tight and pulleys aligned			
All piping components are installed as per project documents			
Piping is arrange for ease of unit/coil removal			
Piping supported as per project documents			
All valves and test ports are easily accessible			

PHYSICAL CHECKS			
	CxA	Others	Comments
Valve tags are attached			
Piping insulation installed as per project documents			
Ductwork flex connectors are properly installed			
Roof curb isolation rail properly installed			
Roof curb flashing properly installed			
Local disconnect installed in accessible location			
Motor rotation correct			
Control panel accessible			
Access doors operable			
Unit internals are clean and free from loose material			
Condensate drain is installed properly			
Energy wheel clean and in good condition			
Energy wheel belt tight			
Bypass dampers close tightly			
Bypass dampers have rubber seals for low air leakage			

ROOF TOP UNIT **UNIT** RTU-CULINARY

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Serial Number			
Voltage / Phase / Frequency			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is free from physical damage			
Coil surface areas are clean and free from damage			
Air filters clean			
Installation and startup manual provided			
Unit tags affixed			
Unit is secured as required by project documents			
Manufacturers recommended clearance is provided			
Unit can be removed if necessary			
Cooling coil drain pan is installed level			
Internal vibration isolators in good condition			
Shipping bolts on isolators are removed			
Belts are tight and pulleys aligned			
All piping components are installed as per project documents			
Piping is arrange for ease of unit/coil removal			
Piping supported as per project documents			
All valves and test ports are easily accessible			

PHYSICAL CHECKS			
	CxA	Others	Comments
Valve tags are attached			
Piping insulation installed as per project documents			
Ductwork flex connectors are properly installed			
Roof curb isolation rail properly installed			
Roof curb flashing properly installed			
Local disconnect installed in accessible location			
Motor rotation correct			
Control panel accessible			
Access doors operable			
Unit internals are clean and free from loose material			
Condensate drain is installed properly			
Energy wheel clean and in good condition			
Energy wheel belt tight			
Bypass dampers close tightly			
Bypass dampers have rubber seals for low air leakage			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-101

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-103

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-106

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-107

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-111

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-112

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-117

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-119

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-138.1

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-138.2

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-139

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-140

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-141

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-141B

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-142

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-143

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-145

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-146

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-147

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-148

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-150

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-156

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-220

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-226

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-226C

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-227

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-235

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-238.1

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-238.2

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-239

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-240

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-241

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-242

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-243

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-244

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-245

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-246

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-247

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-24

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-249

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-250

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE AIR TERMINAL UNIT **UNIT** SATU-256

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Primary air inlet diameter			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from physical damage			
Unit tags affixed			
Unit is supported as required by project documents			
Manufacturers recommended clearance is provided			
Control panel accessible			
Unit can be removed if necessary			
Piping installed per coil detail on drawings			
Balance valve ports are accessible for TABs			
Isolation valve handles are accessible from a ladder			
BAS control wiring installed			

SENSIBLE GROUND SOURCE HEAT PUMP **UNIT** GSCH-1

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Serial Number			
Voltage / Phase / Frequency			

PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from damage			
Unit tags affixed			
Unit is secured as required by project documents			
Manufacturers recommended clearance is provided			
Unit can be removed if necessary			
Unit is installed level			
Vibration isolators are installed			
All piping components are installed as per project documents			
Piping is arrange for ease of unit/coil removal			
Piping supported as per project documents			
All valves and test ports are easily accessible			
Valve tags are attached			
Piping Insulation installed as per project documents			
Local disconnect installed in accessible location			
Control panel accessible			

PHYSICAL CHECKS			
	CxA	Others	Comments
Access doors operable			

SENSIBLE GROUND SOURCE HEAT PUMP **UNIT** GSCH-2

MODEL VERIFICATION			
	Submitted	**Delivered**	**Data**
Manufacturer			
Model			
Serial Number			
Voltage / Phase / Frequency			
PHYSICAL CHECKS			
	CxA	**Others**	**Comments**
Unit is clean and free from damage			
Unit tags affixed			
Unit is secured as required by project documents			
Manufacturers recommended clearance is provided			
Unit can be removed if necessary			
Unit is installed level			
Vibration isolators are installed			
All piping components are installed as per project documents			
Piping is arrange for ease of unit/coil removal			
Piping supported as per project documents			
All valves and test ports are easily accessible			
Valve tags are attached			
Piping Insulation installed as per project documents			
Local disconnect installed in accessible location			
Control panel accessible			

PHYSICAL CHECKS			
	CxA	Others	Comments
Access doors operable			

APPENDIX D

Startup Reports

APPENDIX E

Test & Balance Reports

Design Phase Building Enclosure Commissioning Plan

New Construction High School Center II

Prepared for:

Thompson Consulting Engineers

Prepared by:

MSTB Commissioning Group

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Richmond, Virginia 23228
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Aug 26, 2024

Abbreviations and Definitions

The following are common abbreviations used in this document. Definitions are found in numerous sections of the Specifications.

AB - Air Barrier
A/E - Architect/Engineer
BAS - Building Automation System
BECx - Building Enclosure Commissioning
BOD - Basis of Design
BSC - Building Systems Commissioning
CA - Commissioning Authority
CC - Controls Contractor
CM - Construction Manager
CQC - Contractor's Quality Control Manager
Cx - Commissioning
CxC - Lead Commissioning Specialist
CxS - Technical Commissioning Specialist
EC - Electrical Contractor
EOR Engineer of Record
FAC - Fire Alarm Contractor
FPC - Fire Protection Contractor
GC - General Contractor
HVAC - Heating Ventilation and Air Conditioning
MC - Mechanical Contractor
O&M - Operation and Maintenance
OPR - Owner's Project Requirements
PM - Project Manager
QAR - Contracting Officer's Quality Assurance Representative
SUB - Subcontractor to the General
SUB - Subcontractor to the General
TAB - Test and Balance (Coontractor)

Basis of Design (BOD): A document that records the concepts, calculations, decisions, and product selections used to meet the Owner's Project Requirements and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

Commissioning (Cx): Commissioning is the process of ensuring that all building systems perform interactively according to the design intent and the installed systems meet the Owner's operational needs.

Commissioning Authority (CA): A person or firm responsible for the delivery of the commissioning process. Depending on the size and complexity of the project the process may be executed by one person or an entire team. For a team approach there would typically be a person dedicated to managing the process, while others are involved with the more technical aspects of the process.

Commissioning Coordination Drawings: Construction drawings that are color-coded for the ease of communication and identification of systems between the Cx team members. Color coding and numbering has no specific contractual meaning or engineering reference.

Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

Commissioning Process: A systematic process of ensuring that building systems perform interactively according to the contract documents, the design intent, and districts operational requirements. The commissioning process encompasses and coordinates traditionally separate functions of systems documentation, equipment, startup, control system calibration, testing and balancing, performance testing and training.

Commissioning Team: Individual team members whose coordinated actions are responsible for implementing the Commissioning Process.

Construction Documents: The latest full set of construction drawings, specifications, and submittals as well as any approved modifications, change orders and amendments.

Issues Log: A formal and ongoing record of issues or concerns and their resolutions that have been raised by members of the Commissioning Team during the course of the Commissioning Process.

Lead Commissioning Specialist (CxC): **T**he Commissioning Firm's designated individual to coordinate, manage, and execute the commissioning process. The CxC may also fulfill the role of one of the Technical Commissioning Specialists (CxS). This individual may also be referred to as the Commissioning Manager.

Owner's Project Requirements: A written document that details the functional requirements of a project and the expectations of how it will be used and operated. This includes project and design goals, measurable performance criteria, budgets, schedules, success criteria, and supporting information.

Technical Commissioning Specialist (CxS): A person employed by the Commissioning Firm with qualifications to perform technical work on a given system. These individuals may also be referred to as Commissioning Engineers or Commissioning Professionals.

Training Plan: A written document that details the expectations, schedule, and deliverables of Commissioning Process activities related to the training of project operating and maintenance personnel, users, and occupants.

Web Portal: This project will be managed by Web Portal. The Web Portal contains all pertinent documents for the commissioning process. All team members have access. Documents loaded to the portal will be e-mailed to the owner as well.

MSTB COMMISSIONING GROUP

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1. Overview

1.1. Purpose of the Building Enclosure Commissioning Plan

Commissioning is the systematic process of ensuring, by verification and documentation, that all building systems perform interactively according to the design intent and the Owner's Project Requirements (OPR). The purpose of the Commissioning Plan is to provide project-specific details regarding the commissioning process. The goal of the commissioning plan are to identify and define the following:

- The commissioning standard
- The specific systems to be commissioned for this project.
- The Commissioning Team Members and their roles and responsibilities
- Lines of communication
- Documentation requirements

This plan does not provide a detailed explanation of required testing procedures. The detailed testing requirements and procedures are found in the Contract Specifications. Additionally, this plan does not provide extensive narrative on all commissioning concepts, as may be provided in other commissioning guides.

The Commissioning Authority (CA) can and will utilize the project documents, applicable codes and standards, submittals, manufacturer's literature, and industry practices as guides during commissioning and to develop test plans, however, it is not the responsibility of the CA to verify compliance with these sources. Commissioning IS a quality control function and the OPR is the standard against which the success of commissioning is ultimately determined.

Successful commissioning requires a team effort. The CA is responsible for managing the commissioning process. Ultimately, the CA develops test checklists that must be executed by other members of the commissioning team, and the CA identifies commissioning items that must be addressed by other members of the commissioning team. Cooperation by all team members is essential for a successful project.

1.2. Commissioning Standard

The following standard will be used for the commissioning of this project:

- ASTM 2813-12e1 - Standard Practice for Building Enclosure Commissioning

1.3. Commissioning Scope

Commissioning is a systematic process of ensuring that all commissioned building systems perform interactively according to the Owner's Project Requirements (OPR) and Basis of Design (BOD). This is best achieved by beginning in the design phase, documenting the design intent and continuing through construction, acceptance and the warranty phase with actual verification of performance.

Construction Phase and Acceptance Phase Commissioning is intended to achieve the following specific objectives:

- Review submittals applicable to the building's enclosure.
- Verify and document proper installation and performance of building enclosure materials, assemblies, and systems.
- Maintain the Building Enclosure Commissioning Issues Log.
- Ensure that the final O&M documentation is in the care and custody of the owner.
- Ensure that the Owner's operating personnel are adequately trained.
- Prepare a final BECx Report.
- Develop an Ongoing Enclosure Commissioning Plan for maintenance, renewal, and revitalization cycles.

2. Commissioned Systems

Division 3

- Cast-In-Place Concrete

Division 4

- Unit Masonry

Division 7

- Waterproofing Systems
- Thermal Insulation
- Air Barrier System
- Metal Wall Panels
- Fiber-Reinforced Cementitious Wall Panels
- EPDM Roofing
- Flashings & Trim
- Joint Sealants

Division 8

- Exterior Doors
- Aluminum Framed Entrances and Storefronts
- Glazed Aluminum Curtainwalls

3. Roles and Responsibilities

3.1. Team Members

The success of the commissioning process is determined by its team members. The team's ability to accomplish the work, with teamwork and cooperation, is critical. Please refer to the Cx Team Directory in the beginning of this publication for specific team member contacts.

3.2. General Management Plan

In general, the CxC directs the commissioning activities and reports to the Owner copying the GC on all results in accordance with the construction documents. The CxC's responsibilities, along with all other contractors' commissioning responsibilities are outlined herein. All members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents. Refer to the management protocols section below.

3.3. General Descriptions of Roles

General descriptions of the commissioning roles are as follows:

Owner's Project Manager:

- Provides the Owner's Project Requirements (OPR)
- Facilitates the Commissioning Process
- Approves the Commissioning Plan
- Approves the Commissioning Report
- Has final authority in the decision making processes

Building Enclosure Commissioning Authority:

- Develops the Building Enclosure Commissioning Plan from the OPR, BOD, and Construction Documentation
- Develops the Building Enclosure Construction Checklists
- Attends the Building Enclosure Pre-Construction Meeting
- Witness and Verifies building enclosure systems testing
- Directs the BECx Process and activities
- Maintains the Building Enclosure Commissioning Issues Log
- Develops the Final Building Enclosure Commissioning Report
- Provides the On-going Building Enclosure Commissioning Plan

General Contractor:

- Conducts a Building Enclosure Pre-Construction Meeting prior to construction of the building enclosure systems
- Facilitates the Commissioning Process including all performance testing
- With Input from the Sub-contractors, completes the Building Enclosure Construction Checklists
- Ensures that the Sub-contractors perform their responsibilities
- Integrates Building Enclosure Commissioning into the Construction Process
- Integrates the commissioning schedule into the Master Schedule

Sub-contractors:

- Attends the Building Enclosure Pre-Construction Meeting
- Assists the General Contractor with completion of the Building Enclosure Construction Checklists
- Participates in and provides support for all building enclosure performance testing as specified

Architect / Engineer:

- Attends the Building Enclosure Pre-Construction Meeting
- Performs Construction and Performance Testing Observations
- Approves O&M Manuals
- Assists in Resolving BECx Issues

3.4. Lines of Communication

- For Requests for Information (RFI) or formal documentation requests, the CxC first goes through the Prime Contractor's PM.
- For minor or verbal information and clarifications, the CxC goes directly to the informed party.
- For notifying contractors of deficiencies, the CxC documents deficiencies through the CQC, but may discuss deficiency issues with contractors prior to notifying the CQC and Owner.
- For scheduling performance tests or training, the CxC provides input and coordination of testing and training. Scheduling is done through the CQC.
- For scheduling commissioning meetings, the CxC selects the date and schedules through the Contractor's PM.
- The CxC has no authority to issue change orders.
- Any changes in construction must be approved and documented by the A/E. The CxC may recommend changes, but final authority for changes rests with the A/E.
- If subcontractors disagree with the interpretations of the CxC, the issue should be resolved at the lowest level possible. First, the issue should be attempted to be resolved directly with the CxS, then with the CQC, and lastly the Owner. Some issues may require input from the A/E.

4. Building Enclosure Commissioning Process Matrix

The following matrix tabulates the major commissioning activities in the order they occur during the project life cycle and the commissioning team member roles and responsibilities for each activity. For additional detail, please refer to Section 5: Commissioning Activities Narratives.

In the Commissioning Team Member columns an "**R**" indicates the responsible team member for each activity, and a "✓" indicates a team member who needs to participate in the activity.

Cx ACTIVITY	PROJECT PHASE			Cx TEAM MEMBER							
	Construction	Acceptance	Warranty	Owners PM	Facility Manager	Building Maintenance	Construction Manager	Design Team	Construction Team	BECx Technical Specialist	Lead Cx Specialist
Construction Phase Cx Coordination Meeting	✓			✓			✓			✓	R
Cx Design Review (Construction Phase)	✓									R	✓
Submittal Review	✓						✓	R	✓	✓	✓
Construction Phase BECx Plan	✓									✓	✓
Building Enclosure Construction Checklist Development	✓									✓	✓
Laboratory Building Enclosure Performance Testing	✓			✓			✓	✓	R	✓	✓
Building Enclosure Pre-Construction Meeting	✓			✓	✓	✓	R	✓	✓	✓	✓
Mock-up Building Enclosure Performance Testing	✓			R			✓	✓	✓	✓	✓
BECx Site Observations	✓						✓		✓	R	✓

BECx Issues Log Maintenance	✓	✓	✓	✓		✓	✓	✓	✓	R	✓
Building Envelope Construction Checklist Execution	✓						R		✓	✓	✓
Periodic Meetings	✓			✓			R	✓	✓	✓	✓
In-Situ Building Enclosure Performance Testing	✓			R			✓	✓	✓	✓	✓
Owner Training Plan		✓					R		✓	✓	✓
Owner Training Delivery		✓			✓	✓	✓		R	✓	✓
Final BECx Report		✓								R	✓
Warranty Information Hand-off		✓			✓		R		✓	✓	
Systems Manual		✓					✓	✓	R	✓	✓
Ongoing BECx Plan		✓					✓	✓	✓	R	✓
10-Month Warranty Phase Checkup Site Visit and Meeting			✓		✓	✓		✓	✓	R	✓

Addendum to Final BECx Report			✓					✓	✓	R	✓

5. Building Enclosure Commissioning Activities Narrative

This section sequentially details the commissioning process by commissioning task or activity.

5.1 Construction Phase Commissioning Coordination Meeting

The lead commissioning specialist conducts a coordination meeting to discuss the commissioning process. The meeting provides an overview of the contract requirements, lines of communication, roles and responsibilities, schedules, documentation requirements, inspection and test procedures, and logistics for the construction phase of the project as they pertain to the overall commissioning process.

5.2 Construction Phase Commissioning Design Review

The Building Enclosure Technical Commissioning Specialist reviews the construction contract plans and specifications, the Owner's Project Requirements Document, and the Basis of Design. Discrepancies between the Basis of Design and Owner's Project Requirements, deficiencies of the design to comply with the Owner's Project Requirements or Basis of Design, and deficiencies that would prevent the building systems and features from operating or performing effectively and from being adequately maintainable are submitted in the Construction Phase Building Enclosure Commissioning Design Review Report.

5.3 Submittal Review

The Building Enclosure Technical Commissioning Specialist will identify submittals associated with systems to be commissioned that need to be reviewed.

BECx submittal review comments will focus on the same areas as the commissioning design reviews (e.g. compliance with the OPR, clarity of the design, integration coordination, accessibility and maintainability, O&M training and documentation requirements, and the ability to test and validate the systems). Any discrepancies will be recorded in the BECx Issues Log.

5.4 Final Construction Phase Commissioning Plan

The Building Enclosure Technical Commissioning Specialist finalizes the BECx Plan using the information gathered from the Design Phase BECx Plan responses. Before test procedures are written, the BECx Firm obtains all requested documentation and a current list of change orders affecting materials, assemblies, or systems.

As part of the Building Enclosure Commissioning Plan, the Building Enclosure Technical Commissioning Specialist identifies the specific test procedures to verify proper operation of each piece of equipment and system, using the testing requirements in the specification sections. Prior to execution, the Building Enclosure Technical Commissioning Specialist provides a copy of the primary equipment tests to the Construction Manager who reviews the tests for feasibility, safety, warranty, and equipment protection. The CxS reviews owner-contracted, factory, or required owner acceptance tests and determines what further testing may be required to comply with the Specifications.

5.5 Building Enclosure Construction Checklists

The Building Enclosure Technical Commissioning Specialist develops the Building Enclosure Construction Checklists from the construction documents and the approved submittals. These checklists include items that verify that the building materials and construction will maintain the required thermal performance, moisture integrity, and air-tightness of the building envelope systems. The Building Enclosure Technical Commissioning Specialist will make at a minimum of ten site visits to observe construction of the building envelope in progress and to review the contractor's in-progress checklists to ensure that the BECx Team is inspecting the building enclosure as required.

5.6 Laboratory Building Enclosure Performance Testing

The Building Enclosure Technical Commissioning Specialist shall witness and verify laboratory testing of any building enclosure assemblies, or systems at the discretion of the BECx Firm. Any deficiencies will be recorded in the BECx Issues Log.

5.7 Building Enclosure Pre-Construction Meeting

A Building Enclosure Pre-Construction Meeting is a crucial part of the construction quality control process. This meeting establishes expectations for the installation and subsequent warranties of the components of the building enclosure. By having a pre-construction meeting prior to the commencement of field operations, the owner, design team, general contractor, sub-contractors, and manufacturers are presented with the opportunity to discuss and resolve issues the various trades might encounter during the construction process.

5.8 Mock-up Building Enclosure Performance Testing.

The Building Enclosure Technical Commissioning Specialist shall witness and verify all testing performed on the construction mockup(s), either stand-alone or in-situ. Deficiencies will be recorded in the BECx Issues Log.

5.9 Site Observations

The Technical Commissioning Specialists make periodic visits to the site, as necessary, to witness equipment and system installations. A Site Observation Report is created and distributed after each site visit. The Owner will receive e-mailed attachments as well.

5.10 BECx Issues Log

Throughout construction, the The Building Enclosure Technical Commissioning Specialist provides Site Observation Reports which detail findings and observation during the visits. Included in these reports are any issues which may affect the outcome or success of building enclosure commissioning. These issues are transferred and tracking using the BECx Issues Log. All issues are deemed “open” until resolved and verified by either the BECx Firm or the Owner.

5.11 Periodic Meetings

The Building Enclosure Technical Commissioning Specialists attend selected planning and job-site meetings, at their discretion, in order to remain informed on construction progress and to update parties involved in commissioning. The Owner and Construction Manager provide the BECx Firm with information regarding substitutions, change orders and any supplemental instructions that may affect the commissioning schedule. During construction, necessary meetings between various commissioning team parties will be scheduled by the BECx Firm, through the Construction Manager, as required.

5.12 In-Situ Building Enclosure Performance Testing

The Building Enclosure Technical Commissioning Specialist shall witness and verify all testing performed on the building enclosure assemblies as installed. Deficiencies will be recorded in the BECx Issues Log.

5.13 Deficiencies and Non-Conformance

The Building Enclosure Technical Commissioning Specialist works with the subcontractors and vendors to manage corrections and retest deficiencies found during inspections and testing - involving the CM and others as necessary. The installing subcontractors or vendors correct all areas that are deficient or incomplete according to the checklists and tests.

5.14 Owner Training

The Construction Manager develops a training plan which identifies all training required by specification sections associated with commissioned systems. Include a matrix listing each training requirement, content of the training, the trainer name, trainer contact information, and schedule and location of training. The training plan is submitted to the Building Enclosure Commissioning Technical Specialists prior to the associated training. Training attendance is documented by the Construction Manager using training attendance rosters. Completed attendance rosters are provided to the BECx Firm no later than 7 calendar days following the completion of training for each system for which it is required.

5.15 Final Building Enclosure Commissioning Report

The Final Building Enclosure Commissioning Report includes an executive summary, list of participants and roles, brief building description, overview of commissioning and testing scope and a general description of testing and verification methods. In addition, the report shall contain the following BECx documentation:

- The BECx Issues Log
- The completed Building Enclosure Construction Checklists
- All BECx Site Observation Reports
- Copies of all laboratory, mock-up, and in-situ performance testing

Each non-compliance issue shall be referenced to the specific performance test, inspection, etc. where the deficiency is documented.

5.16 Warranty Information Hand-off

The Contractor and the Construction Manager will provide warranty information to the Owner for the commissioned systems. The warranty information will be transferred prior to Substantial Completion and will include, but not be limited to, master systems list; warranty start and end dates; manufacturer contact information; extended warranty (if any) details; planned maintenance activities required to keep equipment under warranty; etc. The Owner will review and approve the warranty information submitted at the end of construction for compliance with the specifications.

5.17 Systems Manual

The Building Enclosure Technical Commissioning Specialist collects and compiles the Systems Manual. At a minimum, the following documents shall be included:

- Owner’s Project Requirements
- Basis of Design
- Overview of All Enclosure Types and Systems
- Location of All Enclosure Systems
- Maintenance and Inspection Schedules
- Replacement Schedule

The Commissioning Manager will submit the Systems Manual to the Owner and Construction Manager for review.

5.18 Ongoing BECx Plan / Service Life Plan

The Building Enclosure Technical Commissioning Specialist develops a plan to repeatedly perform the BECx process at predefined intervals in order to further optimize the service life, energy efficiency, and function of the building systems. This process is typically performed manually and is supplemental to any preventative maintenance plans.

5.19 10-Month Warranty Phase Check-up Site Visit and Meeting

No later than 2 months before the end of the Warranty Phase, a warranty meeting will be planned, facilitated, and documented by the Lead Commissioning Specialist. This meeting is an opportunity for Facilities Management and other Owner representatives to provide feedback on the effectiveness and efficiency of the new equipment and systems. The Design Team and Construction Team are required to participate in the warranty meeting.

The Owner will oversee the collection of operations issues, concerns, challenges, etc., throughout the Warranty Phase in order for the warranty meeting to be as comprehensive and meaningful as practical. Information received by the Design Team and Construction Team will be used to track and correct warranty-related issues; to contribute to future Owner's Project Requirements documents; and to refine the Owner’s project delivery process.

5.20 Addendum to Final BECx Report

Following the Post Construction Site Visit, the Building Enclosure Commissioning Technical Specialist submits an addendum to the Final Building Enclosure Commissioning Report with any updates resulting from these activities.

6. Building Enclosure Commissioning Documentation Requirements

6.1 Construction and Acceptance Phase Documents

Acceptance of Building Enclosure Commissioning requires the acceptance of the Construction, Acceptance, and Warranty Phase Documents. Documentation delivered at the conclusion of the these phases includes:

- Final Commissioning Plan – BECx Firm
- Laboratory Test Reports – Subcontractors to the GC
- Building Enclosure Construction Checklists – BECx Firm
- Mock-up Test Reports – Subcontractors of the GC and Owner
- BECx Site Observation Reports – BECx Firm
- Completed Building Enclosure Construction Checklists – GC with input from subcontractors
- Building Enclosure In-Situ Test Reports - Subcontractors of the GC and Owner
- Owner Training Plan – Subcontractors of the GC
- Owner Training Attendance Rosters – GC
- Building Enclosure Commissioning Report – BECx Firm
- BECx Systems Manual – BECx Firm
- Ongoing BECx Plan - BECx Firm
- Addendum to the Final BECx Report - BECx Firm

Appendix A: Sample BECx Issues Log

SAMPLE PROJECT

Sample BECx Issues Log

CLOSED	INFO. ONLY	AWAIT. VER.	OPEN
0 0% of 1	0 0% of 1	0 0% of 1	1 100% of 1

ID	Priority	Category	Description	Owner Status	Resp. Status	Assoc. With	Assigned To	Due	Date Closed
BECx Issue - 001	Medium	EIFS	Sample issue text, description of issue here.	Open	Open	Sample Project	erichs@mstbcx.com	1/1/2025 12:00:00 AM	

SECTION 010200

GENERAL SITEWORK REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

1.2 SITEWORK LAYOUT

A. Monuments and Benchmarks

1. Maintain all monuments, property corners, bench marks and other reference points.
2. If these are disturbed or destroyed during construction operations, have them replaced by a surveyor licensed in the Commonwealth of Virginia. This replacement shall be at no additional expense to the Contract.

B. Laying out the Work.

1. Locate all existing bench marks and other reference points.
2. Protect these points throughout construction.
3. Layout work utilizing these reference points.

C. Record Drawings

1. Maintain a record of the horizontal and vertical locations of all underground utilities and piping, both newly installed and existing encountered.
2. Maintain a record of any variations of the work.
3. Record Drawings shall be certified by a Land Surveyor registered in the Commonwealth of Virginia.
4. Maintain record drawings throughout construction, recording information as work is performed. Record Drawings shall be available for periodic inspection during the course of the project.
5. Submit final, complete record drawings at Substantial Completion.

1.3 EASEMENTS

A. Verify the acquisition of all off-site easements and Rights-of-Way prior to the start of off-site construction. This may be done by contacting the Architect.

B. Restore all off-site easements to the condition existing prior to the start of work.

1.4 MAINTENANCE OF TRAFFIC

A. Maintain vehicular and pedestrian traffic across the frontage of this project. Comply with all applicable safety requirements.

1.5 CORRELATION OF CONSTRUCTION DOCUMENTS

A. Review construction documents thoroughly prior to the start of construction.

B. Report any conflict or discrepancy discovered in the Construction Documents to the Architect prior to the start of construction.

C. Report any conflict or discrepancy discovered between the Construction Documents and state and local governmental regulations to the Architect prior to the start of construction.

1.6 PROJECT CONDITIONS

A. The conditions existing at the time of inspection for bidding purposes will be maintained by the Owner to the extent practical. However, minor variations may occur due to natural occurrences prior to the start of clearing work.

B. The location of existing underground utilities indicated is approximate only. Field locate all existing underground utilities in the area of work, regardless of whether or not they are indicated. Call “Miss Utility” prior to the start of demolition work for assistance in the location of existing underground utilities.

C. Should charted, uncharted or incorrectly charted utilities be encountered during demolition, contact the Architect immediately for instructions. Cooperate with Owner and utility companies to keep services and facilities in operation.

1.7 SCHEDULING

A. See Final Site Plan for scheduling of site related items.

PART 2 – PRODUCTS (Not Applicable)

PART 3 – EXECUTION

3.1 PROJECT CLEAN UP

A. Clean site as construction progresses. Do not allow trash or other waste materials to accumulate.

B. Prior to requesting the punch-list inspection, clean the site to the following requirements:

1. Power wash all walks and pavements.
2. The remainder of the site shall be broom clean.
3. Remove all trash and debris.

3.2 EXISTING FACILITIES

A. Preserve existing signs, markers, guardrails, fences and other amenities in their original condition unless written permission is obtained for their removal and replacement.

B. Replace damaged items at no additional cost to the Contract.

END OF SECTION 010200

SECTION 011000
SUMMARY

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Project information.
   2. Work covered by Contract Documents.
   3. Access to site.
   4. Coordination with occupants.
   5. Work restrictions.
   6. Specification and drawing conventions.
   7. Miscellaneous provisions.

1.02 PROJECT INFORMATION

A. Project Identification: New Construction High School Center II
   1. IFB No. 2025-IFB-1007262

B. Project Location:
   1. 2775 Hydraulic Rd, Charlottesville, Virginia 22901

1.03 OWNER:

A. Name: County of Albemarle, Virginia
   1. Address Line 1: 401 McIntire Road.
   2. Address Line 2: Suite 248.
   3. City: Charlottesville.
   4. State: Virginia.
   5. Zip Code: 22902.

B. Primary Contact: All correspondence from the Contractor to the Architect will be direct, with copies to this party, unless alternate arrangements are mutually agreed upon at preconstruction meeting.
   1. Title: Senior Project Manager.
   2. Name: Kagan Squire.
   3. Email: ksquire2@k12albemarle.org.

1.04 CONSULTANTS:

A. Architect: Design Professional of Record. All correspondence from the Contractor regarding construction documents authored by Architect's consultants will be through this party, unless alternate arrangements are mutually agreed upon at preconstruction meeting.

1. Company Name: Quinn Evans.
    a. Address: 1840 West Broad Street, Suite 400.
    b. City, State, Zip: Richmond, VA 23220.
    c. Phone: (804) 788-4774.

1.05 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of this Project is defined by the Contract Documents and includes, but is not limited to, the following:
    1. Demolition of a +/- 10,000 SF existing building and associated parking lots and outbuildings
    2. Construction of a +/-62,000 SF new school building
    3. Construction of site improvements around the new building and in various locations on the Albmemarle High School Campus, including but not limited to play fields, parking lots, driveway improvements, sidewalks and stormwater management facilities.
    4. Installation of a geothermal wellfield serving the new building.

1.06 WORK SEQUENCE AND PROJECT COMPLETION SCHEDULE

A. See Section 013216 - Construction Progress Schedule.
B. The Contractor shall achieve Substantial Completion of the work Sequences not later than as provided in the Supplemental General Conditions and as indicated in the Drawings.
C. It is intended that the execution of the construction work be continuous. The Contractor shall schedule work such that required materials and resources are on hand; and that work progresses in a manner providing the shortest construction schedule while working normal hours. After work hours shall be built into the schedule as necessary to accomplish work which cannot be accomplished during normal hours without disrupting the Owner's use of the premises.

1.07 CONTRACTOR USE OF THE PREMISES

A. General: Contractor shall have limited use of Project site for construction operations as indicated by the Contract limits and as indicated by requirements of this Section. The Contractor’s use of the premises is limited by the Owner’s necessity to maintain this public facility in operation.
B. Use of Site: Use of the site for parking and storage is limited. Parking Spaces, Ground Storage and Staging Area available for the Contractor will be as designated by the Owner and as indicated on Drawings.

1. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
    a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
    b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
2. Site Access Points for Construction Activities have been identified on the Drawings.
3. Separate Projects performed by other Contractors will be carried out on the project site and in adjacent buildings during the course of the Work. Refer to Drawings for locations and schedule of Separate Projects. Contractor shall coordinate work efforts to not interfere with separate projects and to prevent separate projects from impeding the completion of this Project.

1.08 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.
    1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
    1. Notify Owner and Architect not less than two days in advance of proposed utility interruptions.
    2. Obtain Architect's written permission before proceeding with utility interruptions.
C. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
    1. Notify Owner not less than two days in advance of proposed disruptive operations.
    2. Obtain Owner's written permission before proceeding with disruptive operations.
D. Nonsmoking Building: Smoking and Vaping is not permitted on the School campus.
E. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.
F. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

G. Employee Screening: Comply with Owner's requirements for drug and background screening of:
   1. Contractor personnel working on Project site.
H. Maintain list of approved screened personnel with Owner's representative.

1.09 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
   1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
   2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
   1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
   2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.
   3. Keynoting: Materials and products are identified by reference keynotes referencing specification Section numbers found in this Project Manual.

1.10 CORRELATION OF CONSTRUCTION DOCUMENTS

A. Review construction documents thoroughly prior to the start of construction.
B. Report any conflict or discrepancy discovered in the Construction Documents to the Architect prior to the start of construction.
C. Report any conflict or discrepancy discovered between the Construction Documents and state and local governmental regulations to the Architect prior to the start of construction.

1.11 PROJECT CONDITIONS

A. The conditions existing at the time of inspection for bidding purposes will be maintained by the Owner to the extent practical.

1.12 MISCELLANEOUS PROVISIONS

A. ACBM Materials: All new construction shall be free from asbestos containing building materials. The Contractor shall submit certification at the completion of the job that no asbestos containing materials have been used in the construction.

B. Lead-Free Certification: All new construction shall be free from lead containing paint or plumbing materials. The Contractor shall submit certification at the completion of the job that no lead containing materials have been used in the painting or plumbing of this construction

C. Fraternization between construction personnel and non-construction personnel is strictly prohibited. Construction personnel shall not speak to students.

D. Construction workers shall not use the building restrooms in an occupied facility unless designated for use in the specifications.

E. Construction workers shall not consult with school personnel regarding any issue of a construction nature except as necessary for scheduling school activities and in emergency situations.

F. Use of vulgar, suggestive or abusive language or gestures is strictly prohibited on school grounds.

G. Use of radios/stereos or other noise producing equipment may be deemed unacceptable in occupied facilities if they are disruptive to the educational environment.

H. The school waste containers (interior and exterior) are not for construction debris.

I. Construction workers will be properly dressed at all times, including clothing with a company logo.

J. Record Drawings:

1. Maintain a record of the locations of all underground utilities and piping.
2. Maintain a record of any variations of the work.
3. Record Drawings shall be certified by a Land Surveyor registered in the Commonwealth of Virginia.

1.13 PERMITS AND FEES

A. The Contractor shall obtain the Building Permit. Sub-Contractors shall apply for and obtain their respective trade permits after the Building Permit has been issued. There is no cost for the Permits as work occurs within a County-owned facility. The Contractor shall pay for all other fees as may be required by authorities having jurisdiction over this project.

1.14 IAQ SITE MAINTENANCE PROTOCOLS

A. Maintain cleaning protocols required of sustainability goals outlined for the Project.

B. Keep the workplace as clean and dust free as practical and "broom clean" as a daily minimum.

C. Stored materials shall be raised above grade or finished floor. If stored outside the immediate work area (within the building), care shall be taken to protect the materials and/or fixtures from moisture absorption, dirt, dust or other contaminants.

D. When possible, paper or cardboard wrapping shall be removed and taken off site.

E. Casual or minor spills shall be immediately mopped up.

F. No food or drink shall be allowed in the buildings during construction.

1.15 OWNER'S SEPARATE CONTRACTORS

A. The Owner reserves the right to employ separate contractors during construction operations of this contract.

B. It is the responsibility of the General Contractor to coordinate his schedule and construction activities with the Owner's separate contractors.

C. Audio/Visual components (Displays, Media Servers and related components) will be provided under Owner's separate contract.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 012000
PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.
B. Documentation of changes in Contract Sum and Contract Time.
C. Change procedures.
D. Procedures for preparation and submittal of application for final payment.

1.02 RELATED REQUIREMENTS

A. Section 005000 - Contracting Forms and Supplements: Forms to be used.
B. Section 013329.02 - Sustainable Design Reporting - LEED v4 and v4.1: Projects seeking sustainability certification.

1.03 SCHEDULE OF VALUES

A. Arrange Schedule of Values based on County of Albemarle's standard format.
B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.
C. Forms filled out by hand will not be accepted.
D. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement, but no later that 10 business days before submission of first Application for Payment and as outlined below.
E. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section.
F. Stored Materials: Provide line items for each part of Work that includes materials or equipment that is stored prior to install or use.
G. Submittal Schedule: Provide a separate line item in the Schedule of Values for creating, updating and coordinating the required Submittal Schedule with other activities including but not limited to, Construction Schedule changes, scope changes, substitutions, and unforeseen conditions.
H. Coordination Documents: Provide a separate line item in the Schedule of Values for creating, updating, submitting, and each resubmission of the Coordination Documents delivered to Architect for review.
I. Include within each line item, a direct proportional amount of Contractor's overhead and profit.

J. General Conditions: Provide separate line items for general condition expenses, inlcuding but not limited to mobilization, supervision, project management, CPM schedule and updates, field offices, temporary facilties, and waste removal.

K. Revise schedule to list approved Change Orders, with each Application For Payment.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

A. Application for Payment Forms: Use Albemarle County Form AC-12.

B. Draft Copy: Submit "pencil copy" of Application for Payment one week prior to date of application review.

C. Payment Period: Submit at intervals stipulated in the Agreement.

D. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

1. Initial Application for Payment: The following items must precede or coincide with first Application for Payment:
    a. List of subcontractors.
    b. Schedule of Values.
    c. Contractor's Construction Schedule.
    d. Schedule of identified unit prices.
    e. Submittals Schedule.
    f. List of Contractor's key staff assignments.
    g. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
    h. Certificates of insurance and insurance policies.

E. Application for Payment at Substantial Completion: Application for Payment following issuance of Certificate of Substantial Completion shall show 100 percent completion for portion of the Work deemed substantially complete.

1. Complete procedures related to Substantial Completion specified in Section 017000.
2. Reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

F. Application for Final Payment: See article at end of this section.

G. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.

H. Forms filled out by hand will not be accepted.

I. For each item, provide a column for listing each of the following:

1. Item Number.

2. Description of work.
3. Scheduled Values.
4. Previous Applications.
5. Work in Place and Stored Materials under this Application.
6. Authorized Change Orders.
7. Total Completed and Stored to Date of Application.
8. Balance to Finish.
9. Retainage.

J. Execute certification by signature of authorized officer.

K. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.

L. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.

M. Submit electronic copy of draft Application to Architect and Owner 7 day(s) in advance of project progress meeting at which draft application will be reviewed.

N. Submit one electronic and two hard-copies of each Application for Payment.

O. Include the following with the application:
1. Transmittal letter as specified for submittals in Section 013000.
2. Construction progress schedule, revised and current as specified in Section 013216.
3. Current construction photographs specified in Section 013000.
4. Partial release of liens from major subcontractors and vendors.
5. Sustainable design documentation applicable to work for which application is being made; see Section 013329.02 for projects seeking LEED v4 certification.

P. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.05 MODIFICATION PROCEDURES

A. Architect's Supplemental Instruction: For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor.

B. Construction Change Directive: For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.

1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
2. Promptly execute the change.
3. Maintain detailed records on a Time and Materials basis as required by the Construction Change Directive.
4. On completion or at intervals agreed upon with Owner, submit an itemized account and supporting data substantiating cost and time adjustments to the Contract.

C. Owner-Initiated Proposal Request: For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications,and a change in Contract Time for executing the change . Contractor shall prepare and submit a fixed price quotation within 14 days, or within the time indicated in proposal request. Substantiate costs as described in paragraphs below.
   1. Schedule: Include draft of project schedule reflecting impact of proposal request on project completion.

D. Contractor-Initiated Proposals: Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and a statement describing the effect on work by separate or other contractors. Document any requested substitutions in accordance with Section 016000.
   1. Schedule: Include draft of project schedule reflecting impact of proposal request on project completion.

E. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
   1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
   2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
   3. For pre-determined unit prices and quantities, the amount will be based on the fixed unit prices.
   4. For change ordered by Architect and Owner without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.

F. Substantiation of Costs: Provide full information required for evaluation.
   1. Provide the following data:
      a. Quantities of products, labor, and equipment.
         1) Quantities: Include quantities of materials or products required and eliminated. Include survey data when requested to verify quantities.
      b. Taxes, insurance, and bonds.
      c. Overhead and profit.
      d. Justification for any change in Contract Time.
      e. Credit for deletions from Contract, similarly documented.
   2. Support each claim for additional costs with additional information:
      a. Origin and date of claim.
      b. Dates and times work was performed, and by whom.
      c. Time records and wage rates paid.
      d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
   3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.

G. Execution of Change Orders: Architect will issue Change Orders for signatures of parties on Contract Change Order Form AC-11 with appropriate change order estimates on appropriate Change Order Estimate Forms, Forms GC-1, SC-1, and SS-1.

H. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

I. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

1.06 APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

B. Application for Final Payment will not be considered until the following have been accomplished:
   1. All closeout procedures specified in Section 017000.

2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations have been paid..
3. Updated final statement, accounting for final changes to Contract Sum.
4. Contractor's Certificate of Substantial Completion - Form AC-13.2a.
5. Certificate of Final Completion by the Contractor - Form AC-13.2.
6. Final occupancy permit.
7. Final meter readings for utilities and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 012100
ALLOWANCES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

B. Related Requirements:

1. Section 012200 "Unit Prices" for procedures for using unit prices, including adjustment of quantity allowances when applicable.
2. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
3. Section 014000 "Quality Requirements" for procedures governing the use of allowances for field testing by an independent testing agency.

1.03 DEFINITIONS

A. Allowance: A quantity of work or dollar amount included in the Contract, established in lieu of additional requirements, used to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

B. Unit Price: An amount incorporated into the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.04 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection, or purchase and delivery, of each product or system described by an allowance must be completed by the Owner to avoid delaying the Work.

B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

1.05 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances in the form specified for Change Orders.

1.06 INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.07 UNIT PRICE ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight , and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. The Contractor shall include in the Total Base Bid all allowances stated in the Contract Documents.

D. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

E. Include in the unit price the cost of quantity verification by a Surveyor Licensed in the Commonwealth of Virginia.

F. Whenever costs are more or less than allowances, the Total Base Bid shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect the difference between actual costs and the allowance.

1.08 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, required maintenance materials, and similar margins.

1. Include installation costs in purchase amount only where indicated as part of the allowance.
2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other markups.
3. Submit substantiation of a change in scope of Work, if any, claimed in Change Orders related to unit-cost allowances.
4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.02 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.03 SCHEDULE OF UNIT PRICE ALLOWANCES

A. Include the following Allowances in the **Total Base Bid Amount**.

B. Allowance No. 1: **EXCAVATION OF UNSUITABLE MATERIAL**: Include **500 cu. yd.** of unsatisfactory soil excavation below or in addition to the levels required for the Work. Dispose of unsuitable materials in an approved location off-site. Replace with satisfactory structural soil material from off-site, as specified in Section 313000 "Earthwork."

1. Coordinate quantity allowance adjustment with unit-price requirements in Section 012200 "Unit Prices."

C. Allowance No. 2: **EXCAVATION IN TRENCHES**: Include an allowance for **100 cubic yards** for excavation of material in trenches in footings, where authorized or directed, below or in addition to the levels required for the Work. Dispose of excavated materials in an approved off-site location. Backfill with materials compacted as specified in Section 313000 "Earthwork."

1. Coordinate quantity allowance adjustment with unit-price requirements in Section 012200 "Unit Prices".

D. Allowance No. 3: **EXCAVATION OF ROCK:** Include an allowance for **100 cubic yards** for excavation of rock material, where authorized or directed, below or in addition to the levels required for the Work. Dispose of excavated materials in an approved off-site location. Backfill with materials compacted as specified in Section 313000 "Earthwork."
   1. Coordinate quantity allowance adjustment with unit-price requirements in Section 012200 "Unit Prices".

E. Allowance No. 4: **EXCAVATION OF TRENCH ROCK:** Include an allowance for **250 cubic yards** for excavation of rock material in trenches, where authorized or directed, below or in addition to the levels required for the Work. Dispose of excavated materials in an approved off-site location. Backfill with materials compacted as specified in Section 313000 "Earthwork."
   1. Coordinate quantity allowance adjustment with unit-price requirements in Section 012200 "Unit Prices".

F. Allowance No. 5: **SUBSURFACE DRAINS**: Include an allowance for **150 linear feet** of subsurface drain equivalent to VDOT Std. UD-4 standard pavement edge drain, in place, beyond that required by the Work per the Drawings and Specifications.
   1. Coordinate quantity allowance adjustment with unit-price requirements in Section 012200 "Unit Prices".

G. Allowance No. 6: **VDOT #1 STONE**: Include an allowance of **100 c.y.** of VDOT #1 stone, delivered, installed and compacted in place, in addition to the levels required for the Work.
   1. Coordinate quantity allowance adjustment with unit-price requirements in Section 012200 "Unit Prices".

H. Allowance No. 7: **VDOT #57 AGGREGATE:** Inlcude an allowance of **200 c.y.** of VDOT #57 stone, delivered, installed and compacted in place, in addition to the levels required for the Work.
   1. Coordinate quantity allowance adjustment with unit-price requirements in Section 012200 "Unit Prices".

I. Allowance No. 8: **GEOTEXTILE FABRIC**: Include an allowance of **200 square yards** of woven geotextile fabric in-place, in addition to the levels required for the work.
   1. Coordinate quantity allowance adjustment with unit-price requirements in Section 012200 "Unit Prices".

J. Allowance No. 9: **SMOKE DETECTORS**: Include an allowance of **five (5)** additional smoke detectors installed and hooked up to the fire alarm system, beyond that required by the Work as specified in Division 28, at the direction of Owner, Architect or Code Official.

K. Allowance No. 10: **EXIT SIGNS:** Include an allowance of **five (5)** single face exit signs, installed, and wired, beyond that required by the Work as specified in Division 26.

L. Allowance No. 11: **GEOTHERMAL WELLS:** Installation of **one (1)** geothermal well, inclusive of 40' of casing. Final amount shall be adjusted upward or downward based on actual quantity authorized.

M. Allowance No. 12: **GEOTHERMAL WELL CASING:** Include an allowance of **twenty (20) linear feet** of well casing, furnished and installed, in addition to the amounts indicated in the Drawings and Specifications.

N. Allowance No. 13: **ACM WATERLINE REPLACEMENT:** Include an allowance for the cost to remove and replace existing ACM Waterline as indicated on the Drawings. Establish a Unit price per linear foot for the complete scope of replacement. Unit Price will be used for establishing adjustments to Contract Sum if additional length of water line, beyond that indicated on Drawings. Include disposal of waste in accordance with the Specifications.

END OF SECTION

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SECTION 012200
UNIT PRICES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Requirements:

1. Section 012100 "Allowances" for procedures for using unit prices to adjust quantity allowances.
2. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
3. Section 014000 "Quality Requirements" for field testing by an independent testing agency.

1.03 DEFINITIONS

A. Unit price is an amount incorporated into the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.04 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

C. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the Part 3 "Schedule of Unit Prices" Article contain requirements for materials described under each unit price.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SCHEDULE OF UNIT PRICES

A. **Unit Price No. 1: EXCAVATION OF UNSUITABLE MATERIAL** below or in addition to the levels required for the Work. Dispose of unsuitable materials in an approved location off-site. Replace with satisfactory structural soil material from off-site, as specified in Section 313000 "Earthwork." Credit or additions to the Contract Price for actual quantities removed and replaced (based on volume of material cut) shall be made per the Unit Prices contained in the Bid Form. Include in the unit price the cost of quantity verification by a Surveyor Licensed in the Commonwealth of Virginia.
   1. Unit of Measurement: cubic yard of soil excavated, based on in-place surveys of volume before and after removal.
   2. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012100 "Allowances."

B. **Unit Price No. 2: EXCAVATION IN TRENCHES** where authorized or directed, below or in addition to the levels required for the Work. Dispose of excavated materials in an approved off-site location. Credit or additions to the Contract Price for actual quantities removed and replaced (based on volume of material cut) shall be made per the Unit Prices contained in the Bid Form. Include in the unit price the cost of quantity verification by a Surveyor Licensed in the Commonwealth of Virginia.
   1. Unit of Measurement: cubic yard of unsuitable soils excavated, based on survey of in-place surveys volume of before and after removal.
   2. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012100 "Allowances."

C. **Unit Price No. 3: EXCAVATION OF ROCK** material where authorized or directed, below or in addition to the levels required for the Work. Dispose of excavated materials in an approved off-site location. Backfill with materials compacted as specified in Section 313000 "Earthwork." Credit or additions to the Contract Price for actual quantities removed and replaced (based on volume of material cut) shall be made per the Unit Prices contained in the Bid Form. Include in the unit price the cost of quantity verification by a Surveyor Licensed in the Commonwealth of Virginia.
   1. Unit of Measurement: cubic yard of unsuitable soils excavated, based on survey of in-place surveys volume of before and after removal.

2. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012100 "Allowances."

D. **Unit Price No. 4: EXCAVATION OF TRENCH ROCK** material where authorized or directed, below or in addition to the levels required for the Work. Dispose of excavated materials in an approved off-site location. Backfill with materials compacted as specified in Section 313000 "Earthwork." Credit or additions to the Contract Price for actual quantities removed and replaced (based on volume of material cut) shall be made per the Unit Prices contained in the Bid Form. Include in the unit price the cost of quantity verification by a Surveyor Licensed in the Commonwealth of Virginia.
   1. Unit of Measurement: cubic yard of unsuitable soils excavated, based on survey of in-place surveys volume of before and after removal.
   2. Quantity Allowance: Coordinate unit price with allowance adjustment requirements in Section 012100 "Allowances."

E. **Unit Price No. 5: Subsurface Drains:** Installation of subsurface drain equivalent to VDOT Std. UD-4 standard pavement edge drain, in place, beyond that required by the Work, per thge Drawings and Specifications. Credit or additions to the Contract Price for actual quantities shall be made per the Unit Prices contained in the Bid Form.
   1. Unit of Measurement: linear feet of subsurface drain.

F. **Unit Price No. 6: VDOT #1 Stone.**
   1. Description: According to Division 31.
   2. Unit of Measurement: cubic yard of material, based on survey in-place after compaction.

G. **Unit Price No.7: VDOT #57 Aggregate.**
   1. Description: According to Division 31.
   2. Unit of Measurement: cubic yard of material, based on survey in-place after compaction.

H. **Unit Price No.8: Geotextile Fabric**.
   1. Description: According to Division 31.
   2. Unit of Measurement: square yard of material in place.

I. **Unit Price No. 9 - Smoke Detectors** – smoke detectors, installed, mounted and wired, in addition to the levels required for the work. Credit or additions to the Contract Price for actual quantities shall be made per the Unit Prices contained in the Bid Form.

1. Description: According to Division 26.
2. Unit of Measurement: Each.

J. **Unit Price No. 10 – Exit Signs**, installed, mounted and wired, in addition to the levels required for the work. Credit or additions to the Contract Price for actual quantities shall be made per the Unit Prices contained in the Bid Form.
   1. Description: According to Division 26.
   2. Unit of Measurement: each.

K. **Unit Price No. 11 - Geothermal Wells**.
   1. Description: Installation of one (1) geothermal well, inclusive of 40’ of casing. Final amount shall be adjusted upward or downward based on actual quantity authorized.
   2. Unit of Measurement: Each.

L. **Unit Price No. 12 - Geothermal Well Casing**
   1. Description: Well casing, furnished and installed, in addition to the amounts indicated in the Drawings.
   2. Unit of Measurement: Linear Foot.

M. **Unit Price No. 13 - ACM Waterline Replacement**
   1. Description: Removal and replacement of existing ACM Waterline. Unit price per linear foot will be used for establishing adjustments to Contract Sum if additional length of water line, beyond that indicated on Drawings.
   2. Unit of Measurement: Linear Foot.

N. **Unit Price No. 14 - Fire Lane Striping**
   1. Description: Cost to provide twenty (20) linear feet of fire lane striping as direct by Fire Marshall beyond those quantities indicated on the Drawings.

O. **Unit Price No. 15 - Fire Lane Signage**
   1. Description: Cost to provide one (1) fire lane sign as direct by Fire Marshall beyond those quantities indicated on the Drawings

END OF SECTION

SECTION 012300
ALTERNATES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. **Section includes administrative and procedural requirements for alternates, noted as Additive Bids on the Bid Form.**

B. The project manual contains a combined set of specifications for base and alternate work.

1. Typical details and notes included throughout the set apply to base and alternate (Additive Bid) work.

1.03 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form as "ADDITIVE BID" for certain work defined in the bidding requirements that may be added to the Base Bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates (Additive Bids) described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.04 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include, as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation, whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.

C. Execute accepted alternates under the same conditions as other Work of the Contract.

D. Schedule: A Part 3 "Schedule of Alternates" Article is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

1.05 ACCEPTANCE OF ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.06 SCHEDULE OF ALTERNATES

A. Additive Bid No. 1 - SECOND ELEVATOR: Lump sum price for one elevator installed installed in the hoistway, complete and in accordance with the drawings and specifications.

B. Additive Bid No. 2 - PHOTOVOLTAIC SYSTEM: Lump sum price for all work to design, engineer and install a roof-top photovoltaic power system complete and in accordance with the drawings and specifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 012500
SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.02 DEFINITIONS

A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
   1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
      a. Unavailability of product or acceptable warranty terms. Provide documentation from manufacturer or supplier on when product became unavailable.
      b. Regulatory changes.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
   4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
   5. Waives claims for additional costs or time extension that may subsequently become apparent.
   6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.

B. A Substitution Request for specified installer constitutes a representation that the submitter:
   1. Has acted in good faith to obtain services of specified installer, but was unable to come to commercial, or other terms.

C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
   1. Note explicitly any non-compliant characteristics.
D. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
E. Limit each request to a single proposed substitution item.
   1. Submit an electronic document, combining the request form with supporting data into single document.

3.02 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

A. Submittal Form (after award of contract): Use form provided by Architect.
B. Architect will consider requests for substitutions only within 15 days after date of Agreement.
C. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
D. Substitution for Convenience: Not allowed.
E. Substitutions will not be considered under one or more of the following circumstances:
   1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
   2. Without a separate written request.
   3. When acceptance will require revisions to Contract Documents.

3.03 RESOLUTION

A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.
B. Architect will notify Contractor in writing of decision to accept or reject request.
   1. Architect's decision following review of proposed substitution will be noted on the submitted form.

3.04 ACCEPTANCE

A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

3.05 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. Include completed Substitution Request Forms as part of the Project record. Include both approved and rejected Requests.

END OF SECTION

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SECTION 013000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.
B. Electronic document submittal service.
C. Preconstruction meeting.
D. Progress meetings.
E. Contractor's daily reports.
F. Progress photographs.
G. Coordination drawings.
H. Submittals for review, information, and project closeout.
I. Number of copies of submittals.
J. Requests for Interpretation (RFI) procedures.
K. Submittal Schedule.
L. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Section 013216 - Construction Progress Schedule: Form, content, and administration of schedules.
B. Section 013310 - CADD File Transfer Agreement: Form required for use of Architect's electronic plan views in submittal drawings.
C. Section 016000 - Product Requirements: General product requirements.
D. Section 017000 - Execution and Closeout Requirements: Additional coordination requirements.
E. Section 017800 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

1.03 REFERENCE STANDARDS

A. AIA G716 - Request for Information; 2004.

1.04 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 017000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.
B. Make the following types of submittals to Architect:
    1. Requests for Interpretation (RFI).
    2. Requests for substitution.

3. Shop drawings, product data, and samples.
4. Test and inspection reports.
5. Design data.
6. Manufacturer's instructions and field reports.
7. Applications for payment and change order requests.
8. Progress schedules.
9. Correction Punch List and Final Correction Punch List for Substantial Completion.
10. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 ELECTRONIC DOCUMENT SUBMITTAL SERVICE

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via Architect's Newforma Project Center platform that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.
   1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Interpretation (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
   2. Contractor and Architect are required to use this service.
   3. It is Contractor's responsibility to submit documents in allowable format.
   4. Subcontractors, suppliers, and Architect's consultants are to be permitted to use the service at no extra charge.
   5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
   6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.

7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

B. Submittal Service: The selected service is: Web-based project software service listed above.
   1. Newforma Project Center: www.newforma.com/our-solutions/constructex/#sle.

C. Training: Architect will provide one, one-hour, web-based training session if requested by Contractor, with representatives of Architect and Contractor participating; further training is the responsibility of the user of the service.

D. Project Closeout: Architect will determine when to terminate the service for the project.

3.02 PRECONSTRUCTION MEETING

A. Schedule meeting after Notice of Award.

B. Attendance Required:
   1. Owner.
   2. Architect.
   3. Contractor and Superintendent.
   4. Architect's consultants.
   5. Major subcontractors.

C. Agenda:
   1. Execution of Owner-Contractor Agreement.
   2. Use of premises, existing building, work restrictions, and owner occupancy requirements.
   3. Site Logistics: Discuss temporary facilities, parking, storage and laydown areas, security, and working hours.
   4. Distribution of Contract Documents.
   5. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
      a. Subcontract List: Provide a summary of individuals and firms proposed for each portion of the Work. Include the following information:
         1) Name, address, and telephone number of entity perorming subcontract or supplying products.
         2) Number and title of specification section(s) covered by subcontract.
         3) Drawing number and detail references, as appropriate, covered by subcontract.

b. Key Personnel: Submit a list of key personnel including superintendent, project engineer(s), personnel involved in processing of RFIs and submittals, administering Fire Safety Plan, and other personnel regularly in attendance at Project site. List duties, responsibilities, and contact information for each.

6. Submission of initial Submittal schedule.
7. Designation of personnel representing the parties to Contract and Architect.
8. Procedures and processing of field decisions, submittals, both physical and electronic, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
9. Review process using web-based project software, permissions and access, RFI process, RFI logging.
10. Scheduling.
11. Critical work sequencing and long-lead items.
12. Sustainability goals, construction waste management and recycling.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.03 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the work at maximum bi-monthly intervals.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required:

1. Contractor.
2. Owner.
3. Architect.
4. Special consultants as needed.
5. Contractor's superintendent.
6. Major subcontractors.

D. Agenda:

1. Review minutes of previous meetings.
2. Review of work progress.
3. Field observations, problems, and decisions.
4. Identification of problems that impede, or will impede, planned progress.

5. Review of submittals schedule and status of submittals.
6. Review of RFIs log and status of responses.
7. Review of off-site fabrication and delivery schedules.
8. Maintenance of progress schedule.
9. Corrective measures to regain projected schedules.
10. Planned progress during succeeding work period.
11. Maintenance of quality and work standards.
12. Effect of proposed changes on progress schedule and coordination.
13. Other business relating to work.

E. Record minutes and distribute copies within three days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 CONSTRUCTION PROGRESS SCHEDULE - SEE SECTION 013216

3.05 DAILY CONSTRUCTION REPORTS

A. Include only factual information. Do not include personal remarks or opinions regarding operations and/or personnel.

B. Prepare a daily construction report recording the following information concerning events at Project site and project progress:

1. Date.
2. High and low temperatures, and general weather conditions.
3. List of subcontractors at Project site.
4. Approximate count of personnel at Project site.
5. Major equipment at Project site.
6. Material deliveries.
7. Safety, environmental, or industrial relations incidents.
8. Meetings and significant decisions.
9. Unusual events (submit a separate special report).
10. Stoppages, delays, shortages, and losses. Include comparison between scheduled work activities (in Contractor's most recently updated and published schedule) and actual activities. Explain differences, if any. Note days or periods when no work was in progress and explain the reasons why.
11. Directives and requests of Authority(s) Having Jurisdiction (AHJ).
12. Change Orders received and implemented.
13. Testing and/or inspections performed.
14. Signature of Contractor's authorized representative.

3.06 PROGRESS PHOTOGRAPHS

A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.

B. Photography Type: Digital; electronic files.

C. Upload photographs with Application for Payment.

D. Provide photographs of construction throughout progress of work produced by an experienced photographer, acceptable to Architect. Take a minimum of 20 photos weekly. Select vantage points to show status of construction and progress since last photographs were taken.

E. In addition to periodic, recurring views, take photographs of each of the following events:
   1. Completion of site clearing.
   2. Foundations in progress and upon completion.
   3. Structural framing in progress and upon completion.
   4. Enclosure of building, upon completion.
   5. Final completion, minimum of ten (10) photos. Architect will inform photographer of desired vantage points. Submit to Architect for incorporation into Project Record Documents and or as required by Owner.

F. Preconstruction Photographs: Take photographs as evidence of existing project conditions including Project site, context of adjacent properties, and existing items to remain during construction. Take photographs from several vantage points and as follows:
   1. Exterior views: 5.

G. Views:
   1. Provide non-aerial photographs from four cardinal views at each specified time, until date of Substantial Completion.
   2. Consult with Architect for instructions on views required.
   3. Provide factual presentation.
   4. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.

H. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
   1. Delivery Medium: Via Newforma Project Center InfoExchange Platform.
   2. File Naming: Include project identification, date and time of view, and view identification.

3. PDF File: Assemble all photos into printable pages in PDF format, with 2 photos per page, each photo labeled with file name; one PDF file per submittal.

3.07 COORDINATION DRAWINGS

A. General: Coordinate construction operations across different specification Sections that depend on each other for proper installation, connection, and/or operation.

B. Prepare coordination drawings where limited space availability necessitates coordination or to facilitate integration of projects and materials fabricated or installed by more than one subcontractor.

1. Content: Provide project-specific drawings scaled large enough to indicate and resolve conflicts. Include the following as applicable:
    a. Use applicable Drawings as basis for preparation of coordination drawings. Prepare drawings of type needed to describe systems and componensts as they relate to this project.
        1) Use of Architect's electronic drawings is subject to limitations outlined in Section 013310 - CADD File Transfer Agreement.
    b. Add trade-specific information from all major contractors in a sequence that provides for resolution of conflicts between trades prior to submitting coordination drawings for review.
    c. Indicate space requirements for routince maintenance and for anticipated replacement of major components during life of installation.
    d. Coordinate size and location of access doors with equipment, valves, controls, etc. in manner that minimizes number of access doors.
    e. Dimensions: Specifically note dimension that appear to be in conflict with submitted equipment and minimum clearance requirements. Propose resolution of identified conflicts for review. Minor dimension changes and difficult installations will not be considered changes to the Contract.
2. Organization of Coordination Drawings: Organize drawings as follows:
    a. Floor Plans and Reflected Ceiling Plans: Show building elements, mechanical, plumbing, electrical, fire-protection, and fire-alarm Work. Show visible ceiling mounted devices relative to each ceiling type and material.
    b. Plenum Space: Locate components within plenum space allowing for ceiling and wall framing and supports.
    c. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire alarm, and electrical equipment.

1) Show required clearances at major equipment:
   (a) Clear floor space at panels
   (b) Overhead clearances
   (c) Show routing of piping near electrical equipment that may require isolation

d. Structural Penetrations: Indicate penetrations and openings required for all disciplines.

e. Mechanical and Plumbing Work: Show the following:

1) Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
2) Dimensions of major components, access doors, valves, cleanouts, and related equipment.

f. Electrical Work: Show the following:

1) Conduit 1-1/4 inches in diameter and larger, and runs of any size conduit when in groups of more than 5 conduits.
2) Light fixtures including exit lights. Identify fixtures that affect plenum clearances if any. Show smoke detectors, fire alarm locations, and other ceiling and wall mounted devices.
3) Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations. Show required clearances.
4) Locate pull boxes and junction boxes that may be in highly visible locations.

g. Fire-Protection system: Show the following:

1) Locations of standpipes, backflow devices and required clearances.
2) Show mains and branch lines indicating heights of piping relative to ductwork.
3) Indicate areas where sequencing of installation may be counter to typical sequencing of work.

3. Review: Architect will review coordination drawings for conformance with general design intent, though the details of coordination are Contractor's responsibility.
4. Submittal: Prepare coordination drawings and submit for review in accordance with requirements in Section 013000 - Administrative Requirements.

C. Review drawings prior to submission to Architect.

3.08 REQUESTS FOR INTERPRETATION (RFI)

A. Definition: A request seeking one of the following:

1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.

B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.

C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
   1. Prepare a separate RFI for each specific item.
      a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
      b. Do not forward requests which solely require internal coordination between subcontractors.
   2. Prepare in a format and with content acceptable to Owner.
   3. Prepare using software provided by the Electronic Document Submittal Service.
   4. Combine RFI and its attachments into a single electronic file.

D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.
   1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
   2. Unacceptable Uses for RFIs: Do not use RFIs to request the following::
      a. Approval of submittals (use procedures specified elsewhere in this section).
      b. Approval of substitutions (see Section - 016000 - Product Requirements)
      c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
      d. Different methods of performing work than those indicated in the Contract Drawings and Specifications (comply with provisions of the Conditions of the Contract).
   3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
   4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response.

a. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.

E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
   1. Owner's, Architect's, and Contractor's names.
   2. Discrete and consecutive RFI number, and descriptive subject/title.
   3. Issue date, and requested reply date.
   4. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
   5. Reference to Change or Change Proposal or similar as appropriate.
   6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
   7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.

F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.
   1. Indicate current status of every RFI. Update log promptly and on a regular basis.
      a. Provide Owner and Architect ability to download current RFI log from web-based project software for duration of project.
   2. Note dates of when each request is made, and when a response is received.
   3. Highlight items requiring priority or expedited response.
   4. Highlight items for which a timely response has not been received to date.
   5. Identify and include improper or frivolous RFIs.

H. Review Time: Architect will respond and return RFIs to Contractor within 14 calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.

1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.

1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.09 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.

1. Submit at the same time as the preliminary schedule specified in Section - 013216 - Construction Progress Schedule.
2. Coordinate with Contractor's construction schedule and schedule of values.
   a. Assign a value to preparation and maintenance of Submittal Schedule for inclusion in the Schedule of Values.
3. Format schedule to allow tracking of status of submittals throughout duration of construction.
4. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, role and name of subcontractor, and scheduled date for Architect's final approval.
5. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.

a. For groups of related submittals, assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

B. Grouping of Related Submittals: Schedule groups of related items including, but not limited to:
   1. The Submital Schedule itself, list of subcontractors, Schedule of Values, and Construction Progress Schedule.
   2. Air barrier system, veneer and rain screen system components and other penetrating items, and flashings that tie into air barrier.
   3. Interior finishes, including flooring, wall coverings, floor transitions, control / expansion joints, and paint drawdowns.
   4. Exterior finishes requiring color coordination.
   5. Glazing systems and glass.
   6. Doors, hardware, and electronic access.
   7. Custom fabrications.
   8. Integrated systems.
   9. Fabricated assemblies involving components from multiple specification Sections such as casework and countertops, elevator finishes, and similar assemblies.
   10. Submittals that need to be routed to multiple disciplines and consultants.

3.10 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.

B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.

C. Samples will be reviewed for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 017800 - Closeout Submittals.

3.11 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
   1. Design data.

2. Sustainability design submittals and reports.
3. Certificates.
4. Test reports.
5. Inspection reports.
6. Manufacturer's instructions.
7. Manufacturer's field reports.
8. Field engineering daily reports.
9. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner.

C. Architect will retain for their record and will only return if submittals are not in compliance with requirements or are not required.

3.12 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 017800 - Closeout Submittals:

1. Project record documents.
2. Operation and maintenance data.
3. Warranties.
4. Bonds.
5. Other types as indicated.

D. Submit for Owner's benefit during and after project completion.

3.13 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.

1. After review, produce duplicates.
2. Retained samples will not be returned to Contractor unless specifically so stated.

3.14 SUBMITTAL PROCEDURES

A. General Requirements:

1. Use a single transmittal for related items.
2. Submit separate packages of Submittals For Review and Submittals For Information, when included in the same specification section.

a. Architect's contract with Owner stipulates a maximum of two (2) submittals for each specification section (e.g. one initial review and one resubmittal review). The Owner may require the Contractor bear the costs for additional submittal reviews by Architect and/or consulting Engineer(s).
    1) Exception: Submittal packages identified in Architect approved Submittal Schedule. See Grouping of Related Submittals article above.

3. Partial submittals of Submittals For Review are not acceptable and at the Architect's discretion, will be returned "Not Reviewed".
4. Transmit using approved form.
5. Sequentially identify each item, incorporating the Specification Section number with a revision identifier. For revised submittals use original number and a sequential combination numberical and alphabetical suffix.
6. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
7. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
8. Deliver each submittal on date noted in submittal schedule, unless an earlier date has been agreed to by all affected parties, and is of the benefit to the project.
9. Schedule submittals to expedite the Project, and coordinate submission of related items.
    a. For each Submittal For Review package or resubmittal , allow 15 calendar days excluding delivery time to and from the Contractor.
    b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 15 calendar days.
        1) Exceptions:
            (a) Structural steel, metal fabrications, and decorative metal: Allow 25 calendar days for Initial Review, and, if required, 20 calendar days for Resubmittal Review.
            (b) Finish Carpentry: Allow 20 calendar days for Initial Review and, if required, 15 calendar days for Resubmittal Review.
            (c) Building Envelope Systems and Materials: Allow 25 calendar days for Initial Review and, if required, 20 calendar days for Resubmittal Review.
            (d) Doors, Frames, and Hardware: Allow 20 calendar days for Initial Review and, if required, 15 calendar days for Resubmittal Review.

(e) Interior Products and Material Finish Color Selections: Allow 30 calendar days from date of the last material color submittal to Architect for final color package selection.

c. For sequential reviews involving approval from authorities having jurisdiction (AHJ), in addition to Architect's approval, allow an additional 30 days.

10. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
11. Provide space for Contractor and Architect review stamps.
12. When revised for resubmission, identify all changes made since previous submission.
13. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
14. Partial submittals will not be reviewed unless so designated on the Submittal Schedule and approved by Architect. Partial submittals may be approved for unique or distinct portion(s) of the work
15. Submittals not requested will be recognized, and will be returned "Not Reviewed",

B. Product Data Procedures:
1. Submit only information required by individual specification sections.
2. Collect required information into a single submittal.
3. Submit concurrently with related shop drawing submittal.
4. Do not submit (Material) Safety Data Sheets for materials or products.
5. Submit sustainable design reporting submittals under separate cover.

C. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
2. Use of reproductions of Contract Documents in digital data form to create shop drawings is only permitted as defined in the _____.
3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

D. Samples Procedures:
1. Transmit related items together as single package.
2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.

3.15 SUBMITTAL REVIEW

A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.

B. Submittals for Information: Architect will acknowledge receipt, but will take no other action.

C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.

1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.

D. Architect's and consultants' actions on items submitted for review:

1. Authorizing purchasing, fabrication, delivery, and installation - Final acceptance will be contingent upon compliance with requirements of Contract Documents:
    a. "Approved", or language with same legal meaning. Final acceptance will be contingent upon compliance with requirements of Contract Documents.
    b. "Approved as Noted, Resubmission not required", or language with same legal meaning.
        1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.
    c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.
2. Not Authorizing fabrication, delivery, and installation:
    a. "Submit Specified Item".
        1) Resubmit with item(s) noted. If other items included in same submittal are found compliant, those items will be noted with an appropriate action.
    b. "Revise and Resubmit".
        1) Resubmit revised item, with review notations acknowledged and incorporated.
    c. "Rejected".
        1) Submit item complying with requirements of Contract Documents.

E. Architect's and consultants' actions on items submitted for information:

1. Items for which no action was taken:
    a. "Received" - to notify the Contractor that the submittal has been received for record only.
2. Items for which action was taken:
    a. "Reviewed" - no further action is required from Contractor.

END OF SECTION

SECTION 013216
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, with network analysis diagrams and reports.

1.02 RELATED SECTIONS

A. Section 011000 - Summary: Work sequence.

B. Section 013000 - Administrative Requirements for Submittal Schedule requirements.

1.03 REFERENCE STANDARDS

A. AGC (CPSM) - Construction Planning and Scheduling Manual; 2004.

B. M-H (CPM) - CPM in Construction Management - Project Management with CPM; 2016.

1.04 SUBMITTALS

A. Provide schedule in accordance with project General Conditions.

B. Within 10 days after date of Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.

1. Include coordinated draft Submittal Schedule for review.

C. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

D. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.

1. Include written certification that major contractors have reviewed and accepted proposed project schedule and Submital Schedule.

E. Within 10 days after joint review, submit complete project and submittal schedules.

F. Submit updated schedules with each Application for Payment, with pencil copy issued at least one week prior to a designated regularly scheduled progress meeting. Update schedule with comments from progress meeting prior to submitting with Application for Payment.

G. Submit in PDF format and maintain current schedule on web-based project software.

1.05 QUALITY ASSURANCE

A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with one years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.

1.06 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

B. Diagram Sheet Size: Maximum 22 x 17 inches (560 x 432 mm).

C. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SUBMITTAL SCHEDULE - SEE 013000 - ADMINISTRATIVE REQUIREMENTS

3.02 PRELIMINARY SCHEDULE

A. Optional: Prepare preliminary schedule in the form of a horizontal bar chart.

3.03 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by specification section number.

C. Identify work of separate floors and other logically grouped activities.

D. Provide sub-schedules for each stage of Work identified in Section 011000 - Summary.

E. Work By Owner: Create activities for each area of Work performed by Owner showing potential impact on time-sensitive activities.

F. Provide sub-schedules to define critical portions of the entire schedule.

G. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

H. Submittal Schedule: Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, products identified under Allowances, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.

I. Indicate delivery dates for owner-furnished products and products identified under Allowances if applicable.

J. Commissioning and Sustainability Requirements: Coordinate timeframe for commissioning activities with Commissioning Agent. Indicate commissioning milestones on schedule. Allow ample time for specified air quality activities and indicate cutoff time critical components are required to be in place prior to testing.

K. Startup and Testing Time: Include no fewer than 15 days for startup and testing.

L. Substantial Completion: Allow time for Architect's administrative procedures necessary for certification of Substantial Completion.

M. Pumch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.

N. Coordinate content with schedule of values specified in Section 012000 - Price and Payment Procedures.

O. Provide legend for symbols and abbreviations used.

3.04 NETWORK ANALYSIS

A. Prepare network analysis diagrams and supporting mathematical analyses using the Critical Path Method.

B. Illustrate order and interdependence of activities and sequence of work; how start of a given activity depends on completion of preceding activities, and how completion of the activity may restrain start of subsequent activities.

C. Mathematical Analysis: Tabulate each activity of detailed network diagrams, using calendar dates, and identify for each activity:

1. Preceding and following event numbers.
2. Activity description.
3. Estimated duration of activity, in maximum 15 day intervals.
4. Earliest start date.
5. Earliest finish date.
6. Actual start date.
7. Actual finish date.
8. Latest start date.
9. Latest finish date.
10. Total and free float; float time shall accrue to Owner and to Owner's benefit.
11. Monetary value of activity, keyed to Schedule of Values.
12. Percentage of activity completed.
13. Responsibility.

D. Analysis Program: Capable of accepting revised completion dates, and recomputation of all dates and float.

E. Required Reports: List activities in sorts or groups:

1. By preceding work item or event number from lowest to highest.
2. By amount of float, then in order of early start.
3. Listing of activities on the critical path.

3.05 REVIEW AND EVALUATION OF SCHEDULE

A. Participate in joint review and evaluation of schedule with Architect at each submittal.

B. Evaluate project status to determine work behind schedule and work ahead of schedule.

C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.06 UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Annotate diagrams to graphically depict current status of Work.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Substantial Completion.

F. Submit reports required to support recommended changes.

G. Provide narrative report to define problem areas, anticipated delays, and impact on the schedule. Report corrective action taken or proposed and its effect.

3.07 DISTRIBUTION OF SCHEDULE

A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

END OF SECTION

SECTION 013329.02

SUSTAINABLE DESIGN REPORTING - LEED V4 AND V4.1

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General requirements for sustainable design reporting.

1.02 REPORTING REQUIREMENTS

A. Free-standing furniture and furnishings are not included in the Contract.

B. Contractor must familiarize himself with the relevant reporting requirements and provide the necessary information and instruction to all subcontractors and installers.

C. This Project is designed around LEED v4 for Schools, but incorporates select LEED v4.1 credits.

1.03 RELATED REQUIREMENTS

A. Section 013000 - Administrative Requirements: General submittal requirements.

B. Section 016000 - Product Requirements.

1.04 DEFINITIONS

A. Definitions in this Article are in addition to sustainable design definitions directly related to products, as listed in Section - 016000 - Product Requirements.

B. Life Cycle Assessment (LCA): Compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle.

C. Material Cost: The dollar value of materials being provided to the site, after Contractor mark-ups, including transportation costs, taxes, fees, and shop labor, but excluding field equipment and field labor costs.

1.05 PRODUCT REPORTING SCOPE

A. General: Product reporting scope for the purpose of achieving the selected sustainability certification level is limited to those items directly affecting ability to achieve targeted credits.

1. Environmental Product Declarations (EPD): Documentation complying with definition and quality requirements in Section 016000 - Product Requirements.

a. Provide for at least 20 different permanently installed products sourced from at least five different manufacturers that meet the sustainable design certification program criteria.

B. LEED Product Reporting Scope (for MR and EQ Credits): May include any of the products specified in Divisions 2 through 14, 31, and 32, and the following:

1. All paints, coatings, adhesives, and sealants that are used but not specified.

2. Composite wood that is permanently installed but not specified.

1.06 REFERENCE STANDARDS

A. C2C (DIR) - C2C Certified Products Registry; Cradle to Cradle Products Innovation Institute; Current Edition.
B. ECHA (REACH) - European Chemicals Agency – REACH regulations; current list.
C. GreenScreen (METH) - GreenScreen for Safer Chemicals Method v1.2; Clean Production Action; Current Edition.
D. HPDC (HPD-OLT) - Create an HPD On-Line Tool; Health Product Declaration Collaborative; Current Edition.
E. ILFI (DEC) - International Living Future Institute 'Declare' Program; 2017.
F. SMACNA (OCC) - IAQ Guidelines for Occupied Buildings Under Construction; 2007.
G. USGBC LEED v4-BD+C - LEED v4 for Building Design and Construction; 2019.
H. USGBC LEED v4.1-BD+C - LEED v4.1 for Building Design and Construction; 2023.

1.07 SUBMITTALS

A. See Section 013000 - Administrative Requirements for additional submittal procedures requirements.
B. Sustainable Design Documentation: The scope of required documentation is specified in this section and in applicable individual specification sections.
C. LEED v4 Prerequisites and Credits - Documentation is required for the following items:
    1. New Product Documentation:
        a. Materials and Resources: Use the Building Product Disclosure and Optimization (BPDO) Calculator spreadsheet software available from USGBC to track and document materials and products purchases and use. Use for documentation of USGBC LEED v4-BD+C,USGBC LEED v4.1-BD+C, and USGBC LEED v4-ID+C MR Credits.
        b. Building Product Disclosure and Optimization - Environmental Product Declarations.
            1) Submit information for the required number and sources of Environmental Product Declarations complying with LEED reporting requirements.
                (a) Submit for at least twenty permanently installed products, sourced from at least five different manufacturers.
        c. Building Product Disclosure and Optimization - Sourcing of Raw Materials. Use at least one of the following methods:
            1) Raw Materials' Suppliers self-declared reports on sourcing and extracting, or, preferably, third-party verified corporate sustainability reports (CSR).

2) Leadership Extraction Practices compliance, demonstrating, as is appropriate: Manufacturer (producer) responsibility; use of bio-based materials; wood products meeting certification requirements; reuse of materials; materials' recycled content.
3) Submit additional documentation for any eligible products to support the claim that they have been sourced (extracted, manufactured, and purchased) within 100 miles (160 km) of the project site.

d. Building Product Disclosure and Optimization - Material Ingredients.
1) Material Ingredient Reporting: Use, as is appropriate:
(a) Manufacturers' inventories of ingredients.
(b) HPDC (HPD-OLT) Health Product Declarations.
(c) C2C (DIR) Cradle-to-Cradle certifications.
(d) C2C (DIR) Cradle-to-Cradle Material Health certifications.
(e) ILFI (DEC) 'Declare' product labels.
2) Material Ingredient Optimization: Use, as is appropriate:
(a) GreenScreen (METH) GreenScreen v1.2 Benchmark reports.
(b) C2C (DIR)Cradle-to-Cradle certifications.
(c) ECHA (REACH) International Alternative Compliance Path - REACH Optimization reports.
(d) USGBC approved program.
3) Manufacturer's Supply Chain Optimization: Use sourcing documentation demonstrating compliance with stated requirements.

e. Indoor Environmental Quality - Low-emitting Materials: Use the Low-Emitting Materials Calculator spreadsheet software (available from USGBC) to track and document materials and products purchases and use. Use for documentation of USGBC LEED v4-BD+C and USGBC LEED v4-ID+C EQ Credits.

f. Submit updated summaries prior to or along with initial application for payment.

g. Update and re-submit whenever the total cost changes due to contract modifications.

2. Waste Disposal Management: Periodic reports quantifying diversion of construction waste away from landfills and incineration facilities.
a. Include information on percentage of diverted material and number of material streams.

3. Volume Calculations: When required to document EQ Credit Low-Emitting Materials, Option 1, submit volume calculations for the following items:
a. Interior paints and coatings applied on site.
1) General Emissions Evaluation for paints and coatings applied to walls, floors, and ceilings.

2) VOC content requirements for wet applied products.

b. Interior adhesives and sealants applied on site (including flooring adhesive).

1) General Emissions Evaluation.
2) VOC content requirements for wet applied products.

c. Healthcare and Schools Projects only: Exterior applied products.

4. Flooring: Submit general emissions evaluation information for all flooring materials.
5. Composite wood: Submit composite wood evaluation information for all materials not covered by another product category.
6. Ceilings, walls, thermal, and acoustic insulation: Submit general emissions evaluation for all products.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROCEDURES

A. Submit sustainable design documentation required of Contractor, using procedures defined under Submittals for Information in Section 013000.
B. Submit sustainable design documentation to Architect, unless otherwise indicated.
C. Where an item of sustainable design documentation is specified, fill out and submit electronically the appropriate forms, using appropriate software.
   1. Fill out one line for each different brand name product and each different manufacturer of a lot of commodity products.
   2. Where required attachments are specified, attach the documentation.
   3. Mark each blank with the appropriate information; use "ATT" for items attached; if any item is not relevant use the code "NR"; if any item is not available use the code "NA".
D. Each form must be signed by the entity capable of certifying the information.
   1. Certification signatures must be made by an officer of the company.
   2. For products, certification must be made by the manufacturer not the supplier.
   3. For custom fabricated products, certification by the fabricator is acceptable.
E. Submit the completed forms in accordance with the requirements of Section 013000, as information submittals.
   1. Give each form a unique submittal number.
   2. Do not combine sustainable design documentation with product data or shop drawing submittals.

F. Submit forms applicable to work for which application for payment is being made, either prior to or concurrent with application for payment; payment will not be made until relevant forms have been submitted.

G. For work covered by multiple applications for payment, the initial submittal of a form is sufficient for subsequent applications unless the nature of the product has changed.

END OF SECTION

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SECTION 013329.07

PROHIBITED CONTENT INSTALLER CERTIFICATION

PROJECT NAME: NEW CONSTRUCTION HIGH SCHOOL CENTER II; NO.: 41911390.

USE OF THIS FORM

1.01 BECAUSE INSTALLERS ARE ALLOWED AND DIRECTED TO CHOOSE ACCESSORY MATERIALS SUITABLE FOR THE APPLICABLE INSTALLATION, THERE IS A POSSIBILITY THAT SUCH ACCESSORY MATERIALS MIGHT CONTAIN VOC CONTENT IN EXCESS OF THAT PERMITTED, ESPECIALLY WHERE SUCH MATERIALS HAVE NOT BEEN EXPLICITLY SPECIFIED.

1.02 CONTRACTOR IS REQUIRED TO OBTAIN AND SUBMIT THIS FORM FROM EACH INSTALLER OF WORK ON THIS PROJECT.

1.03 FOR EACH PRODUCT CATEGORY LISTED, CIRCLE THE CORRECT WORDS IN BRACKETS: EITHER [HAS] OR [HAS NOT].

1.04 IF ANY OF THESE ACCESSORY MATERIALS HAS BEEN USED, ATTACH TO THIS FORM PRODUCT DATA AND SDS SHEET FOR EACH SUCH PRODUCT.

1.05 VOC CONTENT RESTRICTIONS ARE SPECIFIED IN SECTION 016116.

PRODUCT CERTIFICATION

2.01 I CERTIFY THAT THE INSTALLATION WORK OF MY FIRM ON THIS PROJECT:

A. [HAS] [HAS NOT] required the use of ADHESIVES.
B. [HAS] [HAS NOT] required the use of JOINT SEALANTS.
C. [HAS] [HAS NOT] required the use of PAINTS OR COATINGS.
D. [HAS] [HAS NOT] required the use of COMPOSITE WOOD or AGRIFIBER PRODUCTS.

2.02 ___ LIST OF PRODUCTS OF THESE TYPES THAT WERE USED IS ATTACHED, WITH MANUFACTURER AND BRAND NAME.

2.03 ___ PRODUCT DATA AND SDS SHEETS FOR THESE PRODUCTS:

A. ___ Are attached.
B. ___ Were submitted as normal submittals.
C. ___ Were submitted as sustainable design submittals using the Material Content Form.
D. ___ Were submitted as sustainable design submittals using USGBC BPDO Calculator spreadsheet.

CERTIFIED BY: (INSTALLER/MANUFACTURER/SUPPLIER FIRM)

3.01 FIRM NAME: _____

3.02 PRINT NAME: _____

3.03 SIGNATURE: _____

3.04 TITLE: _____ (OFFICER OF COMPANY)

3.05 DATE: _____

END OF SECTION

SECTION 013566.12

SUSTAINABILITY CERTIFICATION PROJECT PROCEDURES - LEED V4 AND V4.1

PART 1 GENERAL

1.01 PROJECT APPROACH

A. This project intends to achieve recognition for sustainable design using LEED v4 Certification program.

B. Contractor is not responsible for the application for Sustainability certification, nor for determination of methods of achieving Sustainability credits unless specifically so indicated.

C. Many of the Sustainability credits can be achieved only through intelligent design of the project and are beyond the control of the Contractor. However, certain credits relate to the products and procedures used for construction. Therefore, full cooperation of the Contractor and subcontractors is essential to achieving final certification goal, and they must familiarize themselves with the relevant requirements, and provide the necessary information and instructions to product suppliers and installers.

D. Since Contractor and subcontractors may not be familiar with detailed LEED Sustainability procedures, this section includes a list of other specifications sections that contain related requirements for products and procedures necessary for achievement of targeted Sustainability certification level.

1. Achievement of many prerequisites and credits is dependent on proper performance by Contractor and subcontractors, using specific required project management and work execution means and methods.
2. Achievement of other credits involves quantifying percentages of installed products by weight and cost; these require careful recordkeeping and reporting by the Contractor.
3. See www.usgbc.org for more information.

1.02 RELATED REQUIREMENTS

A. General and Technical Sections: Sections that include requirements intended to achieve Sustainability Credits include, but are not limited to, the following:

B. DIVISION 1 - GENERAL REQUIREMENTS

1. Section 011000 - Summary.
    a. Contractor use of site and premises.
2. Section 013329.02 - Sustainable Design Reporting - LEED v4 and v4.1: Requirements and procedures for sustainable design documentation.

3. Section 013329.07 - Prohibited Content Installer Certification: Certification by each installer working on project regardless of product type.
4. Section 015719 - Temporary Environmental Controls.
    a. Basic construction procedures.
    b. Contractor's IAQ management plan and construction procedures.
    c. Testing of ventilation.
    d. Air contaminant testing must be performed by Contractor.
    e. Air contaminant testing may be substituted for building flush out, at Contractor's option.
5. Section 016000 - Product Requirements.
    a. Definitions of:
        1) Recycled Content.
        2) Bio-Based content.
        3) Sustainable forestry certified Wood.
        4) Source Location.
        5) Environmental Product Declarations.
        6) Health Product Declarations.
        7) Manufacturer's Inventory of Product Content.
    b. Regionally-sourced products.
        1) Contractor is not required to provide any particular minimum percentage of regionally-sourced products; however, Contractor is required to collect and submit information necessary to determine whether the material is eligible for application of cost multiplier for products sourced within 100 miles (160 Km) of the project site.
6. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions: List of indoor-emissions-restricted products and VOC-content-restricted products, requirements, evidence required, and reporting.
7. Section 017000 - Execution and Closeout Requirements.
8. Section 017419 - Construction Waste Management and Disposal: Requirements for landfill diversion and reporting.
9. Section 017800 - Closeout Submittals: Maintenance and operation manuals for commissioned systems.
10. Section 017900 - Demonstration and Training.
    a. Demonstration of commissioned systems and equipment.
    b. Training of Owner's personnel.

C. DIVISION 2 - EXISTING CONDITIONS
1. Section 024100 - Demolition.

D. DIVISION 3 - CONCRETE
   1. Section 033000 - Cast-in-Place Concrete: Replacement of Portland cement, to some extent, with recycled content.

E. DIVISION 6 - WOOD, PLASTICS, AND COMPOSITES
   1. Note: Definition of sustainable forestry certified wood is in Section 016000.
   2. Section 064100 - Architectural Wood Casework: Requirement to use sustainable forestry certified wood.

F. DIVISION 7 - THERMAL AND MOISTURE PROTECTION
   1. Section 072100 - Thermal Insulation.
      a. Insulation in exterior walls.
      b. Acoustical insulation.
   2. Section 072700 - Air Barriers.
      a. Continuous air barriers.
   3. Section 076200 - Sheet Metal Flashing and Trim: Lead-free flashing.
   4. Section 078400 - Firestopping.
      a. Emissions-compliant firestopping sealants.
   5. Section 079200 - Joint Sealants.
      a. Emissions-compliant sealants.

G. DIVISION 8 - OPENINGS
   1. Section 084313 - Aluminum-Framed Storefronts: For daylighting and views.
   2. Section 084413 - Glazed Aluminum Curtain Walls: For daylighting and views.
   3. Section 087100 - Door Hardware.
      a. Door closers at rooms where hazardous gases or chemicals are present or used.
   4. Section 088000 - Glazing: For daylighting and views.

H. DIVISION 9 - FINISHES
   1. Section 092116 - Gypsum Board Assemblies: Deck-to-deck sealed partitions around rooms where hazardous gases or chemicals are present or used.
   2. Section 095100 - Acoustical Ceilings: Low-Emitting Materials.
   3. Section 096500 - Resilient Flooring: VOC restrictions.
   4. Section 096700 - Fluid-Applied Flooring: VOC restrictions.
   5. Section 096813 - Tile Carpeting: Carpet tile complying with CRI Green Label Plus requirements.
   6. Section 097200 - Wall Coverings: Emissions-compliant Wall Coverings.
   7. Section 097800 - Interior Wall Paneling: GreenGuard Gold Certified Products.

8. Section 099123 - Interior Painting: Emissions-compliant interior opaque paints and coatings.
    a. Lead-free interior paint.
    b. Interior paint with no intentionally added cadmium.
9. Section 099600 - High-Performance Coatings: Emissions-compliant interior opaque high performance coatings.

I. DIVISION 10 - SPECIALTIES
1. Section 101400 - Signage.
    a. "No Smoking" signs, and signs identifying designated outdoor smoking areas.
    b. Signs identifying preferred parking spaces for green vehicles.
2. Section 107113.43 - Fixed Sun Screens.

J. DIVISION 11 - EQUIPMENT
1. Section 114000 - Foodservice Equipment: Energy Star rated appliances.

K. DIVISION 12 - FURNISHINGS
1. Section 122400 - Window Shades: Motorized window shades.

L. DIVISION 22 - PLUMBING
1. Building-level water meter is provided by the local utility.
2. Section 220519 - Meters and Gauges for Plumbing Piping: Plumbing metering devices for water subsystems.
3. Section 220719 - Plumbing Piping Insulation: Domestic hot water piping insulation.
4. Section 221005 - Plumbing Piping: Potable and non-potable water distribution.
    a. Documentation of products meeting regulatory lead-content restrictions.
    b. Certification of proper soldering of copper piping joints.
5. Section 224000 - Plumbing Fixtures.
    a. WaterSense-labeled water closets, urinals, lavatory faucets, and showerheads.

M. DIVISION 23 - HVAC
1. Section 230593 - Testing, Adjusting, and Balancing for HVAC.
2. Section 230800 - Commissioning of HVAC.
3. Section 233600 - Air Terminal Units: Locally controlled HVAC terminal units.
4. Section 236433 - Modular Water Chillers: Refrigerant options are limited those with ODP of zero and GWP of less than 50.
    a. Non-CFC refrigerant.

5. Section 238124 - Computer Room Air Conditioners - Floor Mounted: Refrigerant options are limited those with ODP of zero and GWP of less than 50.

N. DIVISION 25 - INTEGRATED AUTOMATION
   1. Section 254003 - Integrated Automation: Building automation system integrating plumbing, HVAC, and electrical monitoring and control systems.

O. DIVISION 26 - ELECTRICAL
   1. Section 260923 - Lighting Control Devices: Automatic lighting controls.
   2. Section 263100 - Photovoltaic Collectors: And related equipment and roof supports. See Division 01 Alternates.
   3. Section 265100 - Interior Lighting.
      a. Limitations on mercury content of lamps.
      b. Minimum rated lamp life.
   4. Section 265600 - Exterior Lighting.
      a. Limitations on mercury content of lamps.
      b. Minimum rated lamp life.
      c. Site lighting fixtures that reduce light pollution.

P. DIVISION 31 - EARTHWORK

Q. DIVISION 32 - EXTERIOR IMPROVEMENTS
   1. Section 329219 - Seeding.
   2. Section 329300 - Plants: See drawings for specific plant materials.

1.03 INFORMATION SOURCES

A. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE); 1791 Tullie Circle, NE, Atlanta, GA 30329. Tel: (404) 636-8400. Fax: (404) 321-5478. www.ashrae.org.

B. Green Seal; 1001 Connecticut Avenue, NW, Suite 827, Washington, DC 20036-5525. Tel: (202) 872-6400. Fax: (202) 872-4324. www.greenseal.org.

C. South Coast Air Quality Management District (SCAQMD); 21865 E. Copley Drive, Diamond Bar, CA 91765. Tel: (909) 396-2000. www.aqmd.gov.

D. U.S. Green Building Council (USGBC); 1015 18th Street, NW, Suite 805, Washington, DC 20036. Tel: (202) 82-USGBC or (202) 828-7422. Fax: (202) 828-5110. www.usgbc.org.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PROCEDURES

A. General: Conduct project management and construction operations in a manner consistent with, and in support of successful achievement of Owner's targeted certification level.
   1. Collect and report the quantities, costs, weights, volumes and/or sourcing information for materials and products noted.
      a. Collect information for the volume used for following products:
         1) Interior paints and coatings applied on site.
         2) Interior adhesives and sealants applied on site.
         3) Exterior applied products in Schools projects.
            (a) Include information for adhesives, sealants, coatings, roofing, and waterproofing.
   2. Collect VOC and other emissions information for:
      a. Interior paints and coatings applied on site. Calculated by volume.
      b. Interior adhesives and sealants applied on site (including flooring adhesive). Calculated by volume.
      c. Flooring. 100 percent.
      d. Composite Wood. 100 percent not covered by other product categories.
      e. Ceilings, walls, thermal, and acoustic insulation. 100 percent. Healthcare, Schools projects include additional insulation requirements.
      f. Healthcare and Schools Projects only: Exterior applied products. Calculated by volume.

B. Construction Waste Management and Disposal: Implement approved waste management plan during the entire duration of the Contract.

C. Commissioning Authority Activities: Cooperate with Commissioning Authority to coordinate construction and closeout activities scheduling.

D. Sustainable Design Reporting: Comply with requirements of Section 013329.02.

3.02 SMOKING POLICY

A. General: Smoking policy on the project site is implemented for the following reasons:
   1. Prevention of fire.
   2. Prevention of exposure of building occupants, indoor surfaces, and ventilation air distribution systems to environmental tobacco smoke, resulting in build-up on hard surfaces, and absorption of smoke by textiles and fabrics.
   3. Promotion of successful results of Indoor Air Quality

B. Smoking is not permitted anywhere on project site.

C. Include explanation of smoking policy as part of orientation and safety training for every worker on the site.

1. Post durable signs at prominent locations on the project site, with language as appropriate for the required policy.
2. Reinforce the policy at regular Health and Safety, and other regular employee or labor-management meetings.

D. Enforcement: Institute smoking policy enforcement measures.

3.03 CONSTRUCTION WASTE MANAGEMENT

A. Comply with applicable requirements of Section 017419 - Construction Waste Management and Disposal.

END OF SECTION

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SECTION 014000
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submittals.
B. Quality assurance.
C. References and standards.
D. Testing and inspection agencies and services.
E. Contractor's construction-related professional design services.
F. Contractor's design-related professional design services.
G. Control of installation.
H. Mock-ups.
I. Tolerances.
J. Manufacturers' field services.
K. Defect Assessment.

1.02 REFERENCE STANDARDS

A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2023).
B. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation; 2024.
C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2023.
D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2023.
E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2023.
F. ASTM E699 - Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components; 2016.
G. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2021.

1.03 DEFINITIONS

A. Contractor's Quality Control Plan: Contractor's management plan for executing the Contract for Construction.

B. Contractor's Professional Design Services: Design of some aspect or portion of the project by party other than the design professional of record. Provide these services as part of the Contract for Construction.
   1. Design Services Types Required:
      a. Construction-Related: Services Contractor needs to provide in order to carry out the Contractor’s sole responsibilities for construction means, methods, techniques, sequences, and procedures.
      b. Design-Related: Design services explicitly required to be performed by another design professional due to highly-technical and/or specialized nature of a portion of the project. Services primarily involve engineering analysis, calculations, and design, and are not intended to alter the aesthetic aspects of the design.

C. Design Data: Design-related, signed and sealed drawings, calculations, specifications, certifications, shop drawings and other submittals provided by Contractor, and prepared directly by, or under direct supervision of, appropriately licensed design professional.

1.04 CONTRACTOR'S CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

B. Provide such engineering design services as may be necessary to plan and safely conduct certain construction operations, pertaining to, but not limited to the following:
   1. Temporary sheeting, shoring, or supports.
   2. Temporary scaffolding.
   3. Temporary bracing.
   4. Temporary falsework for support of spanning or arched structures.
   5. Temporary foundation underpinning.
   6. Temporary stairs or steps required for construction access only.
   7. Temporary hoist(s) and rigging.
   8. Investigation of soil conditions to support construction equipment.

1.05 CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

B. Base design on performance and/or design criteria indicated in individual specification sections.

C. Scope of Contractor's Professional Design Services: Provide for the following items of work:

1. Concrete Mix Design: As described in Section 033000 - Cast-in-Place Concrete. No specific designer qualifications are required.
2. Structural Design of Steel Connections: As described in Section 051200 - Structural Steel Framing.
3. Structural Design of Steel Connections: As described in Section 052100 - Steel Joist Framing.
4. Structural Design of Steel Decking: As described in Section 053100 - Steel Decking.
5. Structural Design of Metal Framing: As described in Section 054000 - Cold-Formed Metal Framing.
6. Structural Design of Metal Fabrications: As described in Section 055000 - Metal Fabrications.
7. Structural Design of Stairs: As described in Section 055100 - Metal Stairs.
8. Structural Design of Railings: As described in Section 055213 - Pipe and Tube Railings.
9. Structural Design: Include physical characteristics, engineering calculations, and resulting dimensional limitations as described in Section 084313 - Aluminum-Framed Storefronts.
10. Structural Design: Include calculations for resisting wind loads, anchor locations, loads at points of attachment to building structure, physical characteristics, resulting dimensional limitations as described in Section 084413 - Glazed Aluminum Curtain Walls.
11. Structural Design of Floor System: As described in Section 096900 - Access Flooring.
12. Structural Design and Calculations: As described in Section 107113.43 - Fixed Sun Screens.
13. Structural Design of Foundation: As described in Section 107500 - Flagpoles - QE.
14. Design of Structural Components: As described in Section 142400 - Hydraulic Elevators.
15. Sprinkler Layout: Coordinate with ceiling installation, detailed pipe layout, and hydraulic calculations as described in Section 211300 - Fire-Suppression Sprinkler Systems.

16. System Design: As described in Section 230913 - Instrumentation and Control Devices for HVAC.
17. Written Sequence of Operation: Include entire HVAC system and each piece of equipment, as described in Section 230993 - Sequence of Operations for HVAC Controls.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Designer's Qualification Statement: Submit for Architect's knowledge as contract administrator, or for Owner's information.
   1. Include information for each individual professional responsible for producing, or supervising production of, design-related professional services provided by Contractor.
      a. Full name.
      b. Professional licensure information.
      c. Statement addressing extent and depth of experience specifically relevant to design of items assigned to Contractor.

C. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
   1. Include calculations that have been used to demonstrate compliance to performance and regulatory criteria provided, and to determine design solutions.
   2. Include required product data and shop drawings.
   3. Include a statement or certification attesting that design data complies with criteria indicated, such as building codes, loads, functional, and similar engineering requirements.
   4. Include signature and seal of design professional responsible for allocated design services on calculations and drawings.

D. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
   1. Include:
      a. Date issued.
      b. Project title and number.
      c. Name of inspector.
      d. Date and time of sampling or inspection.
      e. Identification of product and specifications section.

f. Location in the Project.
g. Type of test/inspection.
h. Date of test/inspection.
i. Results of test/inspection.
j. Compliance with Contract Documents.
k. When requested by Architect, provide interpretation of results.

2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.

E. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

F. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

G. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

H. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.
1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

1.07 QUALITY ASSURANCE

A. Testing Agency Qualifications:
1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.

2. Qualification Statement: Provide documentation showing testing laboratory is accredited under IAS AC89.

B. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

C. Quality-Control Personnel Qualifications. Engage a person with requisite training and experience to implement and manage quality assurance (QA) and quality control (QC) for the project.

1.08 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.09 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Contractor Employed Agency:

1. Testing agency: Comply with requirements of ASTM E329, ASTM E699, ASTM C1021, ASTM C1077, ASTM C1093, and ASTM D3740.
2. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.
3. Laboratory: Authorized to operate in the State in which the Project is located.
4. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
B. Comply with manufacturers' instructions, including each step in sequence.
C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
E. Have work performed by persons qualified to produce required and specified quality.
F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 MOCK-UPS

A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.
C. Integrated Exterior Mock-ups: Construct integrated exterior mock-up as indicated on drawings. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.
D. Notify Architect fifteen (15) working days in advance of dates and times when mock-ups will be constructed.
E. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.
F. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

G. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

H. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.

1. Architect will issue written comments within seven (7) working days of initial review and each subsequent follow up review of each mock-up.
2. Make corrections as necessary until Architect's approval is issued.

I. Architect will use accepted mock-ups as a comparison standard for the remaining Work.

J. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

K. Where possible salvage and recycle the demolished mock-up materials.

3.03 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.04 TESTING AND INSPECTION

A. Testing Agency Duties:

1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
2. Perform specified sampling and testing of products in accordance with specified standards.
3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
5. Perform additional tests and inspections required by Architect.
6. Submit reports of all tests/inspections specified.

B. Limits on Testing/Inspection Agency Authority:

1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.

2. Agency may not approve or accept any portion of the Work.
3. Agency may not assume any duties of Contractor.
4. Agency has no authority to stop the Work.

C. Contractor Responsibilities:
1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
3. Provide incidental labor and facilities:
a. To provide access to Work to be tested/inspected.
b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
c. To facilitate tests/inspections.
d. To provide storage and curing of test samples.
4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

D. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

E. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.05 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to Architect 30 days in advance of required observations.
1. Observer subject to approval of Owner.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.06 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

B. If, in the opinion of Owner, it is not practical to remove and replace the work, Owner will direct an appropriate remedy or adjust payment.

END OF SECTION

SECTION 015000
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022, with Errata (2021).

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.03 SUMMARY

A. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Temporary utilities will not be required to be furnished under this Contract. The Contractor may connect to the Owner’s electrical and water services.

C. Telephone services shall be provided by mobile telephone by the Contractor. The Owner prohibits any telephone wiring from being installed at the site by the Contractor.

D. Related Sections include the following:

1. Division 01 Section "Summary" for limitations on utility interruptions and other work restrictions.
2. Division 01 Section "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.
3. Division 01 Section "Execution" for progress cleaning requirements.

1.04 USE CHARGES

A. General: Cost or use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.

B. Existing on-site utilities may be used by the Contractor as long as the privilege is not abused. Utilities required above and beyond those present on site shall be procured and paid for by the Contractor.

1.05 QUALITY ASSURANCE

A. Comply with industry standards and applicable laws and regulations of authorities having jurisdiction.

B. Comply with the following Standards:
   1. NFPA Code 241, “Building Construction and Demolition Operations.”
   2. ANSI-A10 Series standards for “Safety Requirements for Construction and Demolition”.
   3. NECA Electrical Design Library “Temporary Electrical Facilities”.

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. Toilets: The Contractor shall provide adequate temporary toilet facilities outside the existing building. Toilet facilities shall be maintained in a clean and sanitary condition. The Contractor will not be permitted to use toilets within the building.

C. Provide containerized tap-dispenser bottle type drinking water units, including paper cup supply.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.02 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

B. Water Service: Use of Owner's existing water service facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
   1. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.

C. Electric Power Service: Use of Owner's existing electric power service will be permitted, as long as equipment is maintained in a condition acceptable to Owner.

D. Telephone Service: Provide cellular telephone service for use by all construction personnel.
   1. Provide superintendent with cellular telephone for use.

E. Electronic Communication Service: Provide temporary electronic communication service, including electronic mail.
   1. Provide a computer with internet service and a digital camera for use on site at all times.

3.03 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:
   1. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
B. Parking: The Owner will provide limited parking access for the contractor.
C. Project Identification and Temporary Signs: Provide Project identification and other signs.
   1. Install signs where indicated to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted.
   2. Provide temporary, directional signs for construction personnel and visitors.
   3. Maintain and touchup signs so they are legible at all times.
D. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with Division 01 Section "Execution" for progress cleaning requirements.
E. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
F. Existing Stair Usage: Use of Owner's existing stairs will be permitted, as long as stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
   1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If, despite such protection, stairs become damaged, restore damaged areas so no evidence remains of correction work.

3.04 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

B. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

C. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting. Contractor shall erect suitable barricades and take any other precautions necessary to fully protect the public and other trades from dangerous conditions involved with his work.

D. Temporary Enclosures: Provide temporary weather-tight enclosures for exterior openings to protect work from weather as required. Any opening in an outside wall shall be made secure from intrusion. At the end of day's work close temporary enclosures and securely lock up building.

E. Contractor shall be responsible for maintaining building and site security in areas or portions of the building impacted by his scope; and shall secure all appropriate areas during construction. Project security to defer theft and vandalism shall be the responsibility of the Contractor until time of Substantial Completion.

F. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.

1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

G. Tree, Plant, Lawn and Grass Protection: Install temporary barriers to protect lawns and grasses and other vegetation from construction damage. Protect root systems from damage, flooding and erosion.

3.05 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION

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SECTION 015719

TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Construction procedures to promote adequate indoor air quality after construction.

B. Building flush-out after construction and before occupancy.

C. Testing indoor air quality before commencement of construction; existing building areas only.

D. Testing indoor air quality after completion of construction.

E. Testing air change effectiveness after completion of construction.

1.02 PROJECT GOALS

A. Dust and Airborne Particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.

1. Cleaning of ductwork is not contemplated under this Contract.
2. Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.
3. Establish condition of existing ducts and equipment prior to start of alterations.

B. Airborne Contaminants: Procedures and products have been specified to minimize indoor air pollutants.

1. Furnish products meeting the specifications.
2. Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.

1.03 RELATED REQUIREMENTS

A. Section 013329.02 - Sustainable Design Reporting - LEED v4 and v4.1.

1.04 REFERENCE STANDARDS

A. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2017, with Addendum (2022).

B. ASHRAE Std 129 - Measuring Air-Change Effectiveness; 1997 (Reaffirmed 2002).

C. ASTM D5197 - Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air (Active Sampler Methodology); 2021.

D. ASTM E779 - Standard Test Method for Determining Air Leakage Rate by Fan Pressurization; 2019.

E. ASTM E1186 - Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems; 2017.

F. ASTM E1827 - Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door; 2022.
G. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2; 2017.
H. EPA 600/4-90/010 - Compendium of Methods for the Determination of Air Pollutants in Indoor Air; 1990.
I. EPA 625/R-96/010b - Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air; 1999, with Addendum (2000).
J. SMACNA (OCC) - IAQ Guidelines for Occupied Buildings Under Construction; 2007.

1.05 DEFINITIONS

A. Adsorptive Materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabrics, fibrous insulation, and other similar products.
B. Contaminants: Gases, vapors, regulated pollutants, airborne mold and mildew, and the like, as specified.
C. Particulates: Dust, dirt, and other airborne solid matter.
D. Wet Work: Concrete, plaster, coatings, and other products that emit water vapor or volatile organic compounds during installation, drying, or curing.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.
B. Sustainability Documentation: Submit documentation required in this section.
    1. For LEED v4 certification system projects, submit in accordance with procedures specified in Section 013329.02 - Sustainable Design Reporting - LEED v4 and v4.1.
C. Indoor Air Quality Management Plan: Describe, in detail, measures to be taken to promote adequate indoor air quality upon completion; use SMACNA (OCC) as a guide.
    1. Submit not less than 60 days before enclosure of building.
    2. Identify potential sources of odor and dust.
    3. Identify construction activities likely to produce odor or dust.
    4. Identify areas of project potentially affected, especially occupied areas.
    5. Evaluate potential problems by severity and describe methods of control.
    6. Describe construction ventilation to be provided, including type and duration of ventilation, use of permanent HVAC systems, types of filters and schedule for replacement of filters.

7. Describe cleaning and dust control procedures.
8. Describe coordination with commissioning procedures.

D. Interior Finishes Installation Schedule: Identify each interior finish that either generates odors, moisture, or vapors or is susceptible to adsorption of odors and vapors, and indicate air handling zone, sequence of application, and curing times.

E. Duct and Terminal Unit Inspection Report.

F. Air Contaminant Test Plan: Identify:
1. Testing agency qualifications.
2. Locations and scheduling of air sampling.
3. Test procedures, in detail.
4. Test instruments and apparatus.
5. Sampling methods.

G. Air Contaminant Test Reports: Show:
1. Location where each sample was taken, and time.
2. Test values for each air sample; average the values of each set of 3.
3. HVAC operating conditions.
4. Certification of test equipment calibration.
5. Other conditions or discrepancies that might have influenced results.

H. Ventilation Effectiveness Test Plan: Identify:
1. Testing agency qualifications.
2. Description of test spaces, including locations of air sampling.
3. Test procedures, in detail; state whether tracer gas decay or step-up will be used.
4. Test instruments and apparatus; identify tracer gas to be used.
5. Sampling methods.

I. Ventilation Effectiveness Test Reports: Show:
1. Preliminary tests of instruments and apparatus and of test spaces.
2. Calculations of ventilation effectiveness, variable "E".
3. Location where each sample was taken, and time.
4. Test values for each air sample.
5. HVAC operating conditions.
6. Other information specified in ASHRAE Std 129.
7. Other conditions or discrepancies that might have influenced results.

1.07 QUALITY ASSURANCE

A. Testing and Inspection Agency Qualifications: Independent testing agency having minimum of 5 years experience in performing the types of testing specified.

PART 2 PRODUCTS

2.01 MATERIALS

A. Low VOC Materials: See other sections for specific requirements for materials with low VOC content.

B. Auxiliary Air Filters: MERV of 8, minimum, when tested in accordance with ASHRAE Std 52.2.

PART 3 EXECUTION

3.01 CONSTRUCTION PROCEDURES

A. Prevent the absorption of moisture and humidity by adsorptive materials by:
   1. Sequencing the delivery of such materials so that they are not present in the building until wet work is completed and dry.
   2. Delivery and storage of such materials in fully sealed moisture-impermeable packaging.
   3. Provide sufficient ventilation for drying within reasonable time frame.

B. Begin construction ventilation when building is substantially enclosed.

C. If extremely dusty or dirty work must be conducted inside the building, shut down HVAC systems for the duration; remove dust and dirt completely before restarting systems.

D. When working in a portion of an occupied building, prevent movement of air from construction area to occupied area.

E. Use of HVAC equipment and ductwork for ventilation during construction is not permitted:
   1. Provide temporary ventilation equivalent to 1.5 air changes per hour, minimum.
   2. Exhaust directly to outside.
   3. Seal HVAC air inlets and outlets immediately after duct installation.

F. Do not store construction materials or waste in mechanical or electrical rooms.

G. Prior to use of return air ductwork without intake filters clean up and remove dust and debris generated by construction activities.
   1. Inspect duct intakes, return air grilles, and terminal units for dust.
   2. Clean plenum spaces, including top sides of lay-in ceilings, outsides of ducts, tops of pipes and conduit.
   3. Clean tops of doors and frames.

4. Clean mechanical and electrical rooms, including tops of pipes, ducts, and conduit, equipment, and supports.
5. Clean return plenums of air handling units.
6. Remove intake filters last, after cleaning is complete.

H. Do not perform dusty or dirty work after starting use of return air ducts without intake filters.

I. Use other relevant recommendations of SMACNA (OCC) for avoiding unnecessary contamination due to construction procedures.

J. Sustainable Design Reporting: Comply with requirements of Section 013329.02.

3.02 AIR CONTAMINANT TESTING

A. Perform air contaminant testing before occupancy.

B. Do not start air contaminant testing until:
1. All construction is complete, including interior finishes.
2. HVAC systems have been tested, adjusted, and balanced for proper operation.
3. New HVAC filtration media have been installed.

C. Indoor Air Samples: Collect from spaces representative of occupied areas:
1. Collect samples while operable windows and exterior doors are closed, HVAC system is running normally as if occupied, with design minimum outdoor air, but with the building unoccupied.
2. Collect samples from spaces in each contiguous floor area in each air handler zone, but not less than one sample per 25,000 square feet (2300 square meters); take samples from areas having the least ventilation and those having the greatest presumed source strength.
3. Collect samples from height from 36 inches (915 mm) to 72 inches (1830 mm) above floor.
4. Collect samples from same locations on 3 consecutive days during normal business hours; average the results of each set of 3 samples.
5. Exception: Areas with normal very high outside air ventilation rates, such as laboratories, do not need to be tested.
6. When retesting the same building areas, take samples from at least the same locations as in first test.

D. Outdoor Air Samples: Collect samples at outside air intake of each air handler at the same time as indoor samples are taken.

E. Analyze air samples and submit report.

F. Particulate Matter and Inorganic Gases Limits:

1. Carbon Monoxide: Not more than 9 parts per million and not more than 2 parts per million higher than outdoor air.
2. PM10 Particulates: Not more than 50 micrograms per cubic meter.
3. Regulated Pollutants: Measure in relation to outside air; not more than contained in outside air.

G. Volatile Organic Compounds Limits:
1. Formaldehyde: Not more than 27 parts per billion.
2. Total Volatile Organic Compounds (TVOCs): Not more than 500 micrograms per cubic meter.
3. Chemicals Listed in CAL (CDPH SM) Table 4-1, other than Formaldehyde: Not more than allowable concentrations listed in Table 4-1.
4. Airborne Mold and Mildew: Measure in relation to outside air; not higher than outside air.
5. Regulated Pollutants: Measure in relation to outside air; not more than contained in outside air.

H. Air Contaminant Concentration Test Methods:
1. Formaldehyde: ASTM D5197, EPA 625/R-96/010b Method TO-11A, or EPA 600/4-90/010 Method IP-6A.
2. Particulates: EPA 600/4-90/010 Method IP-10.
3. Total Volatile Organic Compounds (TVOC): EPA 625/R-96/010b Method TO-1, TO-15, or TO-17; or EPA 600/4-90/010 Method IP-1.
4. Chemicals Listed in CAL (CDPH SM) Table 4-1, except Formaldehyde: ASTM D5197, or EPA 625/R-96/010b Method TO-1, TO-15, or TO-17.
5. Carbon Monoxide: EPA 600/4-90/010 Method IP-3, plus measure outdoor air; measure in ppm; report both indoor and outdoor measurements.

I. If air samples show concentrations higher than those specified, ventilate with 100 percent outside air and retest at no cost to Owner, or conduct full building flush-out specified above.

3.03 VENTILATION EFFECTIVENESS TESTING

A. Perform ventilation effectiveness testing before occupancy.

B. Do not begin ventilation effectiveness testing until:
1. HVAC testing, adjusting, and balancing has been satisfactorily completed.
2. Building flush-out or air contaminant testing has been completed satisfactorily.
3. New HVAC filtration media have been installed.

C. Test each air handler zone in accordance with ASHRAE Std 129.

D. If calculated air change effectiveness for a particular zone is less than 0.9 due to inadequate balancing of the system, adjust, and retest at no cost to Owner.

3.04 ENVELOPE LEAKAGE TESTING

A. General: Comply with the following procedural requirements for testing building or space envelope, as applicable:
   1. ASTM E779 Standard Test Method for Determining Air Leakage Rate by Fan Pressurization.
   2. ASTM E1827 Standard Test Methods for Determining Airtightness of Buildings Using an Orifice Blower Door.

B. Verify that the envelope to be tested has been sufficiently completed for testing to commence.

C. Conduct ongoing inspections as construction progresses to document satisfactory installation conditions related to thermal and moisture integrity of the building envelope that become concealed upon completion of construction.

D. Submit a detailed narrative of proposed pressure test procedures prior to the test. Include a plan view showing proposed installation locations (personnel doors or other similar openings) for blower doors (or flexible ducts for trailer-mounted fans, if used).

E. Avoid testing on days forecast to experience high winds, rain, or snow.

F. Test the completed building and demonstrate that the air leakage rate of the building envelope does not exceed the specified requirements.
   1. Use equipment and methods necessary to produce indoor/outdoor pressure differential of 0.2 inches w.g. (50 Pa).

G. Determine location and nature of undesirable air leakage pathways using methods specified in ASTM E1186 Standard Practices for Air Leakage Site Detection in Building Envelopes and Air Barrier Systems.

H. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.
   1. If difficulty in correction would delay progress, report deficiency to immediately.
   2. Insulation for remedying building envelope deficiencies evidenced as excessive air leakage is specified in Section 072100.
   3. Air barriers for remedying building envelope deficiencies evidenced as excessive air leakage are specified in Section 072700.
   4. Sealants for remedying building envelope deficiencies evidenced as excessive air leakage are specified in Section 079200.

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SECTION 016000
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.
B. Sustainable design-related product requirements.
C. Re-use of existing products.
D. Transportation, handling, storage and protection.
E. Product option requirements.
F. Substitution limitations.
G. Procedures for Owner-supplied products.
H. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Section 011000 - Summary: Identification of Owner-supplied products.
B. Section 012500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.
C. Section 014000 - Quality Requirements: Product quality monitoring.
D. Section 017419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.
E. Section 018113.14 Sustainable Design Requirements.

1.03 REFERENCE STANDARDS

A. 16 CFR 260.13 - Guides for the Use of Environmental Marketing Claims; Federal Trade Commission; Recycled Content; Current Edition.
B. ANSI A138.1 - Green Squared American National Standard Specifications for Sustainable Ceramic Tiles, Glass Tiles, and Tile Installation Materials; 2011 (Reaffirmed 2021).
C. ASTM D6866 - Standard Test Methods for Determining the Biobased Content of Solid, Liquid, and Gaseous Samples Using Radiocarbon Analysis; 2024.
D. C2C (DIR) - C2C Certified Products Registry; Cradle to Cradle Products Innovation Institute; Current Edition.
E. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2; 2017.

F. EN 15804 - Sustainability of Construction Works - Environmental Product Declarations - Core Rules for the Product Category of Construction Products; 2022 (Corrigendum 2021).
G. ISO 14025 - Environmental Labels and Declarations - Type III Environmental Declarations - Principles and Procedures; 2006.
H. ISO 14040 - Environmental Management - Life Cycle Assessment - Principles and Framework; 2006, with Amendment (2020).
I. ISO 14044 - Environmental Management - Life Cycle Assessment - Requirements and Guidelines; 2006, with Amendment (2020).
J. ISO 21930 - Sustainability in Buildings and Civil Engineering Works — Core Rules for Environmental Product Declarations of Construction Products and Services; 2017.
K. NSF 332 - Sustainability Assessment for Resilient Floor Coverings; 2022.
L. NSF/ANSI 140 - Sustainability Assessment for Carpet; 2019.
M. UL 100 - Standard for Sustainability for Gypsum Boards and Panels; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
   1. Submit within 15 days after date of Notice to Proceed.
   2. For products specified only by reference standards, list applicable reference standards.
B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.
E. Sustainable Design Submittals: Items necessary to document use of sustainable construction materials, products, and practices.

1. See Section 018113.14 for Contractor's procedures necessary for achievement of targeted LEED v4.1 sustainability certification level.

1.05 QUALITY ASSURANCE

A. Bio-Based Content: Of vegetable or animal origin, not including products made by killing the animal.
   1. Determine percentage of bio-based content in accordance with ASTM D6866.
   2. Bio-based content must be sourced from a Sustainable Agriculture Network certified farm.

B. CAL (CDPH SM) v1.1: California Department of Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, v. 1.1–2010, for the emissions testing and requirements of products and materials.

C. Chain-of-Custody (COC): A procedure that tracks a product from the point of harvest or extraction to its end use, including successive stages of processing, transformation, manufacturing, and distribution.

D. Chain-of-Custody Certificates: Certificates signed by manufacturers and fabricators certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001.

E. Composite Wood and Agrifiber: Products made of wood particles and/or plant material pressed and bonded with adhesive or resin such as particleboard, medium density fiberboard (MDF), plywood, wheatboard, strawboard, panel substrates, and door cores.

F. Corporate Sustainability Report: A third-party verified report that outlines the environmental impacts of extraction operations and activities associated with the manufacturer’s product and the product’s supply chain.

G. Cradle-to-Cradle Certified: End use product certified Cradle-to-Cradle v2 Basic or Cradle-to-Cradle v3 Bronze, minimum, as evidenced by C2C (DIR).

H. Environmental Product Declaration (EPD): Publicly available, critically reviewed life cycle analysis having at least a cradle-to-gate scope.
   1. Good: Product-specific; compliant with ISO 14044.
   2. Better: Industry-wide, generic; compliant with ISO 21930, or with ISO 14044, ISO 14040, ISO 14025, and EN 15804; Type III third-party certification with external verification, in which the manufacturer is recognized as the program operator.

3. Best: Commercial-product-specific; compliant with ISO 21930, or with ISO 14044, ISO 14040, ISO 14025, and EN 15804; Type III third-party certification with external verification, in which the manufacturer is recognized as the program operator.
4. Where demonstration of impact reduction below industry average is required, submit both industry-wide and commercial-product-specific declarations; or submit at least 5 declarations for products of the same type by other manufacturers in the same industry.

I. Health Product Declarations (HPD): Complete, published declaration with full disclosure of known hazards, prepared using one of the HPDC (HPD-OLT) online tools.

J. Leadership Extraction Practices: Products that meet at least one of the responsible extraction criteria, which include: extended producer responsibility; bio-based materials; FSC wood products; materials reuse; recycled content; and other programs approved by sustainability certification system used for the project.

K. Manufacturer's Inventory of Product Content: Publicly available inventory of every ingredient identified by name and Chemical Abstract Service Registration Number (CAS RN).
1. For ingredients considered a trade secret or intellectual property, the name and CAS RN may be omitted, provided the ingredient's role, amount, and GreenScreen Benchmark are given.

L. Multi-Attribute Certifications: Lifecycle-based environmental certifications that indicate that a product has undergone rigorous scientific testing, exhaustive auditing, or both, to prove its compliance with stringent, third-party, environmental performance standards. Third-party certifications include the following:
1. Green Squared/ANSI A138.1 for Ceramic Tiles, Glass Tiles and Tile Installation Materials.
2. NSF/ANSI 140 Sustainability Assessment for Carpet.
3. NSF 332 Sustainability Assessment for Resilient Floor Coverings.
4. UL 100 Standard for Sustainability for Gypsum Board and Panels.

M. Rapidly Renewable Materials: Made from agricultural products that are typically harvested within a 10-year or shorter cycle.

N. Recycled Content: Determine percentage of post-consumer and pre-consumer (post-industrial) content separately, using the guidelines contained in 16 CFR 260.13.

1. Previously used, reused, refurbished, and salvaged products are not considered recycled.
2. Wood fabricated from timber abandoned in transit to original mill is considered reused, not recycled.
3. Determine percentage of recycled content of any item by dividing the weight of recycled content in the item by the total weight of materials in the item.
4. Determine value of recycled content of each item separately, by multiplying the content percentage by the value of the item.
5. Acceptable Evidence:
    a. For percentage of recycled content, information from manufacturer.
    b. For cost, Contractor's cost data.

O. Regional Materials: Materials that are extracted, harvested, recovered, and manufactured within a radius of 100 miles (160.9 Km) from the Project site.

P. Source Location: Location of harvest, extraction, recovery, or manufacture; where information about source location is required to be submitted, give the postal address:
1. In every case, indicate the location of final assembly.
2. For harvested products, indicate location of harvest.
3. For extracted (i.e. mined) products, indicate location of extraction.
4. For recovered products, indicate location of recovery.
5. For products involving multiple manufacturing steps, provide a description of the process at each step, with location.
6. Acceptable Evidence:
    a. Manufacturer's certification.
    b. Life cycle analysis (LCA) performed by third-party.

Q. Sustainably Harvested Wood: Solid wood, wood chips, and wood fiber certified or labeled by an organization accredited by one of the following:
1. The Forest Stewardship Council, The Principles for Natural Forest Management; for Canada visit http://www.fsccanada.org, for the USA visit http://www.fscus.org.
2. Sustainable Forestry Board, under The Sustainable Forestry Initiative® of the American Forest & Paper Association; refer to http://www.afandpa.org.
3. Acceptable Evidence: Copies of invoices bearing the certifying organization's certification numbers.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.

B. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.

B. Use of products having any of the following characteristics is not permitted:

1. Made using or containing CFC's or HCFC's.
2. Made of wood from newly cut old growth timber.
3. Containing lead, cadmium, or asbestos.

C. Where other criteria are met, Contractor shall give preference to products that:

1. If used on interior, have lower emissions, as defined in Section 016116.
2. If wet-applied, have lower VOC content, as defined in Section 016116.
3. Are extracted, harvested, and/or manufactured closer to the location of the project.
4. Are made of recycled materials.
5. If bio-based, other than wood, are or are made of Sustainable Agriculture Network certified products.
6. Are Cradle-to-Cradle Certified.

2.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 012500 - Substitution Procedures.

3.02 OWNER-SUPPLIED PRODUCTS

A. Owner's Responsibilities:
   1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
   2. Arrange and pay for product delivery to site.
   3. On delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
   5. Arrange for manufacturers' warranties, inspections, and service.

B. Contractor's Responsibilities:
   1. Review Owner reviewed shop drawings, product data, and samples.
   2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
   3. Handle, store, install and finish products.
   4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

A. Provide protection of stored materials and products against theft, casualty, or deterioration.

B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 017419.

1. Structural Loading Limitations: Handle and store products and materials so as not to exceed static and dynamic load-bearing capacities of project floor and roof areas.

C. Store and protect products in accordance with manufacturers' instructions.

D. Store with seals and labels intact and legible.

E. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

F. For exterior storage of fabricated products, place on sloped supports above ground.

G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

H. Comply with manufacturer's warranty conditions, if any.

I. Do not store products directly on the ground.

J. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

K. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

L. Prevent contact with material that may cause corrosion, discoloration, or staining.

M. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

N. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 016116

VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements for Indoor-Emissions-Restricted products.

B. Requirements for VOC-Content-Restricted products.

C. Requirement for installer certification that they did not use any non-compliant products.

1.02 RELATED REQUIREMENTS

A. Section 013000 - Administrative Requirements: Submittal procedures.

B. Section 013329.02 - Sustainable Design Reporting - LEED v4 and v4.1: Procedures for reporting emissions and VOC content data.

C. Section 013329.07 - Prohibited Content Installer Certification: Form for certifying that no non-compliant products were used.

1.03 DEFINITIONS

A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:

1. Interior paints and coatings applied on site.
2. Interior adhesives and sealants applied on site, including flooring adhesives.
3. Flooring.
4. Composite wood.
5. Products making up wall and ceiling assemblies.
6. Thermal and acoustical insulation.
7. Exterior applied products (for LEED Healthcare and Schools projects only).
8. Other products when specifically stated in the specifications.

B. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:

1. Exterior and interior paints and coatings applied on site.
2. Exterior and interior adhesives and sealants applied on site, including flooring adhesives.
3. Wet-applied roofing and waterproofing.
4. Other products when specifically stated in the specifications.

C. Interior of Building: Anywhere inside the exterior weather barrier.

D. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.

E. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.

F. Inherently Non-Emitting Materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:

1. Concrete.
2. Clay brick.
3. Metals that are plated, anodized, or powder-coated.
4. Glass.
5. Ceramics.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2005 (Reapproved 2018).

C. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers Version 1.2; 2017.

D. CARB (ATCM) - Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products; Current Edition.

E. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board; 2020.

F. CHPS (HPPD) - High Performance Products Database; Current Edition.

G. CRI (GLP) - Green Label Plus Testing Program - Certified Products; Current Edition.

H. SCAQMD 1113 - Architectural Coatings; 1977, with Amendment (2016).

I. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

J. SCS (CPD) - SCS Certified Products; Current Edition.

K. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.

C. Sustainable Design Reporting: Submit evidence of compliance.

1. See Section 013329.02 - Sustainable Design Reporting - LEED v4 and v4.1.

D. Installer Certifications Regarding Prohibited Content: Require each installer of any type of product (not just the products for which VOC restrictions are specified) to certify that either 1) no adhesives, joint sealants, paints, coatings, or composite wood or agrifiber products have been used in the installation of installer's products, or 2) that such products used comply with these requirements.

1.06 QUALITY ASSURANCE

A. Indoor Emissions Standard and Test Method: CAL (CDPH SM), using Standard Private Office exposure scenario and the allowable concentrations specified in the method, and range of total VOC's after 14 days.

1. Wet-Applied Products: State amount applied in mass per surface area.
2. Paints and Coatings: Test tinted products, not just tinting bases.
3. Evidence of Compliance: Acceptable types of evidence are the following;
    a. Current UL (GGG) certification.
    b. Current SCS (CPD) Floorscore certification.
    c. Current SCS (CPD) Indoor Advantage Gold certification.
    d. Current listing in CHPS (HPPD) as a low-emitting product.
    e. Current CRI (GLP) certification.
    f. Test report showing compliance and stating exposure scenario used.
4. Product data submittal showing VOC content is NOT acceptable evidence.
5. Manufacturer's certification without test report by independent agency is NOT acceptable evidence.

B. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.

1. Evidence of Compliance: Acceptable types of evidence are:
    a. Report of laboratory testing performed in accordance with requirements.

C. Composite Wood Emissions Standard: CARB (ATCM) for ultra-low emitting formaldehyde (ULEF) resins.

1. Evidence of Compliance: Acceptable types of evidence are:
    a. Current SCS "No Added Formaldehyde (NAF)" certification; www.scscertified.com.
    b. Report of laboratory testing performed in accordance with requirements.

c. Published product data showing compliance with requirements.

D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.01 MATERIALS

A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.

B. Indoor-Emissions-Restricted Products: Comply with Indoor Emissions Standard and Test Method, except for:

1. Composite Wood, Wood Fiber, and Wood Chip Products: Comply with Composite Wood Emissions Standard or contain no added formaldehyde resins.
2. Inherently Non-Emitting Materials.

C. VOC-Content-Restricted Products: VOC content not greater than required by the following:

1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.
2. Joint Sealants: SCAQMD 1168 Rule.
3. Paints and Coatings: Each color; most stringent of the following:
   a. 40 CFR 59, Subpart D.
   b. SCAQMD 1113 Rule.
   c. CARB (SCM).
4. Wet-Applied Roofing and Waterproofing: Comply with requirements for paints and coatings.

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

A. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.

B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION

SECTION 017000

EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Pre-installation meetings.

C. Cutting and patching.

D. Surveying for laying out the work.

E. Cleaning and protection.

F. Starting of systems and equipment.

G. Demonstration and instruction of Owner personnel.

H. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

1.02 RELATED REQUIREMENTS

A. Section 011000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 017900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

C. Section 078400 - Firestopping.

1.03 REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022, with Errata (2021).

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.

1. On request, submit documentation verifying accuracy of survey work.
2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
3. Submit surveys and survey logs for the project record.

C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:

1. Structural integrity of any element of Project.
2. Integrity of weather exposed or moisture resistant element.
3. Efficiency, maintenance, or safety of any operational element.

4. Visual qualities of sight exposed elements.
5. Work of Owner or separate Contractor.
6. Include in request:
    a. Identification of Project.
    b. Location and description of affected work.
    c. Necessity for cutting or alteration.
    d. Description of proposed work and products to be used.
    e. Alternatives to cutting and patching.
    f. Effect on work of Owner or separate Contractor.
    g. Date and time work will be executed.

D. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.05 QUALIFICATIONS

A. For demolition work, employ a firm specializing in the type of work required.

B. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

C. For field engineering, employ a professional engineer of the discipline required for specific service on Project, licensed in the State in which the Project is located. Employ only individual(s) trained and experienced in establishing and maintaining horizontal and vertical control points necessary for laying out construction work on project of similar size, scope and/or complexity.

D. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.06 PROJECT CONDITIONS

A. Use of explosives is not permitted.

B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

D. Perform dewatering activities, as required, for the duration of the project.

E. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

F. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.

G. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

1. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
2. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.

H. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

I. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.07 COORDINATION

A. See Section 011000 for occupancy-related requirements.

B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

C. Notify affected utility companies and comply with their requirements.

D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

G. Maintain headroom clearances as indicated on Drawings. Where not indicated, maintain minimum of 96 inches in occupied areas and 90 inches in unoccupied spaces.

H. Coordinate completion and clean-up of work of separate sections.

I. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

1. The existence and location of site improvements, utilites, and other construction indicated on drawings as existing are not guaranteed. Before beginning work, investigate and verify existence and location of mechanical and electrical systems and other construction affecting the Work.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

1. The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilites and other construction affecting the Work.
2. Before construction, verify the location and invert elevation of points of connectionof sanitary sewer, storm sewer, and water-service piping, and undergound electrical services.
3. Furnish location data for work related to Project that must be performed by public utilites serving Project site.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.
B. Seal cracks or openings of substrate prior to applying next material or substance.
C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
B. Require attendance of parties directly affecting, or affected by, work of the specific section.
C. Notify Architect four days in advance of meeting date.
D. Prepare agenda and preside at meeting:
   1. Review conditions of examination, preparation and installation procedures.
   2. Review coordination with related work.
E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.
B. Promptly notify Architect of any discrepancies discovered.
C. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

D. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
E. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.
F. Utilize recognized engineering survey practices.
G. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
    1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
    2. Grid or axis for structures.
    3. Building foundation, column locations, ground floor elevations, and major elements as the Work progresses.
H. Periodically verify layouts by same means.
I. Maintain a complete and accurate log of control and survey work as it progresses.
J. On completion of foundation walls and major site improvements, prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.

3.05 GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
E. Make neat transitions between different surfaces, maintaining texture and appearance.
F. Provide anchoring and fastening blocking and plates as recommended by manufacturer of items to be mounted and as indicated in Drawings.
    1. Follow requirements of shop drawings, Drawings, and manufacturer requirements in setting mounting heights of elements. Set heights as directed by Architect where existing conditions prohibit installation indicated.

G. Joint locations not already indicated in Drawings to be approved by Architect. Make joints uniform in width and spacing unless directed otherwise by Architect.

3.06 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. Perform whatever cutting and patching is necessary to:

1. Complete the work.
2. Fit products together to integrate with other work.
3. Provide openings for penetration of mechanical, electrical, and other services.
4. Match work that has been cut to adjacent work.
5. Repair areas adjacent to cuts to required condition.
6. Repair new work damaged by subsequent work.
7. Remove samples of installed work for testing when requested.
8. Remove and replace defective and non-complying work.

C. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

D. Warranties: Review existing warranties of materials and equipment with Owner. Avoid activities that will void existing warranties.

E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 078400, to full thickness of the penetrated element.

J. Patching:

1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit. Finish work until there is no evidence of patching.
2. Match color, texture, and appearance.

3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.07 PROGRESS CLEANING

A. Comply with requirements in Section 017419 - Construction Waste Management and Disposal.
B. Follow requirements in NFPA 241 for handling of combustible waste and debris.
C. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
D. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
E. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
F. Clean areas designed to be concealed before enclosing.
G. Collect and remove waste materials, debris, and trash/rubbish from site weekly and dispose off-site; do not burn or bury.

3.08 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.
B. Provide special protection where specified in individual specification sections.
C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.09 SYSTEM STARTUP

A. Coordinate with requirements of Section 019113 - General Commissioning Requirements and specific requirements of Plumbing, HVAC and Electrical System Commissioning included in this Contract.
B. Coordinate schedule for start-up of various equipment and systems.
C. Notify Architect and Owner seven days prior to start-up of each item.

D. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
E. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
F. Verify that wiring and support components for equipment are complete and tested.
G. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
H. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
I. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.10 DEMONSTRATION AND INSTRUCTION

A. See Section 017900 - Demonstration and Training.

3.11 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.
B. Testing, adjusting, and balancing HVAC systems: See Section 230593 - Testing, Adjusting, and Balancing for HVAC.

3.12 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.
    1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.
    2. Utilize professional, experienced cleaning staff for Final Cleaning.
B. Use cleaning materials that are nonhazardous.
C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
F. Clean filters of operating equipment.

G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.
H. Clean site; sweep paved areas, rake clean landscaped surfaces.
I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.13 CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Architect and Owner.
B. Accompany Architect on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.
D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.
E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.
F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.
H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.14 MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.
B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

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SECTION 017419

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 WASTE MANAGEMENT REQUIREMENTS

A. Owner requires that this project generate the least amount of trash and waste possible.

B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

D. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:

1. Aluminum and plastic beverage containers.
2. Corrugated cardboard.
3. Wood pallets.
4. Clean dimensional wood.
5. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
6. Carpet, carpet cushion, carpet tile, and carpet remnants, both new and removed: DuPont (http://flooring.dupont.com) and Interface (www.interfaceinc.com) conduct reclamation programs.

E. Contractor Reporting Responsibilities: Submit periodic Waste Disposal Reports; report landfill disposal, recycling, salvage, and reuse regardless of to whom the cost or savings accrues; use the same units of measure on required reports.

F. Develop and follow a Waste Management Plan designed to implement these requirements.

G. Methods of trash/waste disposal that are not acceptable are:

1. Burning on the project site.
2. Burying on the project site.
3. Dumping or burying on other property, public or private.
4. Other illegal dumping or burying.

H. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 RELATED REQUIREMENTS

A. Section 012500 - Substitution Procedures.

B. Section 013000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.

C. Section 013566.12 - Sustainability Certification Project Procedures - LEED v4 and v4.1: Procedures for sustainable design documentation.

D. Section 013566.32 - Sustainability Certification Project Procedures - LEED v4.1: Procedures for sustainable design documentation.

E. Section 015000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.

F. Section 016000 - Product Requirements: Waste prevention requirements related to product substitutions.

G. Section 016000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.

H. Section 017000 - Execution and Closeout Requirements: Trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

1.03 DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
I. Return: To give back reusable items or unused products to vendors for credit.
J. Reuse: To reuse a construction waste material in some manner on the project site.
K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.
B. Sustainable Design Submittals: Submit Waste Management Plan and Waste Disposal Reports in accordance with procedures specified in Section 013566.12 - Sustainability Certification Project Procedures - LEED v4 and v4.1.
C. Waste Management Plan: Include the following information:
    1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
    2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
    3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
    4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.

5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.

D. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
   1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
   2. Submit Report on a form acceptable to Owner.
   3. Landfill Disposal: Include the following information:
      a. Identification of material.
      b. Amount, in tons or cubic yards (cubic meters), of trash/waste material from the project disposed of in landfills.
      c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
      d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
   4. Incinerator Disposal: Include the following information:
      a. Identification of material.
      b. Amount, in tons or cubic yards (cubic meters), of trash/waste material from the project delivered to incinerators.
      c. State the identity of incinerators, total amount of fees paid to incinerator, and total disposal cost.
      d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
   5. Recycled and Salvaged Materials: Include the following information for each:
      a. Identification of material, including those retrieved by installer for use on other projects.
      b. Amount, in tons or cubic yards (cubic meters), date removed from the project site, and receiving party.

c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.

6. Material Reused on Project: Include the following information for each:
   a. Identification of material and how it was used in the project.
   b. Amount, in tons or cubic yards (cubic meters).
   c. Include weight tickets as evidence of quantity.
7. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

PART 2 PRODUCTS

2.01 PRODUCT SUBSTITUTIONS

A. See Section 016000 and Section 012500.
B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 016000:
   1. Relative amount of waste produced, compared to specified product.
   2. Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Sum.
   3. Proposed disposal method for waste product.
   4. Markets for recycled waste product.

PART 3 EXECUTION

3.01 WASTE MANAGEMENT PROCEDURES

A. See Section 013000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.
B. See Section 015000 for additional requirements related to trash/waste collection and removal facilities and services.
C. See Section 016000 for waste prevention requirements related to delivery, storage, and handling.
D. See Section 017000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.

C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

D. Meetings: Discuss trash/waste management goals and issues at project meetings.
   1. Prebid meeting.
   2. Preconstruction meeting.
   3. Regular job-site meetings.

E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
   1. Provide containers as required.
   2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
   3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

SECTION 017800
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project record documents.

B. Operation and maintenance data.

C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

A. Section 013000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Section 017000 - Execution and Closeout Requirements: Contract closeout procedures.

C. Individual Product Sections: Specific requirements for operation and maintenance data.

D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Architect with claim for final Application for Payment.

B. Operation and Maintenance Data:

1. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
2. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
3. Submit two sets of revised final documents in final form within 10 days after final inspection.

C. Warranties and Bonds:

1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.

3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress. Record data on installations before they are concealed.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.
   4. Specification Deliverable: Submit annotated PDF, highlighting changes. Bookmark each annotated section.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish first floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Field changes of dimension and detail.
   4. Details not on original Contract drawings.
   5. Confirmed depth of foundations below finish floor.
   6. Inverts and locations of underground utilites.
   7. Actual equipment locations shown diagrammatically on drawings.

8. Duct routing and size if different than design.
9. Other items useful to Owner for maintenance and access.

G. Drawing Deliverable: Mark each Drawing as "PROJECT RECORD DRAWING" and include date completed.
1. Scan and transmit as PDF file.
2. Bookmark each sheet of Record Drawing PDF.

3.02 OPERATION AND MAINTENANCE DATA

A. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

B. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

C. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
1. Product data, with catalog number, size, composition, and color and texture designations.
2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Additional information as specified in individual product specification sections.

D. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:
1. Description of unit or system, and component parts.
2. Identify function, normal operating characteristics, and limiting conditions.
3. Include performance curves, with engineering data and tests.
4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
E. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
F. Provide servicing and lubrication schedule, and list of lubricants required.
G. Include manufacturer's printed operation and maintenance instructions.
H. Include sequence of operation by controls manufacturer.
I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
J. Provide control diagrams by controls manufacturer as installed.
K. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
L. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
M. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
N. Include test and balancing reports.
O. Additional Requirements: As specified in individual product specification sections.

3.05 FACILITIES REQUIREMENTS AND OPERATIONS AND MAINTENANCE PLAN (LEED)

A. A Current facilities requirements and operations and maitencance plan that contains the information necessary to operate the building efficiently.
B. In accordance with LEED credit Fundamental Commissioning and Verification, include the following information:
    1. A Sequence of Operations for the building
    2. The building occupancy schedule
    3. Equipment run-time schedules
    4. Setpoints for all HVAC equipment
    5. Set lighting levels throughout the building
    6. Minimum outside air requirements

7. Changes in schedules or setpoints for different seasons, days of the week and times of day
8. A systems narrative describing the mechanical and electrical systems and equipment
9. A preventative maintenance plan for building equipment described in the systems narrative
10. A commissioning program that includes periodic commissioning requirements, ongoing commissioning tasks and continuous tasks for critical facilities

3.06 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Provide digital PDF format copy of binder contents on USB flash drive in addition to hard copies.

C. Where systems involve more than one specification section, provide separate tabbed divider for each system.

D. Binders: Commercial quality, 8-1/2 by 11 inch (216 by 280 mm) three D side ring binders with durable plastic covers; 2 inch (50 mm) maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

E. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

F. Project Directory: Title and address of Project; names, addresses, and telephone numbers of ArchitectContractor and subcontractors, with names of responsible parties.

G. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

H. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

I. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.

J. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

K. Arrangement of Contents: Organize each volume in parts as follows:
   1. Project Directory.
   2. Table of Contents, of all volumes, and of this volume.
   3. Operation and Maintenance Data: Arranged by system, then by product category.
      a. Source data.
      b. Product data, shop drawings, and other submittals.
      c. Operation and maintenance data.
      d. Field quality control data.
      e. Photocopies of warranties and bonds.

3.07 WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
B. Verify that documents are in proper form, contain full information, and are notarized.
C. Co-execute submittals when required.
D. Retain warranties and bonds until time specified for submittal.
E. Manual: Bind in commercial quality 8-1/2 by 11 inch (216 by 279 mm) three D side ring binders with durable plastic covers.
F. Provide digital PDF format copy of binder contents on USB flash drive in addition to hard copies.
G. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
H. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
I. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION

SECTION 017900
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

A. Demonstration of products and systems to be commissioned and where indicated in specific specification sections.

B. Training of Owner personnel in operation and maintenance is required for:
   1. All software-operated systems.
   2. HVAC systems and equipment.
   3. Plumbing equipment.
   4. Electrical systems and equipment.
   5. Conveying systems.
   6. Items specified in individual product Sections.

C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
   1. Finishes, including flooring, wall finishes, ceiling finishes.
   2. Fixtures and fittings.
   3. Items specified in individual product Sections.

1.02 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures; except:
   1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.
   2. Submit one copy to the Commissioning Authority, not to be returned.
   3. Make commissioning submittals on time schedule specified by Commissioning Authority.
   4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word preferred.

B. Draft Training Plans: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
   1. Submit to Commissioning Authority for review and inclusion in overall training plan.
   2. Submit not less than four weeks prior to start of training.
   3. Revise and resubmit until acceptable.
   4. Provide an overall schedule showing all training sessions.

5. Include at least the following for each training session:
    a. Identification, date, time, and duration.
    b. Description of products and/or systems to be covered.
    c. Name of firm and person conducting training; include qualifications.
    d. Intended audience, such as job description.
    e. Objectives of training and suggested methods of ensuring adequate training.
    f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
    g. Media to be used, such a slides, hand-outs, etc.
    h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
1. Include applicable portion of O&M manuals.
2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
3. Provide one extra copy of each training manual to be included with operation and maintenance data.

D. Training Reports:
1. Identification of each training session, date, time, and duration.
2. Sign-in sheet showing names and job titles of attendees.
3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.
4. Include Commissioning Authority's formal acceptance of training session.

E. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
1. Format: DVD Disc.
2. Label each disc and container with session identification and date.

1.03 QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.

2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstrations conducted during Functional Testing need not be repeated unless Owner personnel training is specified.

C. Demonstration may be combined with Owner personnel training if applicable.

D. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.

1. Perform demonstrations not less than two weeks prior to Substantial Completion.
2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

E. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.

1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

A. Conduct training on-site unless otherwise indicated.

B. Owner will provide classroom and seating at no cost to Contractor.

C. Do not start training until Functional Testing is complete, unless otherwise specified or approved by the Commissioning Authority.

D. Provide training in minimum two hour segments.

E. The Commissioning Authority is responsible for determining that the training was satisfactorily completed and will provide approval forms.

F. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

G. Review of Facility Policy on Operation and Maintenance Data: During training discuss:

1. The location of the O&M manuals and procedures for use and preservation; backup copies.
2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
3. Typical uses of the O&M manuals.

H. Product- and System-Specific Training:
1. Review the applicable O&M manuals.
2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
4. Provide hands-on training on all operational modes possible and preventive maintenance.
5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
6. Discuss common troubleshooting problems and solutions.
7. Discuss any peculiarities of equipment installation or operation.
8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
9. Review recommended tools and spare parts inventory suggestions of manufacturers.
10. Review spare parts and tools required to be furnished by Contractor.
11. Review spare parts suppliers and sources and procurement procedures.

I. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

SECTION 019113

GENERAL COMMISSIONING REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Commissioning is intended to achieve the following specific objectives; this section specifies the Contractor's responsibilities for commissioning:

1. Verify that the work is installed in accordance with Contract Documents and the manufacturer’s recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists executed by Contractor are utilized to achieve this.
2. Verify and document that functional performance is in accordance with Contract Documents: Functional Tests executed by Contractor and witnessed by the Commissioning Authority are utilized to achieve this.
3. Verify that operation and maintenance manuals submitted to Owner are complete: Detailed operation and maintenance (O&M) data submittals by Contractor are utilized to achieve this.
4. Verify that the Owner’s operating personnel are adequately trained: Formal training conducted by Contractor is utilized to achieve this.

B. Commissioning, including Functional Tests, O&M documentation review, and training, is to occur after startup and initial checkout and be completed before Functional Completion.

C. The Commissioning Authority directs and coordinates all commissioning activities; this section describes some but not all of the Commissioning Authority's responsibilities.

D. The Commissioning Authority is employed by Owner.

1.02 SCOPE OF COMMISSIONING

A. The following are to be commissioned:

B. Building envelope:

1. Air tightness.

C. Plumbing Systems:

1. Domestic Water heaters and recirculation pumps.

D. HVAC System

E. Integrated Automation.

F. Electrical Systems:

1. DaylightinLighting controls other than manual switches.

G. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.

1.03 RELATED REQUIREMENTS

A. Section 013329.02 - Sustainable Design Reporting - LEED v4 and v4.1: Reporting requirements relating to commissioning.
B. Section 015719 - Temporary Environmental Controls: Precautions and procedures; smoking room testing; building flush-out.
C. Section 017000 - Execution and Closeout Requirements: General startup requirements.
D. Section 017800 - Closeout Submittals: Scope and procedures for operation and maintenance manuals and project record documents.
E. Section 017900 - Demonstration and Training: Scope and procedures for Owner personnel training.
F. Section 220000 - Plumbing Commissioning Requirements
G. Section 230000 - Mechanical Commissioning Requirements
H. Section 260000 - Electrical Commissioning Requirements
I. Section 230593 - Testing, Adjusting and Balancing for HVAC: Requirements related to review and TAB cooperation with Commissioning activities

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures; except:
    1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority, unless they require review by Architect; in that case, submit to Architect first.
    2. Submit one copy to the Commissioning Authority, not to be returned.
    3. Make commissioning submittals on time schedule specified by Commissioning Authority.
    4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of Prefunctional Checklists or Functional Test requirements; submit in editable electronic format, Microsoft Word 2010 preferred.
    5. As soon as possible after submittals made to Architect are approved, submit copy of approved submittal to the Commissioning Authority.
B. Product Data: If submittals to Architect do not include the following, submit copies as soon as possible:
    1. Manufacturer's product data, cut sheets, and shop drawings.

2. Manufacturer's installation instructions.
3. Startup, operating, and troubleshooting procedures.
4. Fan and pump curves.
5. Factory test reports.
6. Warranty information, including details of Owner's responsibilities in regard to keeping warranties in force.

C. Manufacturers' Instructions: Submit copies of all manufacturer-provided instructions that are shipped with the equipment as soon as the equipment is delivered.

D. Startup Plans and Reports.

E. Completed Prefunctional Checklists.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 COMMISSIONING PLAN

A. Commissioning Authority has prepared the Commissioning Plan.
   1. Attend meetings called by the Commissioning Authority for purposes of completing the commissioning plan.
   2. Require attendance and participation of relevant subcontractors, installers, suppliers, and manufacturer representatives.

B. Contractor is responsible for compliance with the Commissioning Plan.

C. Commissioning Plan: The commissioning schedule, procedures, and coordination requirements for all parties in the commissioning process.

D. Commissioning Schedule:
   1. Submit anticipated dates of startup of each item of equipment and system to Commissioning Authority within 60 days after award of Contract.
   2. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.
   3. Provide sufficient notice to Commissioning Authority for delivery of relevant Checklists and Functional Test procedures, to avoid delay.

3.02 STARTUP PLANS AND REPORTS

A. Comply with Division 22, 23 and 26 Commissioning Requirements

B. Startup Plans: For each item of equipment and system for which the manufacturer provides a startup plan, submit the plan not less than 8 weeks prior to startup.

C. Startup Reports: For each item of equipment and system for which the manufacturer provides a startup checklist (or startup plan or field checkout sheet), document compliance by submitting the completed startup checklist prior to startup, signed and dated by responsible entity.

D. Submit directly to the Commissioning Authority.

3.03 PREFUNCTIONAL CHECKLISTS

A. Comply with Division 22, 23 and 26 Commissioning Requirements

B. A Prefunctional Checklist is required to be filled out for each item of equipment or other assembly specified to be commissioned.

1. No sampling of identical or near-identical items is allowed.
2. These checklists do not replace manufacturers' recommended startup checklists, regardless of apparent redundancy.
3. Prefunctional Checklist forms will not be complete until after award of the contract; the following types of information will be gathered via the completed Checklist forms:
    a. Certification by installing contractor that the unit is properly installed, started up, and operating and ready for Functional Testing.
    b. Confirmation of receipt of each shop drawing and commissioning submittal specified, itemized by unit.
    c. Manufacturer, model number, and relevant capacity information; list information "as specified," "as submitted," and "as installed."
    d. Serial number of installed unit.
    e. List of inspections to be conducted to document proper installation prior to startup and Functional Testing; these will be primarily static inspections and procedures; for equipment and systems may include normal manufacturer’s start-up checklist items and minor testing.
    f. Sensor and actuator calibration information.

C. Contractor is responsible for filling out Prefunctional Checklists, after completion of installation and before startup; witnessing by the Commissioning Authority is not required unless otherwise specified.

1. Each line item without deficiency is to be witnessed, initialed, and dated by the actual witness; checklists are not complete until all line items are initialed and dated complete without deficiencies.

2. Checklists with incomplete items may be submitted for approval provided the Contractor attests that incomplete items do not preclude the performance of safe and reliable Functional Testing; re-submission of the Checklist is required upon completion of remaining items.
3. Individual Checklists may contain line items that are the responsibility of more than one installer; Contractor shall assign responsibility to appropriate installers or subcontractors, with identification recorded on the form.
4. If any Checklist line item is not relevant, record reasons on the form.
5. Contractor may independently perform startup inspections and/or tests, at Contractor's option.
6. Regardless of these reporting requirements, Contractor is responsible for correct startup and operation.
7. Submit completed Checklists to Commissioning Authority within two days of completion.

D. Commissioning Authority is responsible for furnishing the Prefunctional Checklists to Contractor.
1. Initial Drafts: Contractor is responsible for initial draft of Prefunctional Checklist where so indicated in Contract Documents.
2. Provide all additional information requested by Commissioning Authority to aid in preparation of checklists, such as shop drawing submittals, manufacturers' startup checklists, and O&M data.
3. Commissioning Authority may add any relevant items deemed necessary regardless of whether they are explicitly mentioned in Contract Documents or not.
4. When asked to review the proposed Checklists, do so in a timely manner.

E. Commissioning Authority Witnessing: Required for:
1. Comply with Division 22, 23 and 26 Commissioning Requirements
2. A sampling of non-primary equipment, as allowed by the commissioning plan.

F. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.
1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.

3.04 FUNCTIONAL TESTS

A. A Functional Test is required for each item of equipment, system, or other assembly specified to be commissioned, unless sampling of multiple identical or near-identical units is allowed by the final test procedures.

B. Comply with Division 22, 23 and 26 Commissioning Requirements

C. Contractor is responsible for execution of required Functional Tests, after completion of Prefunctional Checklist and before closeout.

D. Commissioning Authority is responsible for witnessing and reporting results of Functional Tests, including preparation and completion of forms for that purpose.

E. Contractor is responsible for correction of deficiencies and re-testing at no extra cost to Owner; if a deficiency is not corrected and re-tested immediately, the Commissioning Authority will document the deficiency and the Contractor's stated intentions regarding correction.

1. Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with Contract Documents or does not perform properly.
2. When the deficiency has been corrected, the Contractor completes the form certifying that the item is ready to be re-tested and returns the form to the Commissioning Authority; the Commissioning Authority will reschedule the test and the Contractor shall re-test.
3. Identical or Near-Identical Items: If 10 percent, or three, whichever is greater, of identical or near-identical items fail to perform due to material or manufacturing defect, all items will be considered defective; provide a proposal for correction within 2 weeks after notification of defect, including provision for testing sample installations prior to replacement of all items.
4. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing.
5. Contractor shall bear the cost of Owner and Commissioning Authority personnel time witnessing re-testing if the test failed due to failure to execute the relevant Prefunctional Checklist correctly; if the test failed for reasons that would not have been identified in the Prefunctional Checklist process, Contractor shall bear the cost of the second and subsequent re-tests.

F. Functional Test Procedures:

1. Some test procedures are included in Contract Documents; where Functional Test procedures are not included in Contract Documents, test procedures will be determined by the Commissioning Authority with input by and coordination with Contractor.
2. Examples of Functional Testing:
    a. Test the dynamic function and operation of equipment and systems (rather than just components) using manual (direct observation) or monitoring methods under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint).
    b. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc.
    c. Systems are run through all the HVAC control system’s sequences of operation and components are verified to be responding as the sequence's state.
    d. Traditional air or water test and balancing (TAB) is not Functional Testing; spot checking of TAB by demonstration to the Commissioning Authority is Functional Testing.

G. Deferred Functional Tests: Some tests may need to be performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions; performance of these tests remains the Contractor's responsibility regardless of timing.

3.05 TEST PROCEDURES - GENERAL

A. Provide skilled technicians to execute starting of equipment and to execute the Functional Tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.

B. Provide all necessary materials and system modifications required to produce the flows, pressures, temperatures, and conditions necessary to execute the test according to the specified conditions. At completion of the test, return all affected equipment and systems to their pre-test condition.

C. Sampling: Where Functional Testing of fewer than the total number of multiple identical or near-identical items is explicitly permitted, perform sampling as follows:

1. Identical Units: Defined as units with same application and sequence of operation; only minor size or capacity difference.
2. Sampling is not allowed for:
    a. Major equipment.
    b. Life-safety-critical equipment.
    c. Prefunctional Checklist execution.
3. XX = the percent of the group of identical equipment to be included in each sample; defined for specific type of equipment.
4. YY = the percent of the sample that if failed will require another sample to be tested; defined for specific type of equipment.
5. Randomly test at least XX percent of each group of identical equipment, but not less than three units. This constitutes the "first sample."
6. If YY percent of the units in the first sample fail, test another XX percent of the remaining identical units.
7. If YY percent of the units in the second sample fail, test all remaining identical units.
8. If frequent failures occur, resulting in more troubleshooting than testing, the Commissioning Authority may stop the testing and require Contractor to perform and document a checkout of the remaining units prior to continuing testing.

D. Manual Testing: Use hand-held instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the “observation”).

E. Simulating Conditions: Artificially create the necessary condition for the purpose of testing the response of a system; for example apply hot air to a space sensor using a hair dryer to see the response in a VAV box.

F. Simulating Signals: Disconnect the sensor and use a signal generator to send an amperage, resistance or pressure to the transducer and control system to simulate the sensor value.

G. Over-Writing Values: Change the sensor value known to the control system in the control system to see the response of the system; for example, change the outside air temperature value from 50 degrees F to 75 degrees F to verify economizer operation.

H. Indirect Indicators: Remote indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed, are considered indirect indicators.

I. Monitoring: Record parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of the relevant control systems; where monitoring of specific points is called for in Functional Test Procedures:

1. All points that are monitored by the relevant control system shall be trended by Contractor; at the Commissioning Authority's request, Contractor shall trend up to 20 percent more points than specified at no extra charge.
2. Other points will be monitored by the Commissioning Authority using dataloggers.
3. At the option of the Commissioning Authority, some control system monitoring may be replaced with datalogger monitoring.
4. Provide hard copies of monitored data in columnar format with time down left column and at least 5 columns of point values on same page.
5. Graphical output is desirable and is required for all output if the system can produce it.
6. Monitoring may be used to augment manual testing.

3.06 OPERATION AND MAINTENANCE MANUALS

A. See Section 017800 - Closeout Submittals for additional requirements.

B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.

C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

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SECTION 024100
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Building demolition excluding removal of hazardous materials and toxic substances.

B. Abandonment and removal of existing utilities and utility structures.

1.02 RELATED REQUIREMENTS

A. Section 011000 - Summary: Sequencing and staging requirements.

B. Section 011000 - Summary: Description of items to be removed by Owner.

C. Section 011000 - Summary: Description of items to be salvaged or removed for re-use by Contractor.

D. Section 015000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

E. Section 016000 - Product Requirements: Handling and storage of items removed for salvage and relocation.

F. Section 017419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

G. Section 311000 - Site Clearing: Vegetation and existing debris removal; earth stripping and stockpiling.

H. Section 312000 - Earthwork: Rough and fine grading.

I. Section 31200 - Earthwork: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

1.03 DEFINITIONS

A. Demolition: Dismantle, raze, destroy or wreck any building or structure or any part thereof.

1.04 REFERENCE STANDARDS

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Site Plan: Indicate:

1. Areas for temporary construction and field offices.

C. Demolition Plan: Submit demolition plan as required by OSHA and local AHJs.

1. Indicate extent of demolition, removal sequencing, bracing and shoring, and location and construction of barricades and fences.
2. Demolition firm qualifications.

D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

PART 2 PRODUCTS

2.01 MATERIALS

A. Fill Material: See Section Earthwork - 312000.

PART 3 EXECUTION

3.01 DEMOLITION

A. Remove the entire building indicated on Site Demolition Drawings.
B. Remove paving and curbs required to accomplish new work.
C. Remove all other paving and curbs as indicated on drawings.
D. Within area of new construction, remove foundation walls and footings completely.
E. Remove other items indicated, for salvage, relocation, and recycling.
F. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Section Earthwork - 31200.

3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
    1. Obtain required permits.
    2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
    3. Provide, erect, and maintain temporary barriers and security devices.
    4. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
    5. Do not close or obstruct roadways or sidewalks without permits from authority having jurisdiction.
    6. Conduct operations to minimize obstruction of public and private entrances and exits. Do not obstruct required exits at any time. Protect persons using entrances and exits from removal operations.
    7. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon, or limit access to their property.
B. Do not begin removal until receipt of notification to proceed from Owner.
C. Protect existing structures and other elements to remain in place and not removed.
    1. Provide bracing and shoring.
    2. Prevent movement or settlement of adjacent structures.

3. Stop work immediately if adjacent structures appear to be in danger.

D. Minimize production of dust due to demolition operations. Do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

E. Hazardous Materials:

1. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCBs, and mercury.

F. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

3.03 EXISTING UTILITIES

A. Contractor shall be responsible for disconnection of utilities and obtaining disconnection letters and/or other documentation required to carry out work.

B. Coordinate work with utility companies. Notify utilities before starting work, comply with their requirements, and obtain required permits.

C. Protect existing utilities to remain from damage.

D. Do not disrupt public utilities without permit from authority having jurisdiction.

E. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

F. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

G. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

H. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

3.04 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

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SECTION 024113

SELECTIVE SITE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Demolition and removal of existing asphalt and/or concrete pavement, concrete and/or asphalt walks, curbs and gutters, and other exterior site items indicated or not indicated which interfere with the Work.
2. Removal and/or relocation of existing underground utilities.
3. Removal and disposal of existing sanitary sewer pipe, water pipe, storm drainage pipe and appurtenances indicated. Filling of existing pipes to be abandoned in place.
4. Removal and replacement of fencing and playground equipment.
5. Removal and relocation of existing light poles.

1.3 DEFINITIONS

A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the Owner's property.

B. Remove and Salvage: Items indicated to be removed and salvaged remain the Owner's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to Owner's designated storage area.

C. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in the same locations or in locations indicated.

D. Existing to Remain: Protect items indicated to remain against damage and soiling. When permitted by the Architect, items may be removed to a suitable, protected storage location and then cleaned and reinstalled in their original locations.

1.4 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain the Owner's property, remove demolished materials from the site with further disposition at the Contractor's option.

B. Storage or sale of removed items or materials on-site will not be permitted.

C. Historical items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to the Owner, which may be encountered, remain the Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to the Owner.

1.5 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by the Work.

B. Record drawings at Project closeout.

1. Identify and accurately locate capped utilities and other subsurface structural, electrical, or mechanical conditions.

C. Proposed dust-control measures.

D. Schedule of selective demolition activities indicating the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
2. Interruption of utility services.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Detailed sequence of selective demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
6. Locations of temporary partitions and means of egress.

E. Inventory of items to be removed and salvaged or turned over to Owner.

F. Landfill records indicating receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: All work shall comply with Federal, State and Local laws and regulations concerning hauling and disposal of demolition debris.

B. Notify the proper agencies prior to the start of work and obtain all necessary permits for this work.

1.7 PROJECT CONDITIONS

A. Owner assumes no responsibility for actual condition of items or structures to be demolished. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner to the extent practical. However, minor variations may occur due to Owner's removal and salvage operations prior to the start of demolition work.

B. The location of existing underground utilities indicated is approximate only. Field locate all existing underground utilities in the area of work, regardless of whether or not they are indicated. Call "Miss Utility" prior to the start of demolition work for assistance in the location of existing underground utilities.

C. Should charted, uncharted or incorrectly charted utilities be encountered during demolition, contact the Architect immediately for instructions. Cooperate with Owner and utility companies to keep services and facilities in operation.

D. Do not interrupt existing utilities serving facilities occupied and used by the Owner and others, except when permitted in writing by the Owner. Provide acceptable temporary utility service as required to maintain Owner's operations.

1.8 SCHEDULING

A. Owner will occupy portions of the building immediately adjacent to the Work. Conduct selective demolition so that the Owner's operations will not be disrupted. Provide not less than 72 hours notice to Owner of activities that will affect Owner's operations.

B. Arrange selective demolition schedule so as not to interfere with Owner's on-site operations.

C. Notify and coordinate any required relocation and/or removal of existing underground utilities, poles, meters or other above ground appurtenances with the appropriate utility company (i.e. power, telephone, cable and natural gas/propane) prior to the start of selective demolition work.

1.9 PAYMENT FOR UTILITY REMOVAL / RELOCATIONS

A. Electric Service – The Owner will pay Electrical Utility Fees for removal

B. Phone Service– The Owner will pay Utility Fees for removal

C. Cable Television– The Owner will pay Utility Fees for removal

D. Gas– The Owner will pay Utility Fees for removal

E. Fiber Optic Lines– The Owner will pay Utility Fees for removal

1.10 USE OF EXPLOSIVES

A. Do not use explosives to perform selective site demolition work.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Call “Miss Utility” prior to the start of demolition work for assistance in the location of existing underground utilities. Field locate all existing underground utilities in the area of work, regardless of whether or not they are indicated.

B. Should uncharted or incorrectly charted existing utilities be identified, contact the Architect immediately for instructions. Provide a scale drawing with the location of the uncharted or incorrectly charted utilities for use by the Architect in preparing additional direction.

C. Verify that utilities indicated as removed, abandoned and/or relocated have been disconnected and capped.

D. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

E. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged and turned over to the Owner.

3.2 PROTECTION OF PERSONS AND PROPERTY

A. Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.

B. Conduct demolition operations and remove debris to ensure minimum interference with roads, streets, walks and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

C. Conduct demolition operations to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around selective demolition area.

1. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
2. Protect existing site improvements, appurtenances, and landscaping to remain.

D. Barricade areas of demolition occurring as part of this work, and post with warning lights as required by authorities having jurisdiction.

E. Protect structures, buildings, utilities, walks, pavements, existing vegetation and other facilities to remain from damage caused by settlement, lateral movement, undermining, washout and other hazards created by demolition operations.

3.3 POLLUTION CONTROLS

A. Perform all work in accordance with the requirements of the latest edition of the Virginia Erosion and Sediment Control Handbook and those of the local Erosion Control official.

B. Clean adjacent structures and improvements of dust, dirt, and debris caused by the Work. Return adjacent areas to condition existing before start of selective demolition.

3.4 DEMOLITION OF EXISTING FACILITIES

A. Electric Service

1. Coordinate the removal and/or relocation of existing utilities with Power Company.
2. Contact Power Company Representative to arrange for required removal and/or relocation of existing service.

B. Phone Service

1. Coordinate the removal and/or relocation of existing utilities with Phone Company.
2. Contact Phone Company Representative to arrange for required removal and/or relocation of existing service.

C. Cable Television

1. Coordinate the removal and/or relocation of existing utilities with Cable Company.
2. Contact Cable Company Representative to arrange for required removal and/or relocation of existing service.

D. Gas

1. Coordinate the removal and/or relocation of existing utilities with Gas Company.
2. Contact Gas Company Representative to arrange for required removal and/or relocation of existing service.

E. Fiber Optic Lines

1. Coordinate the removal and/or relocation of existing utilities with Fiber Optic Company.
2. Contact Fiber Optic Company Representative to arrange for required removal and/or relocation of existing service.

F. Petroleum Pipelines

1. Coordinate the removal and/or relocation of existing utilities with Petroleum Pipeline Company.
2. Contact Petroleum Pipeline Company Representative to arrange for required removal and/or relocation of existing service.

G. Utilities

1. Coordinate the removal and/or relocation of existing utilities with the appropriate utility companies.
2. Remove existing utilities as indicated and terminate in a manner conforming to the nationally recognized code covering the specific utility and to local jurisdictional codes.
3. Provide adequate means of support and protection during demolition and other construction operations for existing utilities that are to remain in place. Repair utilities damaged by construction operations to the satisfaction of the utility owner.

H. Asphalt Pavement

1. Remove asphalt concrete pavement by sawcutting to the full depth of the pavement. Provide neat sawcuts at the limits of pavement removal indicated.

I. Concrete Pavement, Walks and Curbs

1. Remove concrete pavement and walks to the nearest joint. Sawcut concrete if joints are not present adjacent to the area of demolition.
2. Sawcut concrete along straight lines to a depth of not less than 2 inches. Break out remainder of concrete, provided that the broken area is concealed in the finished work, and the remaining concrete is sound. At locations where the broken face cannot be concealed, grind smooth or sawcut entirely through concrete.

J. Light Poles

1. Remove and relocate light poles as indicated. If light poles are owned by a public utility, coordinate the relocation with them.

K. Fencing

1. Remove existing chain-link fencing as indicated on the drawings.
2. Turn fencing materials removed over to the Owner.

L. Playground Equipment

1. Remove, store and protect existing playground equipment interfering with proposed construction.
.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.

B. Do not burn demolished materials or debris.

C. Transport and legally dispose of demolished materials off of Owner's property.

3.6 CLEANUP AND REPAIR

A. Upon completion of demolition work remove all tools, equipment and demolition materials from site. Remove demolition work area protection and leave areas clean.

B. Repair any demolition performed in excess of that required. Return elements of construction and surfaces to remain to the condition existing prior to the start of construction. Repair adjacent construction or surfaces soiled or damaged by demolition work.

END OF SECTION 024113

SECTION 031000
CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cast-in-place concrete formwork, shoring, bracing and anchorage.

B. Openings for other work.

C. Form accessories, form-facing materials and form liners

D. Form stripping, removal and re-shoring

1.02 RELATED REQUIREMENTS

A. Section 032000 - Concrete Reinforcing.

B. Section 033000 - Cast-in-Place Concrete.

C. Section 051200 - Structural Steel Framing: Placement of embedded steel anchors and plates in cast-in-place concrete.

1.03 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary.

B. ACI PRC-347 - Guide to Formwork for Concrete.

C. ACI SPEC-117 - Specification for Tolerances for Concrete Construction and Materials.

D. ACI SPEC-301 - Specifications for Concrete Construction.

1.04 PRE-INSTALLATION MEETINGS

A. Meet at project site prior to beginning of installation to review the following:
   1. Special inspector and testing/inspection agency procedures for field quality control.
   2. Construction, movement, contraction, and isolation joints.
   3. Forms and form-removal limitations.
   4. Shoring and reshoring procedures.
   5. Anchor rod and anchor device installation tolerances.

1.05 SUBMITTALS

A. Product Data: Provide data on form materials and installation requirements to include form liners, form ties, waterstops and form-release agents.

B. Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties. Shop drawings prepared by, and signed and seal by, a qualified professional engineer responsible for their preparation.
   1. For exposed vertical concrete walls, indicate dimensions and form tie locations.
   2. Indicate dimensions and locations of construction and movement joints required to construct the structure in accordance with ACI 301.
      a. Location of construction joints is subject to approval of the Architect.
   3. Indicate locations of waterstops.
   4. Indicate form liner layout and form liner termination details.
   5. Indicate proposed schedule and sequence of stripping of forms, shoring removal, and re-shoring installation and removal.

C. Samples
   1. Waterstops
   2. Construction joint devices
   3. Form Liners

1.06 SUBMITTAL PROCEDURES

A. Submit shop drawings and product data in complete packages so that all parts of a given component or area may be reviewed together.

B. Indicate the applicable Contract Drawings and Specification Sections used to develop the submittal.

C. All modifications or revisions to submittals must be clearly clouded with a revision number and date indicated. Clouding of entire sheets, plans, sections, or details is not acceptable unless the sheet, plan, section, or detail is completely new to the revised submittal. The following may be considered cause for rejection of the submittal without review by the Engineer of Record.
   1. Failure to clearly indicate revisions with clouds and revision date.
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D. Resubmittals: Make corrections and completely address all previous comments prior to resubmitting shop drawings and product data. The Engineer of Record will only review those sheets, plans, sections, and details that have been clouded and tagged with a revision triangle.

1.07 REQUESTS FOR INFORMATION (RFI) PROCEDURES

A. RFIs shall be submitted by the Contractor. RFIs submitted by any other entity will not be reviewed.

B. Limit RFIs to one main subject. RFIs including more than one main subject will be returned with a request to break them up into multiple RFIs.

C. Submit RFIs only for clarification or interpretation of the Contract Documents. RFIs shall include a list of sheets, plans, sections, details, and specifications in the Contract Documents where the Contractor has already looked for the information being requested.

D. RFIs requesting a substitution will be rejected. Any substitution requests shall follow Substitution Procedures indicated in Division 01 Specifications.

E. RFIs submitted for correction of field work shall include the Contractor's proposed solution. Provide an engineered solution from the Contractor's engineer in applicable situations.

1.08 QUALITY ASSURANCE

A. Designer Qualifications: Design formwork under direct supervision of a Professional Structural Engineer experienced in design of concrete formwork and licensed in the State in which the Project is located.

1.09 MOCK-UPS

A. Construct a mock-up of formwork for 10'-0" long by 10'-0" wide or as directed by architect. Mock-up exhibiting form surfaces to demonstrate typical joints, surface finish, texture, tolerances and standard of workmanship.
   1. Include reinforcement, ties, and accessories specified in Section 032000.
   2. Provide concrete in accordance with provisions of Section 033000.
   3. Cure concrete in accordance with provisions of Section 033000.

B. Locate mock-up where directed by architect.

C. Mock-up may remain as part of the Work as directed by architect.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver prefabricated forms and installation instructions in manufacturer's packaging.

B. Store prefabricated forms off ground in ventilated and protected manner to prevent deterioration from moisture.

C. Protect plastic foam products from damage and exposure to sunlight.

PART 2 PRODUCTS

2.01 FORMWORK - GENERAL

A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.

B. Design and construct concrete that complies with design with respect to shape, lines, and dimensions. Provide the largest practicable sizes to minimize the number of joints.

C. Chamfer outside corners of beams, joists, columns, and walls.

D. Comply with applicable code and design requirements with respect to design, fabrication, erection, and removal of formwork to support vertical, lateral, static and dynamic loads, and construction loads that might be applied, until the structure can support such loads.
   1. Design formwork to limit deflection of form-facing material to L/240 of center-to-center spacing of supports.
   2. For architectural concrete specified in Section 033300 Architectural Concrete, design formwork to limit deflection of form-facing material to L/400 of center-to-center spacing of supports.

E. Comply with relevant portions of ACI CODE-318, ACI PRC-347, and ACI SPEC-301. Design wood panel forms in accordance with APA's Concrete Forming Design/Construction Guide.

2.02 WOOD FORM MATERIALS

A. Exterior-grade plywood panels, suitable for plywood forms, complying with DOS PS 1 and as follows:
   1. APA HDO (high-density overlay)
   2. APA MDO (medium-density overlay); mill-release agent treated and edge sealed.
   3. APA Structural I Plyform, B-B or better, mill oiled and edge sealed.
   4. APA Plyform Class I, B-B or better; mill oiled and edge sealed.

2.03 REMOVABLE PREFABRICATED FORMS

A. Preformed Steel Forms: Minimum 16 gauge, 0.0598 inch thick, matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

2.04 FORMWORK ACCESSORIES

A. Form Ties: Removable type, galvanized metal, fixed length, cone type, with waterproofing washer, 1 inch back break dimension, free of defects that could leave holes larger than 1 inch in concrete surface.

B. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.
   1. Formulate form-release agents with rust inhibitor for steel form-facing materials.
   2. Form release agent for form liners shall be acceptable to form liner manufacturer.

C. Dowel Sleeves: Plastic sleeve and nailable plastic base for smooth, round, steel load-transfer dowels.

D. Filler Strips for Chamfered Corners: Wood, metal, PVC or rubber type; 3/4" x 3/4" minimum size, maximum possible lengths.

E. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

F. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 051200.

G. Waterstops: Self-Expanding Rubber Strip. Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer-modified chloroprene rubber, for adhesive bonding to concrete. Size: 3/8" x 3/4".

H. Waterstops: Self-Expanding Butyl Strip. Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete. Size: 3/4" x 1".

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI SPEC-301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Arrange and assemble formwork to permit dismantling and stripping without hammering or prying against concrete surfaces. Do not damage concrete during stripping. Provide keyways, reglets, recesses, and other accessories, for easy removal. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

D. Do not use rust-stained, steel, form-facing material.

E. Align joints and make watertight. Keep form joints to a minimum. At exposed concrete locations, symmetrically align joints in forms.

F. Construction and Movement Joints
   1. At construction joints, overlap forms onto previously placed concrete not less than 12".
   2. Construct joints true to line with faces perpendicular to surface plane of concrete.
   3. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   4. Place joints perpendicular to main reinforcement.
   5. Locate joints for beams, slabs, joists, and girders in the middle third of spans.
      a. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
   6. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at top of footings or floor slabs.
   7. Space vertical joints as indicated on Drawings.
      a. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

G. Obtain approval before framing openings in structural members that are not indicated on drawings.

H. Limit concrete surface irregularities as follows:
   1. Class A Surface: 1/8" allowable in 5ft. Applicable at exposed concrete surfaces critical for appearance purposes. Locations indicated on Drawings.
   2. Class B Surface: 1/4" allowable in 5ft. Applicable at all exposed concrete surfaces.

I. Professional engineer form designer shall inspect installed forming that supports weight of concrete for compliance with Section 26.11 of ACI 318 prior to placing concrete.

3.03 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

3.04 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work. Obtain written approval of Architect prior to forming openings not indicated on Drawings.

B. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.
   1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.

C. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

D. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms, at inconspicuous locations, to allow flushing water to drain.

E. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.05 INSTALLATION OF WATERSTOPS

A. Install waterstops in longest length practical. Locate waterstops in center of construction joints and at all locations indicated on Drawings.

B. Self-Expanding Strip Waterstops: Install according to manufacturer's written instructions, by adhesive bonding, mechanically fastening, and firmly pressed into place. Protect exposed waterstops during progress of work.

3.06 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms, clean surfaces, remove fins and laitance, and tighten to close joints. Split, frayed, delaminated, or other-wise damaged form-facing material are unacceptable for exposed surfaces.

B. Clean formed cavities of debris prior to placing concrete.
   1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.
   2. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.07 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI SPEC-117, unless otherwise indicated, and to comply with the Surface Finish designations specified in Section 033000 Cast-In-Place for as-cast finishes and Section 033300 Architectural Concrete.

B. Construct and align formwork for elevator hoistway in accordance with ASME A17.1.

3.08 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
   1. Formwork for sides of beams, walls, columns and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
   2. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

3.09 SHORING AND RE-SHORING INSTALLATION

A. Comply with ACI 318, ACI 301 and ACI PRC-347 for design, installation, and removal of shoring and re-shoring.
   1. Do not remove shoring or re-shoring until measurement of slab tolerances is complete.

B. In multi-story construction, extend shoring or re-shoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and re-shore to avoid damage to concrete. Locate and provide adequate re-shoring to support construction without excess stress or deflection.

D. Professional engineer form designer shall inspect form removal and re-shoring for compliance with Section 26.11 of ACI 318.

3.10 FIELD QUALITY CONTROL

A. Owner will engage an independent special inspector and qualified testing and inspecting agency to perform field quality control tests and special inspections.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

C. Verification of concrete strength before removal of shores and forms from beams and slabs.

END OF SECTION

SECTION 032000
CONCRETE REINFORCING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reinforcing steel for cast-in-place concrete.

B. Supports and accessories for steel reinforcement.

1.02 RELATED REQUIREMENTS

A. Section 031000 - Concrete Forming and Accessories.

B. Section 033000 - Cast-in-Place Concrete.

C. Section 042200 - Concrete Unit Masonry: Reinforcement for masonry.

1.03 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary.

B. ACI MNL-66 - ACI Detailing Manual.

C. ACI SPEC-301 - Specifications for Concrete Construction.

D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

E. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.

F. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

G. AWS D1.4/D1.4M - Structural Welding Code - Steel Reinforcing Bars.

H. CRSI (DA4) - Manual of Standard Practice.

1.04 PRE-INSTALLATION MEETINGS

A. Meet at project site prior to beginning installation to review the following:
   1. Special inspector and testing/inspection agency procedures for field quality control.
   2. Steel-reinforcing installation.
   3. Construction contraction and isolation joints.

1.05 SUBMITTALS

A. Shop Drawings: Comply with requirements of ACI MNL-66 Include bar schedules, shapes of bent bars, spacing of bars, and location of splices. Indicate proposed construction joints required to build the structure.

B. Reports: Submit certified copies of mill test report of reinforcement materials analysis.

C. Product Data: Bar supports and rebar splicing/coupler systems.

1.06 LEED SUBMITTALS

A. MR Credit 2: Environmental Product Declarations.
   1. Steel reinforcement.

B. MR Credit 3: Sourcing of Raw Materials.
   1. Recycled Content: Steel. Include material cost values.
   2. Regionally Source Recycled Content: Steel.

C. MR Credit 4: Material Ingredients.
   1. Report: Steel reinforcement.
   2. Optimization Report or Action Plan: Steel reinforcement.

1.07 SUBMITTAL PROCEDURES

A. Submit shop drawings and product data in complete packages so that all parts of a given component or area may be reviewed together.

B. Indicate the applicable Contract Drawings and Specification Sections used to develop the submittal.

C. All modifications or revisions to submittals must be clearly clouded with a revision number and date indicated. Clouding of entire sheets, plans, sections, or details is not acceptable unless the sheet, plan, section, or detail is completely new to the revised submittal. The following may be considered cause for rejection of the submittal without review by the Engineer of Record.
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D. Resubmittals: Make corrections and completely address all previous comments prior to resubmitting shop drawings and product data. The Engineer of Record will only review those sheets, plans, sections, and details that have been clouded and tagged with a revision triangle.

1.08 REQUESTS FOR INFORMATION (RFI) PROCEDURES

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B. Limit RFIs to one main subject. RFIs including more than one main subject will be returned with a request to break them up into multiple RFIs.

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D. RFIs requesting a substitution will be rejected. Any substitution requests shall follow Substitution Procedures indicated in Division 01 Specifications.

E. RFIs submitted for correction of field work shall include the Contractor's proposed solution. Provide an engineered solution from the Contractor's engineer in applicable situations.

1.09 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI CODE-318 and ACI SPEC-301.
   1. Maintain one copy of each document on project site.

B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.4/D1.4M and no more than 12 months before start of scheduled welding work.

PART 2 PRODUCTS

2.01 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
   1. Plain billet-steel bars.
   2. Unfinished.

B. Reinforcing Steel: ASTM A706/A706M, deformed low-alloy steel bars.
   1. Unfinished.

C. Headed Steel Reinforcing Steel: ASTM A970/A970M.

D. Steel Welded Wire Reinforcement (WWR): Galvanized, deformed type; ASTM A1064/A1064M.

E. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch.
   2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
      a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.
   3. Joint Dowel Bars: ASTM A615, Grade 60, hot-dip galvanized steel bars as indicated, cut true to length with ends square and free of burrs.

2.02 RE-BAR SPLICING/COUPLER SYSTEMS:

A. Coupler Systems: Mechanical devices for splicing reinforcing bars.
   1. Comply with ACI CODE-318 steel reinforcing design strength requirements for splices in tension and compression.

2.03 FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.

B. Locate reinforcing splices not indicated on drawings at point of minimum stress.
   1. Review locations of splices with Architect.
   2. Continue reinforcement across construction joints unless otherwise indicated.

PART 3 EXECUTION

3.01 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position.

B. Do not displace or damage vapor barrier.

C. Accommodate placement of formed openings.

D. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

E. Comply with ACI 318 for concrete cover over reinforcement.

F. Set wire ties with ends directed into concrete, not towards exposed concrete surfaces.

G. Install weld-wire-fabric reinforcement in longest practical lengths.
   1. Continuous support spacing not to exceed 12 inches.
   2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches.

3.02 FIELD QUALITY CONTROL

A. Owner will engage an independent special inspector and qualified inspection agency to perform field quality control tests and inspections.

B. Inspect installed reinforcement and mechanical rebar-splicing/coupler devices for compliance with contract documents before concrete placement.

END OF SECTION

SECTION 033000
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete building frame members.
B. Concrete for composite floor construction.
C. Elevated concrete slabs.
D. Floors and slabs on grade.
E. Concrete shear walls, elevator shaft walls, and foundation walls.
F. Joint devices associated with concrete work.
G. Concrete curing.

1.02 RELATED REQUIREMENTS

A. Section 031000 - Concrete Forming and Accessories: Forms and accessories for formwork.
B. Section 032000 - Concrete Reinforcing.
C. Section 321313 - Concrete Paving: Sidewalks, curbs and gutters.
D. Section 033543 - Polished Concrete Floor Finish: For polished concrete finishing.

1.03 REFERENCE STANDARDS

A. ACI 211.2 - Standard Practice for Selecting Proportions for Structural Lightweight Concrete.
B. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary.
C. ACI PRC-211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide.
D. ACI PRC-302.1 - Guide to Concrete Floor and Slab Construction.
E. ACI PRC-304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
F. ACI PRC-305 - Guide to Hot Weather Concreting.
G. ACI PRC-306 - Guide to Cold Weather Concreting.
H. ACI PRC-308 - Guide to External Curing of Concrete.
I. ACI PRC-347 - Guide to Formwork for Concrete.
J. ACI SPEC-117 - Specification for Tolerances for Concrete Construction and Materials.
K. ACI SPEC-301 - Specifications for Concrete Construction.
L. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
M. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
N. ASTM C33/C33M - Standard Specification for Concrete Aggregates.
O. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
P. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
Q. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens).
R. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete.
S. ASTM C150/C150M - Standard Specification for Portland Cement.
T. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
U. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.

V. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete.

W. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

X. ASTM C476 - Standard Specification for Grout for Masonry.

Y. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.

Z. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

AA. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

BB. ASTM C1116/C1116M - Standard Specification for Fiber-Reinforced Concrete.

CC. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.

DD. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.

EE. ASTM C1708/C1708M - Standard Test Methods for Self-Leveling Mortars Containing Hydraulic Cements.

FF. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers.

GG. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

HH. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

1.04 SUBMITTALS

A. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
   1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.
   2. For membrane-forming, moisture emission-reducing, curing and sealing compound, provide manufacturer's installation instructions.

B. Mix Design: Submit proposed concrete mix design.
   1. Indicate intended location within Project for each proposed mix design to include the the appropriate Exposure Class designation.
   2. Indicate proposed mix design complies with requirements of ACI SPEC-301, Section 4 - Concrete Mixtures.
   3. Indicate proposed mix design complies with fiber reinforcing manufacturer's written recommendations.
   4. Indicate proposed mix design complies with admixture manufacturer's written recommendations.

C. Test Reports: Submit report for each test or series of tests specified.

1.05 LEED SUBMITTALS

A. MR Credit 2: Environmental Product Declarations.
   1. Concrete.
   2. Slag cement.
   3. Portland cement.

B. MR Credit 3: Sourcing of Raw Materials.
   1. Recycled Content: Fly ash, aggregates, and slag cement. Include material cost values.
   2. Regionally Sourced Recycled Content: Fly ash, aggregates, and slag cement.

C. MR Credit 4: Material Ingredients.
   1. Report: Concrete curing compounds, densifiers, and sealers.

D. EQ Credit 2: Low-Emitting Materials.
   1. Paints and Coatings Applied Within Building Interior: Certificate stating compliance with California Department of Public Health (CDPH) Standard Method including TVOC range and product data stating VOC content in grams per Liter (g/L). Include volume of material applied per product.

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C. Submit RFIs only for clarification or interpretation of the Contract Documents. RFIs shall include a list of sheets, plans, sections, details, and specifications in the Contract Documents where the Contractor has already looked for the information being requested.

D. RFIs requesting a substitution will be rejected. Any substitution requests shall follow Substitution Procedures indicated in Division 01 Specifications.

E. RFIs submitted for correction of field work shall include the Contractor's proposed solution. Provide an engineered solution from the Contractor's engineer in applicable situations.

1.08 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI SPEC-301 and ACI CODE-318.

B. Follow recommendations of ACI PRC-305 when concreting during hot weather.

C. Follow recommendations of ACI PRC-306 when concreting during cold weather.

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I - Normal or Type II - Moderate. ASTM C150/C150M, Type III High-Early Strength may be used for cold weather construction.
   1. Acquire cement for entire project from same source.

B. Blended Cement: ASTM C595/C595M, Type IL. Portland Limestone cement.

C. Fine and Coarse Aggregates: ASTM C33/C33M.
   1. Acquire aggregates for entire project from same source.
   2. Maximum Coarse Aggregate Size: 1 inch nominal, typical. Provide 3/8" maximum aggregate size for concrete toppings less than 3 inch thick.
   3. Aggregate Polished Concrete slabs shall be a blended aggregate mix of three or more individual aggregate sizes in order to achieve a general uniform gradation from the 1 1/2" to the No. 100 sieve. Submit a combined aggregate sieve analysis of the fine and coarse

aggregate indicating general uniform gradation and a maximum percentage on any given sieve of 24 percent. Material proportions shall provide a coarseness factor (CF) range of 60-75 percent, past fraction of 25-28 percent, and an adjusted workability factor ((11.25-0.15CF) + 35%)% +/- 2.5%. Comply with the recommendations of Section 8.5.4 of ACI 302.1R.

D. Fly Ash: ASTM C618, Class F.

E. Slag Cement: ASTM C989/C989M, proportion in accordance with ACI PRC-233.

F. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

G. Synthetic Macro-Fiber Reinforcement: ASTM C1116/C1116M, Type III
   1. Fiber Length: 1 to 2 1/4 inches nominal.
   2. Fiber Type: Alkali-resistant synthetic.
      a. Products:
         1) Euclid Chemical Company; TUF-STRAND SF: www.euclidchemical.com/#sle.
         2) Sika Fibermesh; Fibermesh 650: www.fibermesh.com/#sle.
         3) GCP Applied Technologies; STRUX 90/40: www.gcpat.com/#sle.

H. Synthetic Fibrillated Micro-Fiber Reinforcement: ASTM C1116/C1116M, Type III.
   1. Fiber Length: 1/2 to 1 1/2 inches nominal.
   2. Fiber Type: Alkali-resistant synthetic
      a. Products:
         1) Euclid Chemical Company; PSI Fiberstrand F: www.euclidchemical.com/#sle.
         2) Sika Fibermesh; Fibermesh 300: www.fibermesh.com/#sle.
         3) GCP Applied Technologies; Grace Microfiber: www.gcpat.com/#sle.

2.02 ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement. Do not use calcium chloride or admixtures containing calcium chloride.

B. Air Entrainment Admixture: ASTM C260/C260M.

C. High Range Water Reducing and Retarding Admixture: ASTM C494/C494M Type G.

D. High Range Water Reducing Admixture: ASTM C494/C494M Type F.

E. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.

F. Retarding Admixture: ASTM C494/C494M Type B.

G. Water Reducing Admixture: ASTM C494/C494M Type A.

2.03 ACCESSORY MATERIALS

A. Underslab Vapor Barrier:
   1. Sheet Material: ASTM E1745, Class A, not less than 15 mils thick; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single-ply polyethylene is prohibited.
   2. Accessory Products: Vapor barrier manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.

B. Self-Leveling Cementitious Concrete Floor Underlayment:
   1. Minimum Compressive Strength at 28 Days, ASTM C109/C109M: 5000 pounds per square inch.
   2. Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 in and that can be feathered at edges to match adjacent floor elevations. ASTM C1708.
   3. Follow all manufacturer's recommendations on surface preparation, primers and washed gravel aggregate.
   4. For use in applications as base layer prior to the installation of final floor finish such as carpet, tile, vinyl and other floor coverings.

2.04 BONDING AND JOINTING PRODUCTS

A. Epoxy Bonding System:
   1. Complying with ASTM C881/C881M and of Type required for specific application to include Types IV and V minimum, load-bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.05 CURING MATERIALS

A. Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound; complying with ASTM C309.
   1. Application: Use this product at all locations where Curing and Sealing Compounds are not required.
   2. Product dissipates within 4 to 6 weeks.

B. Curing and Sealing Compound, Low Gloss: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C1315 Type 1 Class A.
   1. Application: Use at exposed interior slabs, including parking garage slabs.
   2. Vehicle: Water-based.
   3. Solids by Mass: 25 percent, minimum.
   4. VOC Content: OTC compliant.

C. Moisture-Retaining Sheet: ASTM C171.
   1. Curing paper, regular.
   2. Polyethylene film, white opaque, minimum nominal thickness of 4 mil, 0.004 inch.
   3. White-burlap-polyethylene sheet, weighing not less than 3.8 ounces per square yard.

D. Water: Potable, not detrimental to concrete.

2.06 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI PRC-211.1 recommendations.

B. Concrete Mixes: Comply with the durability/exposure classification, weight, minimum strength, maximum water-cement ratio and air content requirements provided in the Structural Construction Documents.
   1. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI SPEC-301.
      a. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.
   2. Cement content: not less than indicated in ACI 301.
   3. Slump: The contractor's mix designer shall determine the appropriate slump for each type of concrete. Slump tolerances shall comply with ACI 117.

C. Admixtures: Add acceptable admixtures as recommended in ACI PRC-211.1 and at rates recommended or required by manufacturer.
   1. Air Entrainment: All exterior exposed concrete shall include air-entrainment admixture.

D. Macro-Fiber Reinforcement: Add to mix at rate of 4.0 pounds per cubic yard, or as recommended by manufacturer for specific project conditions.

E. Micro-Fiber Reinforcement: Add to mix at rate of 1.5 pounds per cubic yard, or as recommended by manufacturer for specific project conditions.

2.07 MIXING

A. Transit Mixers: Comply with ASTM C94/C94M.

B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

A. Formwork: Comply with requirements of ACI SPEC-301. Design and fabricate forms to support all applied loads until concrete is cured and for easy removal without damage to concrete.

B. Verify that forms are clean and free of rust before applying release agent.

C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

D. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
   1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.

E. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

F. Interior Slabs on Grade: Install vapor barrier under interior slabs on grade. Comply with ASTM E1643. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor barrier before covering.
   1. Vapor Barrier Over Granular Fill: Install compactible granular fill before placing vapor retarder as indicated on drawings. Do not use sand.

G. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.

3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

A. Comply with requirements of ACI SPEC-301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

B. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.

C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

3.04 PLACING CONCRETE

A. Place concrete in accordance with ACI PRC-304.

B. Place concrete for floor slabs in accordance with ACI PRC-302.1.

C. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

D. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

E. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

F. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.05 SLAB JOINTING

A. Locate joints as indicated on drawings.

B. Anchor bond break material to prevent movement during concrete placement.

C. Isolation Joints: Install wherever necessary to separate slab from other building members, including columns, wall, equipment foundations, footings, stairs, and other locations as indicated. Use polyethylene.
   1. Extend bond-breaking polyethylene strips full weight and depth of joint, terminating flush with finish concrete surface unless otherwise indicated on drawings.

2. Terminate bond-breaking polyethylene strips not less than 1/2 in or more than 1 inch below finish concrete surface, where joint sealants are indicated.
3. Install bond-breaking polyethylene strips in lengths as long as practicable.

D. Load Transfer Construction and Contraction Joints: Install joint dowel bars and support assemblies at joints where indicated on drawings. Lubricate or asphalt coat one-half of dowel bar length to prevent concrete bonding to one side of joint.

E. Saw Cut Contraction/Control Joints in Slabs-on-Ground: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; cut 1/8 in wide by at least 1 inch deep but not less than one quarter (1/4) the depth of the slab. Saw cutting joints should not tear, abrade, or otherwise damage surface and should begin before concrete develops random cracks.

3.06 SEPARATE FLOOR TOPPINGS

A. Prior to placing floor topping, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.

B. Place required dividers, edge strips, reinforcing, and other items to be cast in.

C. Apply bonding agent to substrate in accordance with manufacturer's instructions.

3.07 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. Minimum F(F) Floor Flatness and F(L) Floor Levelness Values:
1. Typical Slabs-on Ground: F(F) of 25; F(L) of 20.
2. Typical Suspended Slabs: F(F) of 25. The F(L) Value is not required for un-shored construction.
3. Slabs-on-Ground with Polished Concrete Finish: F(F) of 50; F(L) of 30.

3.08 CONCRETE FINISHING

A. Form Finishes: Provide finish as follows:
1. ACI 301 Surface Finish-1.0 (SF-1.0): Applicable at surfaces permanently concealed.
   a. No form-facing material is specified.
   b. Patch voids larger than 1 3/4 in wide or 1/2 in deep.
   c. Remove projections larger than 1 in.
   d. Tie holes need not be patched.
   e. Surface tolerance Class D as specified in ACI 117.
   f. Mockup not required.
2. ACI 301 Surface Finish-2.0 (SF-2.0): Applicable at all exposed concrete surfaces.
   a. Use form-facing material.
   b. Patch voids larger than 3/4 in wide or 1/2 in deep.
   c. Remove projections larger than 1/4 in.
   d. Patch tie holes.
   e. Surface tolerance Class B as specified in ACI 117.
   f. Unless otherwise specified, provide mockup of concrete surface appearance and texture.
3. ACI 301 Surface Finish-3.0 (SF-3.0): Applicable at exposed concrete surfaces critical for appearance purposes. Locations indicated on Drawings.
   a. Use form-facing material as specified.
   b. Patch voids larger than 3/4 in wide or 1/2 in deep.
   c. Remove projections larger than 1/8 in.
   d. Patch tie holes.
   e. Surface tolerance Class A as specified in ACI 117.
   f. Provide mockup of concrete surface appearance and texture.

B. Concrete Floors and Slabs: Finish to requirements of ACI PRC-302.1, meeting ACI 117 tolerances and the Floor Flatness and Levelness tolerances specified. Unless indicated on Drawings, provide the following finishes:
1. Scratch finish - for surfaces intended to receive bonded cementitious mixtures.

2. Float finish - for walks, drives, steps, ramps and for surfaces intended to receive waterproofing, roofing, insulation, or sand-bed terrazzo.
3. Trowel finish - for floors intended as walking surfaces, floors in manufacturing, storage, and warehousing areas, or floors that will receive floor coverings.
4. Broom finish - for exterior concrete platforms, steps, ramps and locations indicated on Drawings. Coordinate final finish with Architect before application.

3.09 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling in:
1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend in with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations:
1. Coordinate sizes and locations of concrete bases with actual equipment provided.
2. Construct concrete bases 4 inches high unless otherwise indicated on Drawings, and extend bases not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
3. Minimum Compressive Strength: 3500 psi at 28 days.
4. Install headed anchors to connect concrete base to concrete floor. Unless otherwise indicated, install headed anchors at 16 inch centers around the full perimeter of concrete base.
5. For supported equipment, install anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior pouring concrete, place and secure anchorage devices.
   a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   b. Cast anchor-rods inserts into bases.
   c. Install anchor rods to elevations required for proper attachment to supported equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items.
1. Cast-in inserts and accessories, as shown on Drawings and shop drawings.
2. Screed, tamp, and trowel finish.

3.10 CURING AND PROTECTION

A. Comply with requirements of ACI PRC-308. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
1. Comply with ACI PRC-305 for Hot Weather protection during curing.
   a. Maintain moisture loss no more than 0.2 lb/sq. ft x h before and during finishing operations.
2. Comply with ACI PRC-306 for Cold Weather protection during curing.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
1. Normal concrete: Not less than seven days.
2. High early strength concrete: Not less than four days.

C. Curing Methods
1. Ponding, continuous fogging, or continuous sprinkling.
2. Application of mats or fabric kept continuously wet.
3. Continuous application of steam.
4. Application of sheet materials confirming to ASTM C171.

5. Application of curing compound conforming to ASTM C309 or ASTM C1315.
    a. The contractor shall be responsible for removing any traces of the dissipating curing compound ASTM C309 that remains on the concrete surface prior to application of adhesive-applied flooring or any type of bonded application.
    b. Only use curing and sealing compound ASTM C1315 on surfaces where sealed concrete is the finished surface.

D. Curing Formed Concrete Surfaces:
1. Keep absorbent wood forms wet until they are removed.
2. As soon as forms can be loosened without damage to concrete, water should be applied to the top of the form and allowed to run down the interface between the form and new concrete until forms are fully removed.
3. After form removal, formed surfaces, including underside of beams, supported slabs and other similar surfaces, should be cured for remainder of curing period by one of the listed methods.

E. Curing Unformed Concrete Surfaces
1. After placement and finishing of concrete surfaces, apply one of the listed curing methods.

F. Curing Floor to receive Polished Concrete Finish.
1. After placement and finish of concrete surfaces, apply one of the following curing methods:
    a. Ponding, continuous fogging, or continuous sprinkling.
    b. Application of mats or fabric kept continuously wet.

3.11 FIELD QUALITY CONTROL

A. The owner will engage an independent special inspector and qualified testing agency to perform field quality control tests and special inspections of the following:
1. Inspect cast-in-place anchor installation, to included headed anchor rods and embed plates, for compliance with contract documents before concrete placement.
2. Inspect post-installed anchor installation to verify conformance with manufacturer's installation instructions.
3. Verify use of required design mix for placement location.
4. Inspect, sample and test materials and concrete production. When it appears that material furnished or work performed fails to conform to Contract Documents, the testing agency will immediately report such deficiency to Architect/Engineer, Owner, Contractor and Concrete Supplier.
5. Testing agency will report test and inspection results of the work to Owner, Architect/Engineer, Contractor and concrete supplier within 7 days after tests and inspections are performed. Strength test reports to include location in the Work where the concrete represented by each test was deposited, date and time sample was obtained, and batch ticket. Strength test reports to include detailed information of storage and curing of specimens before testing.
6. Contractor to provide space and electrical power on the project site for facilities to be used for initial curing of concrete test specimens. Testing agency to be responsible for providing curing container for test specimens on site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
7. For each concrete mixture on the project placed in any one day, obtain samples of fresh concrete in accordance with ASTM C172, selected on a random basis.
    a. Testing Frequency: Obtain one composite sample for each day's pour of each mixture exceeding 5 cu yd, but less than 25 cu yd, plus one set for each additional 50 cu yd or fraction thereof. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
    b. Slump: ASTM C143/C143M: One test at truck (as delivered) for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

c. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete; ASTM C173/C173M volumetric method, for lightweight concrete: one test for each composite sample, but not less than one test for each day's pour of each concrete mixture
d. Concrete Temperature: ASTM C1064/C1064M: one test for each composite sample.
e. Unit Weight: ASTM C567/C567M fresh unit weight of structural lightweight concrete: one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
f. Compression Test Specimens: ASTM C31/C31M: Samples shall be taken from concrete pump discharge hose when concrete is transported by concrete pump.
    1) Cast and laboratory cure one set of six 4-in by 8-in cylinder specimens for each composite sample. Cast additional cylinder specimens as required to satisfy OSHA requirements
g. Compressive Strength Tests: ASTM C39/C39M: Test one set of two laboratory-cured specimens at 7 days and one set of three specimens at 28 days. Test one specimen at 56 days if required.
    1) Concrete strengths for acceptance shall be the average of at least three 4-in by 8-in cylinders tested at 28 days.
    2) Strength level of concrete mixture shall be acceptable if both are satisfied:
        (a) Every average of any three consecutive strength tests equals or exceeds f'c.
        (b) No strength test falls below f'c by more than 500 psi if f'c is 5000 psi or less; or by more than 0.10 x f'c if f'c exceeds 5000 psi.
h. Nondestructive tests for uniformity: use of the rebound hammer in accordance with ASTM C805 or the pulse-velocity method in accordance with ASTM C597 may be permitted by Architect/Engineer to evaluate uniformity of in-place concrete or to select areas to be cored. These methods shall not be used to evaluate in-place strength.
i. Testing agency to make additional tests of concrete when test results indicate that slump, air entrainment, compressive strength, or other requirements have not been met, as directed by Architect.
j. If concrete strength is in doubt or when required by Contract Documents, the testing agency shall obtain cores, prepared and tested in accordance with ASTM C42/C42M.
k. Additional testing and inspecting required to demonstrate compliance with Contract Documents will be at the Contractor's expense.

8. Verify maintenance of specified curing temperatures and techniques.
9. Measure floor and slab flatness and levelness in accordance with ASTM E1155/E1155M within 72 hours of completion of floor finishing and before removal of supporting formwork or shoring (if applicable) and properly report test results to Architect. Report both composite overall values and local values for each measured section.
    a. Correct the slab surface if composite overall value is less than specified and if local value is less than two-thirds of specified value or less than F(F) 13 / F(L) 10.
    b. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.12 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

B. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

C. Repair Mortar: Mix dry-pack repair mortar, consisting of 1 part portland cement to 2 1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing. Alternatively, acceptable commercial repair products may be used for repairs - use in accordance with manufacturer's instructions.

D. Partially Exposed Reinforcement: The surface of partially exposed reinforcement where exposed less than or equal to half the reinforcement bar size shall be clean of all detritus material. Where reinforcement is exposed more than half the reinforcement bar size, concrete shall be removed around the entire circumference of the reinforcement plus 3/4 inch and the reinforcement shall be clean of all detritus material.

E. Repairing Formed Surfaces: Surface defects including color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projects on the surface, and stains and other discolorations that cannot be removed by cleaning.
   1. Immediately after form removal, remove fins and cut out honeycombs, rock pockets, and voids that exceed ACI 301 Surface Finish requirements back to solid concrete.
      a. Limit cut depth to 1/2 inch.
      b. Make edges of cuts perpendicular to concrete surface.
      c. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
      d. Fill and compact the patching mortar before bonding agent has dried.
      e. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
   2. Repair defects on exposed concrete surfaces by blending white portland cement and standard portland cement, so that, when dry, patching mortar matches surrounding color.
      a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
      b. Compact mortar in place and strike off slightly higher than surrounding surface.
   3. Repair defects on concealed formed surfaces that will affect concrete's durability and structural performance as determined by Architect/Engineer.

F. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish, and verify surface tolerances specified for each surface. Test surfaces sloped to drain for trueness of slope and smoothness.
   1. Repair finished surfaces containing surface defects, including spalls, popouts, honeycombs, rock pockets, crazing, and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
   2. Correct high areas by grinding, after concrete has cured at least 14 days. Depth of removal shall not exceed 1/4 inch without scanning the affected area to verify required concrete cover will be maintained.
   3. Correct localized low areas during, or immediately after, completing surface-finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
   4. Correct other low areas scheduled to receive floor coverings with Self-Leveling Cementitious Concrete Floor Underlayment. Feather edges to match adjacent floor elevations.
   5. Correct other low areas that are scheduled to be left exposed with Architectural Concrete Floor Topping Overlayment. Feather edges to match adjacent floor elevations.

G. Structural Repairs of Concrete: subject to Architect/Engineer's approval, using epoxy adhesives and patching mortar.

3.13 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

B. Maintain concrete protection to prevent freezing of the concrete and to ensure necessary strength development for structural safety.

END OF SECTION

SECTION 033545

POLISHED CONCRETE AND CONCRETE TOPPING - FLOOR SEAL TECHNOLOGY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Polished concrete floor finish system for slab on grade and slab on deck where Polished Concrete is indicated as the Floor Finish.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete.

1.03 ABBREVIATIONS AND ACRONYMS

A. CPC: Concrete Polishing Council.

1.04 REFERENCE STANDARDS

A. ACI PRC-211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide; 2022.

B. ACI PRC-302.1 - Guide to Concrete Floor and Slab Construction; 2015.

C. ACI SPEC-117 - Specification for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).

D. ACI SPEC-301 - Specifications for Concrete Construction; 2020.

E. ANSI A326.3 - American National Standard Test Method for Measuring Dynamic Coefficient of Friction of Hard Surface Flooring Materials; 2021.

F. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2023.

G. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2023.

H. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2024.

I. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.

J. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2019.

K. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2017.

L. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete; 2019.

M. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2022.

N. ASTM D4039 - Standard Test Method for Reflection Haze of High-Gloss Surfaces; 2009 (Reapproved 2023).

O. ASTM D5767 - Standard Test Method for Instrumental Measurement of Distinctness-of-Image (DOI) Gloss of Coated Surfaces; 2018 (Reapproved 2023).
P. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers; 2020.
Q. ASTM E1155M - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers (Metric); 2014.
R. CRSI (DA4) - Manual of Standard Practice; 2023.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting 15 days prior to start of work of this section.
    1. Review project conditions, manufacturer requirements, delivery and storage, staging and sequencing, and protection and coordination with other work.
    2. Require attendance of parties directly affecting work of this section, including:
        a. Installer.
        b. Contractor's representative.
        c. Architect.
        d. Manufacturer's representatives.
        e. Owner's representative.
B. Notify Architect and manufacturer of concrete placement schedule prior to commencement of placement operations.
C. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.
B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
C. Test Reports: Submit report for each test or series of tests specified.
D. Manufacturer's Qualification Statement: Submit five projects of similar size and complexity as references.
E. Executed warranty.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years of documented experience.

1.08 MOCK-UPS

A. See Section 014000 - Quality Requirements for additional requirements.

B. Construct mock-up panel for architectural concrete surfaces indicated to receive special treatment or finish.
   1. Panel Size: 10 by 10 feet (3 by 3 meters).
   2. Number of Panels: Two.
   3. Show each concrete color and finish.
   4. Locate where directed by Architect.

C. Accepted mock-up panel is considered basis of quality for finished work. Maintain mix design consistent with mock-up panel for duration of concrete work. Keep mock-up exposed to view for duration of concrete work.

D. Mock-up may remain as part of work.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 20-year manufacturer warranty against installation defects and material performance; ensure forms have been completed in Owner's name and registered with manufacturer.

PART 2 PRODUCTS

2.01 POLISHED CONCRETE FLOOR FINISH SYSTEM FOR NEW SLAB-ON-GRADE

A. Comprehensive polished concrete floor finish system to be applied at locations where 'Polished Concrete' is indicated as the Floor Finish on Drawings.

B. Manufacturer: Basis-of-Design Manufacturer shall be Floor Seal Technology, MirrorCrete system, or approved equal as determined by Architect.
   1. Floor Seal Technology, Inc; MirrorCrete: www.floorseal.com/#sle.
   2. Retroplate Systems.
   3. WR Meadows InduroShine.

C. Concrete Materials: Approved by polished concrete manufacturer.
   1. Water: ASTM C1602/C1602M, clean, potable, and not detrimental to concrete.
   2. Cement: ASTM C150/C150M, Type I - Normal portland type; use cement from same source for entire project.
   3. Fine and Coarse Aggregates: ASTM C33/C33M, manufacturer-sourced colored aggregate.
   4. Densifier: Odorless, non-film forming, penetrating colloidal silica solution, reactive with free lime and calcium hydroxide; designed to chemically harden and densify concrete surface.
      a. Basis of Design Product: Floor Seal Technology, Inc; MirrorCrete

5. Curing Agent: Resin based, film-forming membrane complying with ASTM C1315 and ASTM C309.
    a. Basis of Design Product: Floor Seal Technology, Inc; MirrorCure: www.floorseal.com/#sle.
6. Grout: Resinous grouting designed to fill in surface defects to produce uniform, high gloss, high clarity final surface.
    a. Basis of Design Product: Floor Seal Technology, Inc; MirrorGrout: www.floorseal.com/#sle.
7. Surface Repair Products: Polishable, three-component UV and moisture-resistant, fast-curing resinous-cement color matching repair system for a seamless visual surface.
    a. Basis of Design Product: Floor Seal Technology, Inc; ColorMatchPatch
8. Finishing Aid: Liquid applied.
    a. Basis of Design Product: Floor Seal Technology, Inc; MirrorCrete finishing aid: www.floorseal.com/#sle.
9. Concrete Sealer: Film-forming, stain resistant, food resistant water repellant, impregnating type.
    a. Basis of Design Product: Floor Seal Technology; MirrorSeal
10. Floor Protection:
    a. Sheet Products: Breathable cloth or paper sheet, recommended in writing by Manufacturer
    b. Tapes: Breathable tape as recommended in writing by Manufacturer. "Duct Tape" not permitted.

2.02 CONCRETE MIX DESIGN

A. Normal Weight Concrete: Comply with ACI PRC-211.1 recommendations.
    1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 4,000 psi (27.6 MPa), as specified in ACI 301.
    2. Water-Cement Ratio: Maximum 45 percent by weight.
    3. Total Air Content: Maximum 3 percent, determined in accordance with ACI SPEC-301.
    4. Maximum Aggregate Size: 5/8 inch (16 mm).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

B. Submit proposed mix design to manufacturer for review prior to commencement of concrete operations.

3.02 MIXING

A. Transit Mixers: Comply with ASTM C94/C94M.

B. Add water if concrete arrives on-site with slump less than suitable for placement, but do not exceed the maximum water-cement ratio or exceed the maximum permissible slump.

C. On Project Site: Mix in drum-type batch mixer, complying with ASTM C685/C685M.

1. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.

3.03 PREPARATION FOR NEW CONCRETE SLABS

3.04 INSTALLING REINFORCEMENT FOR NEW CONCRETE SLABS

A. Comply with requirements of CRSI (DA4) and ACI SPEC-301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

3.05 PLACING NEW CONCRETE SLABS

A. Place concrete for floor slabs in accordance with ACI SPEC-117, ACI SPEC-301, and ACI PRC-302.1.

B. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.06 PLACING SEPARATE FLOOR TOPPINGS

A. Prior to placing floor topping, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.

B. Apply bonding agent to substrate minimum of 24 hours in advance in accordance with manufacturer's instructions.

C. Place concrete floor toppings to required lines and levels to match approved mock-ups.

3.07 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. Measure FF Floor Flatness and FL Floor Levelness in accordance with ASTM E1155 (ASTM E1155M) and following ACI SPEC-117 using 3D laser imaging within 72 hours after slab installation; report both composite overall values and local values for each measured section.

B. Minimum FF Floor Flatness and FL Floor Levelness Values: FF of 35; FL of 18.

3.08 CONCRETE FINISHING

A. Decorative Exposed Surfaces: Trowel as described in ACI PRC-302.1; take measures necessary to avoid black-burnish marks; decorative exposed surfaces include surfaces to be polished, pigmented concrete, surfaces to receive liquid hardeners, and surfaces to receive dry-shake hardeners.

3.09 CONCRETE POLISHING

A. Execute using materials, equipment, and procedures specified by manufacturer, using manufacturer-approved installer.
   1. Resin-Diamond pads and polishing machines type as recommended by Manufacturer.

B. Apply one coat of undiluted densifier solution to point of rejection, remove excess liquid, and cure in accordance with manufacturer's instructions. Repeat with second coat.

C. Fill surface imperfections utilizing manufacturer-recommended materials, and apply grout to continuous monolithic surface.

D. Final Polished Concrete Aggregate Exposure: CPC Class A - Cement Fines; cement fines, 85 to 95 percent; fine aggregates, 5 to 15 percent based on visual observation of overall area of polished floor versus Polished Concrete Aggregate Exposure Chart.

E. Final Polished Concrete Appearance: CPC Level 2 - Satin, image clarity value 10 to 39 percent with haze index less than 10.

F. Sealing: Apply two coats of manufacturer-recommended sealer, and burnish to uniform sheen.

3.10 FIELD QUALITY CONTROL

A. Defective Concrete: Repair or replace concrete not complying with required lines, details, dimensions, tolerances, or specified requirements at no additional cost to Owner.

B. Slip Resistance: Minimum 0.43 in accordance with ANSI A326.3 after polishing.

C. Final Polished Concrete Appearance: Test image clarity value and haze index prior to application of sealer at a rate of three tests per 1000 sq ft of polished concrete.
   1. Image clarity: Test with Image Clarity Meter in accordance with ASTM D5767.
   2. Haze index: Test with Glossmeter in accordance with ASTM D4039.
   3. Match approved mock-ups.

3.11 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

B. Protect finished surface as required and as recommended by manufacturer of polishing system until Substantial Completion date.
   1. Provide sheet products for floor protection as specified
   2. Do not apply adhesive products directly to concrete surfaces
   3. Remove sand, rocks, and debris daily from protected areas

END OF SECTION

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SECTION 034500

PRECAST ARCHITECTURAL CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Architectural precast concrete accessories.

1.02 RELATED REQUIREMENTS

A. Section 032000 - Concrete Reinforcing.

B. Section 033000 - Cast-in-Place Concrete: Admixtures.

C. Section 079200 - Joint Sealants: Sealing perimeter and intermediate joints.

1.03 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).

B. ACI SPEC-301 - Specifications for Concrete Construction; 2020.

C. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2022.

D. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2023.

E. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.

F. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2023, with Editorial Revision.

G. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.

H. ASTM C989/C989M - Standard Specification for Slag Cement for Use in Concrete and Mortars; 2024.

I. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures; 2020.

J. PCI MNL-117 - Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products; 2013.

K. PCI MNL-120 - PCI Design Handbook; 2017, with Errata (2021).

L. PCI MNL-122 - Architectural Precast Concrete: Fully Revised Manual Including New Sections, Extensive Updates, and Detailed Specifications to Meet Today's Construction Needs.; 2007.

M. PCI MNL-123 - Connections Manual: Design and Typical Details of Connections for Precast and Prestressed Concrete; 1988.

N. PCI MNL-135 - Tolerance Manual for Precast and Prestressed Concrete Construction; 2000.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's information on accessory products, including pigments, admixtures, inserts, plates, etc.

C. Shop Drawings: Indicate layout, unit locations, configuration, unit identification marks, reinforcement, connection details, support items, dimensions, openings, and relationship to adjacent materials.

D. Samples: Submit two sill samples, 6 by 6 inch (152 by 152 mm) in size, illustrating surface finish, color and texture.

E. Sustainable Design Reporting: If any fly ash, ground granulated blast furnace slag, silica fume, rice hull ash, or other waste material is used in mix designs to replace Portland cement, submit the total volume of concrete, mix design(s) used showing the quantity of Portland cement replaced, reports showing successful cylinder testing, and temperature on day of pour if cold weather mix is used.

F. Maintenance Data: Indicate surface cleaning instructions.

1.05 MOCK-UPS

A. Provide sill mock-up of size indicated, or if not indicated, a typical window size as directed by Architect. Finish in accordance with approved sample.

B. See Section 014000 - Quality Requirements for additional requirements.

C. Include mock-up panel with typical window.

D. Locate where directed.

E. Mock-up may remain as part of the Work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handling: Lift and support precast units only from support points.

B. Blocking and Lateral Support During Transport and Storage: Use materials that are clean, non-staining, and non-harmful to exposed surfaces. Provide temporary lateral support to prevent bowing and warping.

C. Protect units to prevent staining, chipping, or spalling of concrete.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Architectural Precast Concrete:

1. Any manufacturer holding a PCI Group A Plant Certification for the types of products specified; see www.pci.org/#sle.

2. Substitutions: See Section 016000 - Product Requirements.

2.02 PRECAST UNITS, GENERAL

A. Precast Architectural Concrete Units: Comply with PCI MNL-120, PCI MNL-122, PCI MNL-123, PCI MNL-135, and ACI CODE-318.
   1. Concrete: Minimum 5000 psi (34 MPa), 28 day strength, air entrained to 5 to 7 percent; comply with ACI SPEC-301.
   2. Design Loads: Static loads, anticipated dynamic loading, including positive and negative wind loads, thermal movement loads, and erection forces as defined by applicable code.
   3. Calculate structural properties of units in accordance with ACI CODE-318.
   4. Accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
   5. Provide connections that accommodate building movement and thermal movement and adjust to misalignment of structure without unit distortion or damage.

B. Finish Type A: Ensure exposed-to-view finish surfaces of precast units are uniform in color and appearance.

2.03 REINFORCEMENT

A. Comply with requirements of Section 032000.

2.04 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I - Normal Portland type.

B. Other Cementitious Materials:
   1. Fly Ash or Natural Pozzolans: Comply with ASTM C618.
   2. Ground Granulated Blast Furnace Slag: ASTM C989/C989M.
   3. Silica Fume: Comply with ASTM C1240.

C. Fine and Coarse Structural Aggregates: ASTM C33/C33M.

D. Color Additives: Pure, concentrated mineral pigments specifically intended for mixing into concrete and complying with ASTM C979/C979M.
   1. Color(s): To match Architect's sample(s) when incorporated into specified mix design(s).

E. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

F. Admixtures: Air entrainment as specified in Section 033000.

2.05 FABRICATION

A. Fabricate in compliance with PCI MNL-117 and PCI MNL-135.

B. Use rigid molds, constructed to maintain precast unit uniform in shape, size, and finish.

C. Maintain consistent quality during manufacture.
D. Cure units to develop concrete quality, and to minimize appearance blemishes such as non-uniformity, staining, or surface cracking.
E. Minor patching in plant is acceptable, providing structural adequacy and appearance of units is not impaired.

2.06 FABRICATION TOLERANCES

A. Comply with PCI MNL-117 and PCI MNL-135, except as specifically amended below.
1. Maximum Variation From Nominal Face Dimensions: Plus or minus 3/32 in (2.4 mm).
2. Maximum Variation From Square or Designated Skew: Plus or minus 1/8 inch in 10 feet (1 mm per m).
3. Maximum Variation from Thickness: Plus or minus 1/8 in (3 mm).
4. Maximum Misalignment of Anchors, Inserts, Openings: Plus or minus 1/8 inch (3 mm).
5. Maximum Bowing of Members: Plus or minus length/360.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building structure, anchors, devices, and openings are ready to receive work of this section.

3.02 ERECTION

A. Erect units without damage to shape or finish. Replace or repair damaged panels.
B. Erect units level and plumb within allowable tolerances.
C. Align and maintain uniform horizontal and vertical joints as erection progresses.
D. Exposed Joint Dimension: 1/2 inch (12 mm) maximum. Adjust units so that joint dimensions are within tolerances.

3.03 TOLERANCES

A. Erect members level and plumb within allowable tolerances. Comply with PCI MNL-135.

3.04 CLEANING

A. See Section 017419 - Construction Waste Management and Disposal, for additional requirements.

END OF SECTION

SECTION 042000

UNIT MASONRY, MORTAR AND GROUT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Clay facing brick.

B. Common brick.

C. Special shapes.

D. Mortar and grout.

E. Reinforcement and anchorage.

F. Flashings.

G. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 042200 - Concrete Unit Masonry.

B. Section 079200 - Joint Sealants: Sealing control and expansion joints.

1.03 DEFINITIONS

A. High-lift grouting; Maximum lifts of 4 feet (1.2 m) each for a maximum height of 24 feet (7.3 m).

B. Low-lift grouting; Maximum lifts of 12 inches (305 mm).

1.04 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2023a.

C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.

D. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019.

E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.

F. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2022.

G. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2022.

H. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made from Clay or Shale); 2023.
I. ASTM C67/C67M - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2023.
J. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2023.
K. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2018.
L. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.
M. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2018.
N. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale); 2023.
O. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.
P. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2024.
Q. ASTM C476 - Standard Specification for Grout for Masonry; 2023.
R. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.
S. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry; 2019a.
T. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2017.
U. BIA Technical Notes No. 13 - Ceramic Glazed Brick Exterior Walls; 2017.
V. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls; 2005.
W. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2017.
X. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
C. Samples: Submit four samples of each color of facing brick units to illustrate color, texture, and extremes of color range.

D. Veneer Anchors: Provide manufacturer's engineering design calculations for anchors used in varying widths of cavity walls shown in project based on wind loads indicated.
E. Air Barrier Coordination: Provide methods and materials required to maintain continuity of air barrier at time of veneer anchor installation.
F. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.
G. Manufacturer's Qualification Statement.
H. Installer's Qualification Statement.
I. Testing Agency Qualification Statement.

1.07 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of the codes, specifications, and standards, listed above in the Reference Standards article, except where more stringent requirements are shown or specified.
B. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
C. Designer Qualifications: Engineer licensed in project jurisdiction.
D. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.
E. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
F. Testing Agency Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.08 MOCK-UPS

A. Construct a masonry wall as a mock-up(s) sized 8 feet (2.4 m) long by 6 feet (1.8 m) high each; include mortar, accessories, structural backup, and flashings (with lap joint, corner, and end dam) in mock-up. Include the following:
    1. Demonstration of air barrier seal at veneer anchors.
    2. Integration of precast banding.
    3. Two examples of brick patterning as directed by Architect.
    4. Integration of typical storefront flashing and framing. Show integration of air barrier with storefront.
B. Locate where directed.
C. Mock-up may remain as part of work.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

B. Store all materials above ground on level paltforms that allow air circulation.

C. Maintain materials clean, dry, and protected against dampness, wetness, freezing and foreign matter. Monitor continuity of cover at all times.

D. Deliver, store and install materials in such a manner as to not exceed the floor design live loads specified on the structural drawings.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS - SUSTAINABLITY

A. Recycled Content: Provide steel reinforcement with minimum 90 percent total recycled content, including at least 60 percent post-consumer recycled content.

2.02 CONCRETE MASONRY UNITS - SEE SECTION 042200 CONCRETE UNIT MASONRY

2.03 BRICK UNITS

A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide bricks from Belden Brick, or comparable bricks from one of the following;

1. Endicott Clay Products Co; Face Brick - FBX: www.endicott.com/#sle.
2. Taylor Clay Products, Inc.; FBX Face Brick.
3. Substitutions: See section 016000 - Product Requirements.

B. Facing Brick: ASTM C216, Type FBX, Grade SW, all colors except Color 1.

1. Actual Size: Ambassador 3 5/8 x 2 1/4 x 15 5/8 inches.
    a. Applications: Field brick. Blend colors in patterns indicated on Drawings. Colors shown are from BOD manufacturer:
        1) Brick Color 1: 8520A 16-04.
        2) Brick Color 2: Landmark Gray Velour A 16-51.
        3) Brick Color 3: Goldenrod 20-16.
        4) Brick Color 4: Mayo Clear Light.
2. Actual Size -: Modular 3 5/8 x 2 1/4 x 7 5/8 inches.
    a. Applications: Soldier courses.
        1) Match Brick Color 3.
3. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect without sawn surfaces being exposed to view.

C. Building (Common) Brick: ASTM C62, Grade SW; solid units.

1. Actual size: Match face brick in height.

2.04 MORTAR AND GROUT MATERIALS

A. Masonry Cement: Not Permitted.

B. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.

C. Hydrated Lime: ASTM C207, Type S

D. Mortar Aggregate: ASTM C144.

1. Sand Mix: Use Acres (orange) Sand local to project location, or comparable similar color sand.

E. Grout Aggregate: ASTM C404.

F. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.

G. Water: Clean and potable.

H. Admixtures, General: As approved by Architect. Conform to ACI 212.3R. Admixtures shall not contain calcium chloride.

I. Grout Admixtures: Grout installed using high-lift techniques shall contain shrinkage compensating, water reducing and set retarding admixture.

1. Products: Subject to compliance with requirements, provide one of the following products;

a. E-Z Mix, Inc., Grout Additive.

b. Orco Blended Products, GA213 R-Grout Aid.

c. Sika Corporation, Sika Grout Aid.

d. Substitutions: See Section 016000 - Product Requirements.

J. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.

1. Type: Types as scheduled on Structural Drawings.

2. Color: Mineral pigments added as required to produce approved color sample.

3. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide York Building Products, Workrite Cements, or approved comparable product from one of the following:

a. Argos USA LLC.

b. Heidelberg Materials.

c. Oldcastle APG.

K. Packaged Dry Material for Grout for Masonry: Premixed cementitious materials and dried aggregates; capable of producing grout of the specified strength in accordance with ASTM C476 with the addition of water only.
   1. Type: Fine.

2.05 REINFORCEMENT AND ANCHORAGE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following;
   1. Blok-Lok Limited: www.blok-lok.com/#sle.
   2. Heckmann Building Products;
   3. Hohmann & Barnard, Inc: www.h-b.com/#sle.
   4. TruFast Walls, a division of Altenloh, Brinck & Co. US, Inc: www.trufastwalls.com/#sle.
   5. WIRE-BOND: www.wirebond.com/#sle.
   6. Substitutions: See Section 016000 - Product Requirements.

B. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa), deformed billet bars; uncoated.

C. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

D. Single Wythe Joint Reinforcement: ASTM A951/A951M.
   1. Type: Ladder.
   2. Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M Class 3.
      a. Provide hot-dip galvanized reinforcement at all exterior walls or walls exposed to 75% relative humidity.
   3. Size: 0.1875 inch (4.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods; width as required to provide not less than 5/8 inch (16 mm) of mortar coverage on each exposure.

E. Strap Anchors: Bent steel shapes, 1-1/2 inch (38 mm) width, 0.105 inch (2.7 mm) thick, 24 inch (610 mm) length, with 1-1/2 inch (38 mm) long, 90 degree bend at each end to form a U or Z shape or with cross pins, hot dip galvanized to ASTM A153/A153M Class B.

F. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not less than 5/8 inch (16 mm) of mortar coverage from masonry face.

1. Steel frame: Crimped wire anchors for welding to frame, 0.25 inch (6.3 mm) thick, with trapezoidal wire ties 0.1875 inch (4.75 mm) thick, hot dip galvanized to ASTM A 153/A 153M, Class B.

2.06 ADJUSTABLE MASONRY VENEER ANCHORS

A. General: Provide anchors that allow vertical differential movement between veneer and substrate but resist minimum 100 lbf load in tension and compression perpendicular to plane of wall without deforming or allowing play in excess of 1/16 inch.
   1. Continuous Insulation: Size anchors to accommodate thickness of continuous insulation in each location indicated.
   2. Embeddment: Size wire ties for embeddment in veneer a minimum of 1-1/2 inches, maintaining a minimum 5/8 inch coverage of mortar at outer face of veneer.
   3. Anchor Plate Type: Use anchor plate designed for each type of structural backup:
      a. Masonry Backup: Flat plate.
      b. Cold Form Metal Framing and Sheathing: Plate with prongs or similar shape engineered to make contact with steel framing to resist crushing of sheathing under compressive loads.

B. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, stainless steel.
   1. Anchor plates: Not less than 12 ga., 0.105 inch (2.67 mm) thick, designed for fastening to masonry, concrete, or panel backup. Anchor plate designed and engineered to accommodate depth of cavity and insulation indicated.
   2. Wire ties: Manufacturer's standard shape, thickness required to resist loads indicated, but not less than 3/16 inch diameter, stainless steel.
   3. Vertical adjustment: Maximum 1-1/4 inches (31.7 mm).
   4. Manufacturers: Subject to compliance with requirements, provide products from one of the following. Adjust plate type for each structural backup as noted above:
      a. Heckmann Building Products; #213.
      b. Hohmann and Barnard, Inc.; HB-213.
      c. Wire Bond; HCL-711.

C. Metal-to-Metal Fasteners: Self-drilling, self-tapping screws; corrosion resistant finish or hot dip galvanized to ASTM A153/A153M.

1. Subject to compliance with requirements, provide fasteners with highest level of corrosion resistance recommended by anchor manufacturer for intended use.

2.07 FLASHINGS

A. Metal Flashing Materials:
   1. Stainless Steel Flashing: ASTM A666, Type 304, soft temper; 26 gauge, 0.0187 inch (0.48 mm) thick; finish 2B to 2D.

B. Combination Non-Asphaltic Flashing Materials - Stainless Steel:
   1. Stainless Steel Flashing - Self-adhering: ASTM A240/A240M; 2 mil (0.05 mm) type 304 stainless steel sheet with 8 mil (0.20 mm) of butyl adhesive and a removable release liner.
   2. Stainless Steel/Polymer Fabric Flashing: ASTM A240/A240M; 2 mil (0.05 mm) type 304 stainless steel sheet bonded on one side to one sheet of polymer fabric.

C. Factory-Fabricated Flashing Corners and End Dams: Stainless steel.

D. Flashing Sealant/Adhesives: Silicone, polyurethane, or silyl-terminated polyether/polyurethane or other type required or recommended by flashing manufacturer; type capable of adhering to type of flashing used.
   1. Manufacturers, Synthetic Rubber Products: Subject to compliance with requirements, provide one of the following;
      a. Mortar Net Solutions; BTL-1 Butyl Sealant: www.mortarnet.com/#sle.
      b. Substitutions: See Section 016000 - Product Requirements.

E. Termination Bars: Stainless steel; compatible with membrane and adhesives.
   1. Manufacturers: Subject to compliance with requirements, provide one of the following;
      a. Hohmann & Barnard, Inc; Termination Bar: www.h-b.com/#sle.
      b. Mortar Net Solutions; Termination Bars: www.mortarnet.com/#sle.
      c. York Manufacturing, Inc; Termination Bar: www.yorkmfg.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.

F. Drip Edge: Stainless steel; angled drip with hemmed edge; compatible with membrane and adhesives.
   1. Manufacturers: Subject to requirements, provide one of the following;
      a. Hohmann & Barnard, Inc: www.h-b.com/#sle.
      b. Mortar Net Solutions; Metal Drip Edges: www.mortarnet.com/#sle.
      c. York Manufacturing, Inc: www.yorkmfg.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.

G. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.

2.08 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.
   1. Manufacturers: Subject to compliance with requirements, provide one of the following products;
      a. Blok-Lok Limited: www.blok-lok.com/#sle.
      b. Hohmann & Barnard, Inc: www.h-b.com/#sle.
      c. WIRE-BOND: www.wirebond.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.

B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; in maximum lengths available.

C. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
   1. Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations.
      a. Manufacturers: Subject to compliance with requirements, provide one of the following products;
         1) Advanced Building Products, Inc; Mortar Break DT: www.advancedbuildingproducts.com/#sle.
         2) Advanced Building Products Inc; Mortar Break: www.advancedbuildingproducts.com/#sle.
         3) Mortar Net Solutions; MortarNet: www.mortarnet.com/#sle.
         4) York Manufacturing, Inc.; Weep-Net: www.yorkmfg.com/#sle.
         5) Substitutions: See Section 016000 - Product Requirements.

D. Weeps:
   1. Type: Extruded propylene with honeycomb design.
   2. Color(s): As selected by Architect from manufacturer's full range.
   3. Manufacturers: Subject to compliance with requirements, provide one of the following products;
      a. Advanced Building Products, Inc; Mortar Maze: www.advancedbuildingproducts.com/#sle.
      b. Blok-Lok Limited; CellVent: www.blok-lok.com/#sle.
      c. Masonry Technology, Inc; Cavity Weep: www.mtidry.com/#sle.
      d. Mortar Net Solutions; WeepVent: www.mortarnet.com/#sle.

e. Substitutions: See Section 016000 - Product Requirements.

E. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.09 MORTAR AND GROUT MIXING

A. Mortar Schedule for Unit Masonry: ASTM C270, using the Property Specification.
   1. Masonry below grade and in contact with earth: Type S.
   2. Exterior, loadbearing masonry: Type S.
   3. Exterior, non-loadbearing masonry: Type N.
   4. Interior, loadbearing masonry: Type N.
   5. Interior, non-loadbearing masonry: Type O.

B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.
   1. Use sand mix color noted in Mortar and Grout Materials article above.
   2. Basis-of-Design Colors:
      a. At Brick Colors 1 and 2: Raw Umber #WR2246.
      b. At Brick Color 3: Burnt Sienna #WR2272.
      c. At Brick Color 4: Morning Mist #WR2247a.

C. Grout: ASTM C476; 3,000 psi (20.68 MPa) strength at 28 days, unless indicated otherwise with 8-10 inches (203-254 mm) slump (before admixtures) and consistency required to fill completely volumes indicated for grouting;
   1. Fine grout for spaces with smallest horizontal dimension of 2 inches (50 mm) or less.
   2. Course grout for spaces with smallest horizontal dimension greater than 2 inches (50 mm).
   3. Add admixtures in accordance with manufacturer's instructions; mix uniformly.

D. Sand: Maintain sand uniformly damp immediately before the mixing process.

E. Admixtures: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. Add cold-weather admixture (if used) at same rate for all mortar that wil be exposed to view, regardless of weather conditions, to ensure consistent mortar color.

F. Mixing: Use mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use. Comply with referenced standards.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Clean reinforcement of loose rust.

C. Ensure that units are clean and free of dust, including dust from cutting, dirt and other foreign materials.

D. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. Do not use frozen mortar and grout materials.

B. Maintain materials and surrounding air temperature to minimum 40 degrees F (5 degrees C) prior to, during, and 48 hours after completion of masonry work.

C. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

3.04 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:

1. Bond: Running, except where indicated on drawings.
2. Coursing: One unit and one mortar joint to equal 8 inches (200 mm).
3. Mortar Joints: Concave.

D. Brick Units:

1. Bond: As indicated for different locations.
2. Coursing: Three units and three mortar joints to equal 8 inches (200 mm).
3. Mortar Joints: Concave.

3.05 PLACING AND BONDING

A. Do not use anti-freeze compounds to lower the freezing point of mortar.

B. Use mortar within two hours of mixing.

1. If water is lost by evaporation, re-temper only within the two hour limit of initial mixing.

C. Do not wet masonry units, except in hot, dry weather when units are warm to the touch. Wetting of units with light fog spray is permitted.

D. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

E. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

F. Remove excess mortar and mortar smears as work progresses.

G. Interlock intersections and external corners, except for units laid in stack bond.

H. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

I. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

J. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.

K. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.

L. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.06 WEEPS/CAVITY VENTS

A. Install weeps in veneer and cavity walls at 24 inches (600 mm) on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.

3.07 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.08 REINFORCEMENT AND ANCHORAGE - GENERAL

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches (400 mm) on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Embed longitudinal wires of joint reinforcement in mortar joint with at least 5/8 inch (16 mm) mortar cover on each side.

E. Lap joint reinforcement ends minimum 6 inches (150 mm).

F. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 24 inches (600 mm) horizontally and 16 inches (400 mm) vertically.

G. Embed ties and anchors in mortar joint and extend into masonry unit a minimum of 1-1/2 inches (38 mm) with at least 5/8 inch (16 mm) mortar cover to the outside face of the anchor.

3.09 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Masonry Back-Up: Embed anchors in masonry back-up to bond veneer at maximum 1.77 sq ft (0.16 sq m) of wall surface per anchor. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches (200 mm) on center.

B. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches (400 mm) on center vertically and 16 inches (400 mm) on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches (200 mm) on center.

3.10 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
   1. Extend flashings full width at such interruptions and at least 6 inches (152 mm), minimum, into adjacent masonry or turn up flashing ends at least 1 inch (25.4 mm), minimum, to form watertight pan at nonmasonry construction.
   2. Remove or cover protrusions or sharp edges that could puncture flashings.
   3. Seal lapped ends and penetrations of flashing before covering with mortar.

B. Terminate flashing up 8 inches (203 mm) minimum on vertical surface of backing:
   1. Install vertical leg of flashing behind water-resistive barrier sheet over backing.
   2. Install vertical leg of flashing over fluid-applied or self-adhered air/vapor barriers over backing or per manufacturer’s directions.
   3. Anchor vertical leg of flashing into backing with a termination bar and sealant.
   4. Apply cap bead of sealant on top edge of self-adhered flashing.

C. Extend metal flashings to within 1/2 inch (12 mm) of exterior face of masonry and adhere to top of stainless steel angled drip with hemmed edge.

D. Support flexible flashings across gaps and openings.

E. Extend laminated flashings to within 1/2 inch (12 mm) of exterior face of masonry and adhere to top of stainless steel angled drip with hemmed edge.

F. Lap end joints of flashings at least 6 inches (152 mm), minimum, and seal watertight with flashing sealant/adhesive.

3.11 LINTELS

A. Comply with Section 042200 Concrete Unit Masonry.

3.12 GROUTED COMPONENTS

A. Comply with Section 042200 Concrete Unit Masonry.

3.13 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

C. Size control joints as indicated on drawings; if not indicated, 3/4 inch (19 mm) wide and deep.

D. Form expansion joint as detailed on drawings.

3.14 BUILT-IN WORK

A. As work progresses, install built-in metal door frames and glazed frames and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.

1. Fill adjacent masonry cores with grout minimum 12 inches (300 mm) from framed openings.

D. Do not build into masonry construction organic materials that are subject to deterioration.

3.15 TOLERANCES

A. Install masonry within the site tolerances found in TMS 402/602.

B. Maximum Variation from Alignment of Columns: 1/4 inch (6 mm).

C. Maximum Variation From Unit to Adjacent Unit: 1/16 inch (1.6 mm).

D. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft (6 mm/3 m) and 1/2 inch in 20 ft (13 mm/6 m) or more.

E. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.

F. Maximum Variation from Level Coursing: 1/8 inch in 3 ft (3 mm/m) and 1/4 inch in 10 ft (6 mm/3 m); 1/2 inch in 30 ft (13 mm/9 m).

G. Maximum Variation of Mortar Joint Thickness: 1/8 inch in 3 feet.

H. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch (6 mm).

3.16 CUTTING AND FITTING

A. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.17 FIELD QUALITY CONTROL

A. Comply with Section 042200 Concrete Unit Masonry and as follows:

B. Engage an independent testing agency to perform field quality control tests, as specified in Section 014000 - Quality Requirements.

C. Clay Masonry Unit Tests: Test each variety of clay masonry in accordance with ASTM C67/C67M requirements, sampling 5 randomly chosen units for each 50,000 installed.

3.18 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.19 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

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SECTION 042200
CONCRETE UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete block.
B. Mortar and grout.
C. Reinforcement and anchorage.
D. Lintels.
E. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 079200 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
C. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement.
D. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
E. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units.
F. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
G. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar.
H. ASTM C150/C150M - Standard Specification for Portland Cement.
I. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes.
J. ASTM C270 - Standard Specification for Mortar for Unit Masonry.
K. ASTM C404 - Standard Specification for Aggregates for Masonry Grout.
L. ASTM C476 - Standard Specification for Grout for Masonry.
M. ASTM C780 - Standard Test Methods for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
N. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry.
O. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures.

1.04 SUBMITTALS

A. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
B. Shop Drawings: Indicate pertinent dimensions, materials, anchorage, size and type of fasteners, and accessories for brickwork support system.
C. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.
D. Manufacturer's Qualification Statement.
E. Installer's Qualification Statement.

1.05 LEED SUBMITTALS

A. MR Credit 2: Environmental Product Declarations.
    1. Cement, CMU, and steel reinforcing.

B. MR Credit 3: Sourcing of Raw Materials.
   1. Recycled Content: CMU, mortar, grout, and steel reinforcing. Include material cost values.
   2. Regionally Sourced Recycled Content: Fly ash and steel reinforcing.

1.06 SUBMITTAL PROCEDURES

A. Submit shop drawings and product data in complete packages so that all parts of a given component or area may be reviewed together.

B. Indicate the applicable Contract Drawings and Specification Sections used to develop the submittal.

C. All modifications or revisions to submittals must be clearly clouded with a revision number and date indicated. Clouding of entire sheets, plans, sections, or details is not acceptable unless the sheet, plan, section, or detail is completely new to the revised submittal. The following may be considered cause for rejection of the submittal without review by the Engineer of Record.
   1. Failure to clearly indicate revisions with clouds and revision date.
   2. Submittal contains revisions or modifications to a previously reviewed submittal that were not requested by the Engineer of Record.

D. Resubmittals: Make corrections and completely address all previous comments prior to resubmitting shop drawings and product data. The Engineer of Record will only review those sheets, plans, sections, and details that have been clouded and tagged with a revision triangle.

1.07 REQUESTS FOR INFORMATION (RFI) PROCEDURES

A. RFIs shall be submitted by the Contractor. RFIs submitted by any other entity will not be reviewed.

B. Limit RFIs to one main subject. RFIs including more than one main subject will be returned with a request to break them up into multiple RFIs.

C. Submit RFIs only for clarification or interpretation of the Contract Documents. RFIs shall include a list of sheets, plans, sections, details, and specifications in the Contract Documents where the Contractor has already looked for the information being requested.

D. RFIs requesting a substitution will be rejected. Any substitution requests shall follow Substitution Procedures indicated in Division 01 Specifications.

E. RFIs submitted for correction of field work shall include the Contractor's proposed solution. Provide an engineered solution from the Contractor's engineer in applicable situations.

1.08 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.09 MOCK-UPS

A. Construct a masonry wall as a mock-up panel sized 8 feet long by 6 feet high; include mortar and accessories in mock-up.

B. Mock-up may remain as part of work.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:

1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on drawings for specific locations.
2. Special Shapes: Provide nonstandard blocks configured for corners.
   a. Provide bullnose units for outside corners.
3. Load-Bearing Units: ASTM C90, lightweight.
   a. Hollow block, as indicated.
   b. Exposed Faces: Manufacturer's standard color and texture where indicated.

2.02 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.
   1. Not more than 0.60 percent alkali.

B. Hydrated Lime: ASTM C207, Type S.

C. Mortar Aggregate: ASTM C144.

D. Grout Aggregate: ASTM C404.

E. Water: Clean and potable.

F. Accelerating Admixture: Nonchloride type for use in cold weather.

G. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
   1. Type: Type S.
   2. Color: Standard gray.

H. Packaged Dry Material for Grout for Masonry: Premixed cementitious materials and dried aggregates; capable of producing grout of the specified strength in accordance with ASTM C476 with the addition of water only.

2.03 REINFORCEMENT AND ANCHORAGE

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi), deformed billet bars; uncoated.

B. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

C. Single Wythe Joint Reinforcement: ASTM A951/A951M.
   1. Type: Ladder.
   2. Material: ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M Class B.
   3. Size: 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.

D. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not less than 5/8 inch of mortar coverage from masonry face.
   1. Steel frame: Crimped wire anchors for welding to frame, 0.25 inch thick, with trapezoidal wire ties 0.1875 inch thick, hot dip galvanized to ASTM A 153/A 153M, Class B.

2.04 ACCESSORIES

A. Preformed Control Joints: Polyvinyl chloride material. Provide with corner and tee accessories, fused joints.

B. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.05 LINTELS

A. Site-Cast Bond Beam Lintels: Built in place lintels comprised of bond beam units matching adjacent CMU in texture, color, and density. Place reinforcing bars in lintels and fill with grout; provide temporary shoring of lintels until grout has cured.

2.06 MORTAR AND GROUT MIXING

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.

1. Masonry below grade and in contact with earth: Type S.
2. Exterior, loadbearing masonry: Type S.
3. Exterior, non-loadbearing masonry: Type S.
4. Interior, loadbearing masonry: Type S.
5. Interior, non-loadbearing masonry: Type S.

B. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

C. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.

D. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

B. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.

C. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

3.04 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:
1. Bond: Running.
2. Coursing: One unit and one mortar joint to equal 8 inches.
3. Mortar Joints: Concave.

3.05 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

D. Remove excess mortar and mortar smears as work progresses.

E. Interlock intersections and external corners.

F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

H. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.

I. Isolate masonry partitions from vertical structural framing members with a control joint.

J. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.06 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.

3.07 REINFORCEMENT AND ANCHORAGE - GENERAL, SINGLE WYTHE MASONRY, AND CAVITY WALL MASONRY

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Embed longitudinal wires of joint reinforcement in mortar joint with at least 5/8 inch mortar cover on each side.

E. Lap joint reinforcement ends minimum 6 inches.

F. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 24 inches horizontally and 16 inches vertically.

G. Embed ties and anchors in mortar joint and extend into masonry unit a minimum of 1-1/2 inches with at least 5/8 inch mortar cover to the outside face of the anchor.

3.08 LINTELS

A. Install loose steel lintels over openings.

B. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.
   1. Do not splice reinforcing bars.
   2. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
   3. Place and consolidate grout fill without displacing reinforcing.
   4. Allow masonry lintels to attain specified strength before removing temporary supports.

C. Maintain minimum 8 inch bearing on each side of opening unless indicated otherwise in the Contract Drawings.

3.09 GROUTED COMPONENTS

A. Lap splices as indicated on Drawings.

B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

C. Place and consolidate grout fill without displacing reinforcing.

3.10 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

3.11 BUILT-IN WORK

A. As work progresses, install built-in metal door frames and glazed frames and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.
   1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

3.12 TOLERANCES

A. Install masonry within the site tolerances found in TMS 402/602.

B. Maximum Variation from Alignment of Columns: 1/4 inch.

C. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

D. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

E. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

F. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

G. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

H. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.13 CUTTING AND FITTING

A. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.14 FIELD QUALITY CONTROL

A. Special Inspector and Independent Testing Agency: Owner will engage a qualified Special Inspector and Independent Testing Agency to perform tests and inspections. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements with be at the Contractor's expense.

B. Inspections: Special Inspections in accordance with Level 2 in TMS 402.
   1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
   2. Place grout only after inspectors have verified compliance of grout spaces and of size, spacing and grades of reinforcing steel.
   3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of testes for each 5,000 sq. ft. of wall area or portion thereof.

E. Finish: Hot-dip zinc coating where indicated to be galvanized on Drawings.

F. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140/C140M for compliance with requirements of this specification.

G. Mortar Tests (Proportion Specification): Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

H. Grout Tests (Compressive Strength): For each mix provided,in accordance with ASTM C1019.

I. The Owner's Special Inspector and Independent Testing Agency shall inspect the masonry construction during various work stages for compliance with the project Drawings and Specifications, and keep records of the following:
   1. Quality and testing of masonry units.
   2. Proportioning, mixing, and consistency of mortar and grout. Laying, mortaring and grouting of masonry units and elements.
   3. Condition, grade, size, spacing, and placement of reinforcing.
   4. Any significant or unusual construction loads on masonry structural elements.
   5. General progress of the work.
   6. When ambient temperatures fall below 40 degrees F or rises above 100 degrees F, a complete record shall be maintained of weather conditions and of the preconditioning and protection given to masonry materials and protection and curing of completed work.

7. Inspection records shall be furnished to the Building Official, Owner and Architect/Engineer during progress of the work.
8. The inspector shall not supervise the construction; however, they shall visit the project with the frequency necessary to observe the various stages of the work and length of time at each visit to ascertain that it is being done in compliance with the Contract Documents and code requirements.

J. Evaluation of Quality Control Tests and Inspections: In the absence of other indications of non-compliance with requirements, masonry will be considered satisfactory if results from construction quality control tests and inspections comply with the minimum requirements indicated.

3.15 CLEANING AND REPAIRING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

E. Remove and replace CMUs that are damaged, loose, or stained and do not match adjacent units. Install replacement units with fresh mortar and repoint joints to eliminate perception of unit replacement.

3.16 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 051200
STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural steel framing members.

B. Grouting under base plates.

C. Shear stud connectors.

D. Deformed bar anchors.

E. Reinforced Thermoset Resin Structural Thermal Break Pads.

1.02 RELATED REQUIREMENTS

A. Section 051213 - Architecturally-Exposed Structural Steel Framing: Additional requirements for structural steel members designated as architecturally-exposed structural steel (AESS).

B. Section 052100 - Steel Joist Framing.

C. Section 053100 - Steel Decking: Field installation of steel shear studs connectors through deck.

D. Section 055000 - Metal Fabrications: Bearing plates, loose lintels, shelf angles, raised-pattern floor plate, steel bar grating and other steel items not defined as structural steel.

1.03 DEFINITIONS

A. Structural Steel - Structural frame members indicated on the Drawings and defined by AISC 303.

1.04 REFERENCE STANDARDS

A. AISC (MAN) - Steel Construction Manual.

B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

D. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.

E. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

F. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength.

G. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

H. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric).

I. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.

J. ASTM A992/A992M - Standard Specification for Structural Steel Shapes.

K. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

L. ASTM D638 - Standard Test Method for Tensile Properties of Plastics.

M. ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics.

N. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments.

O. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.

P. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

Q. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.

R. AWS D1.1/D1.1M - Structural Welding Code - Steel.

S. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections.

T. SSPC-SP 3 - Power Tool Cleaning.

1.05 COORDINATION

A. Coordinate selection of shop primers with subsequent paint topcoats to ensure compatibility. Comply with all manufacturer's written recommendations.

B. Coordinate installation of anchor rods, bearing plates and other anchorage items embedded into other construction without delaying the work of other trades. Provide shop drawings with detailed layout information, setting diagrams, and installation instructions.

1.06 PRE-INSTALLATION MEETING

A. Pre-installation conference - Hold conference on site with virtual attendance option.

1.07 SUBMITTALS

A. Product Data and Product Test Reports
   1. Structural steel materials.
   2. Bolt-nut-washer assemblies.
   3. Shear stud connectors.
   4. Deformed bar anchors.
   5. Anchor rods.
   6. Shrinkage-resistant grout.
   7. Shop primer.
   8. Reinforced thermoset resin structural thermal break pads.

B. Shop Drawings:
   1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
   2. Connections.
   3. Indicate cambers.
   4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.
   5. Indicate bolt type, size, and length. Include requirements for pre-tensioned and slip-critical connections.
   6. Include items embedded in other construction.
   7. Identify surface preparation and shop primer.

C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.

D. Mill Test Reports:

E. Fabricator Test Reports: Comply with ASTM A1011/A1011M.

F. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M.

G. Fabricator's Qualification Statement.

H. Erector's Qualification Statement.

I. Paint Compatibility Certificates: From topcoat manufacturers certifying that topcoats are compatible with shop primers.

J. Source Quality Control Reports: Including ultrasonic testing of complete-joint-penetration welds performed at the fabricator's shop.

K. Certificate of Compliance: The approved fabricator shall submit a certificate of compliance to the AHJ stating that the materials supplied and work performed by the fabricator are in

accordance with the Construction Documents.

L. Field Quality Control Reports.

1.08 LEED SUBMITTALS

A. MR Credit 2: Environmental Product Declarations.
   1. Steel, if available.

B. MR Credit 3: Sourcing of Raw Materials.
   1. Recycled Content: Steel. Include material cost values.
   2. Regionally Sourced Recycled Content: Steel.

C. MR Credit 4: Material Ingredients.
   1. Report: Structural steel, if available.
   2. Optimization Report or Action Plan: Structural steel, if available.

1.09 SUBMITTAL PROCEDURES

A. Submit shop drawings and product data in complete packages so that all parts of a given component or area may be reviewed together.

B. Indicate the applicable Contract Drawings and Specification Sections used to develop the submittal.

C. All modifications or revisions to submittals must be clearly clouded with a revision number and date indicated. Clouding of entire sheets, plans, sections, or details is not acceptable unless the sheet, plan, section, or detail is completely new to the revised submittal. The following may be considered cause for rejection of the submittal without review by the Engineer of Record.
   1. Failure to clearly indicate revisions with clouds and revision date.
   2. Submittal contains revisions or modifications to a previously reviewed submittal that were not requested by the Engineer of Record.

D. Resubmittals: Make corrections and completely address all previous comments prior to resubmitting shop drawings and product data. The Engineer of Record will only review those sheets, plans, sections, and details that have been clouded and tagged with a revision triangle.

1.10 REQUESTS FOR INFORMATION (RFI) PROCEDURES

A. RFIs shall be submitted by the Contractor. RFIs submitted by any other entity will not be reviewed.

B. Limit RFIs to one main subject. RFIs including more than one main subject will be returned with a request to break them up into multiple RFIs.

C. Submit RFIs only for clarification or interpretation of the Contract Documents. RFIs shall include a list of sheets, plans, sections, details, and specifications in the Contract Documents where the Contractor has already looked for the information being requested.

D. RFIs requesting a substitution will be rejected. Any substitution requests shall follow Substitution Procedures indicated in Division 01 Specifications.

E. RFIs submitted for correction of field work shall include the Contractor's proposed solution. Provide an engineered solution from the Contractor's engineer in applicable situations.

1.11 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."

B. Structural steel members designated as architecturally-exposed structural steel (AESS) to also comply with Section 051213.

C. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M.

D. Fabricator Qualifications: Fabricator shall participate in a Quality Certification Program audited by an independent third party.
   1. AISC-Certified Plant, Category BU

2. Independent inspection and quality control agency: Fabricator shall employ a qualified independent testing and inspection agency to conduct periodic in-plant inspections of the fabricator's plant. Inspections shall be at a frequency required to assure the fabricator's conformance with the requirements of the inspection agency's approved quality assurance program as required by the Building Code.

E. Erector Qualifications: Installer shall participate in a Quality Certification Program audited by an independent third party.
1. AISC Certified Erector, Category CSE
2. Independent inspection and quality control agency: Erector shall employ a qualified independent testing and inspection agency to conduct periodic field inspections of the erector's work. Inspections shall be at a frequency required to assure the erector's conformance with the requirements of the inspection agency's approved quality assurance program as required by the Building Code.

F. Fabricator and Erector Quality Certification Programs shall adhere to the minimum requirements of AISC 360, Chapter N.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Store steel members off the ground using supports and spacers. Protect steel members from corrosion.

B. Store fasteners in sealed containers with visible manufacturer's identifying label.
1. Clean and re-lubricate snug-tightened bolts that become dry or rusty.
2. Clean and re-lubricate tension-control bolts that become dry or rusty in conformance with written manufacturer's instructions. Re-test bolt assemblies after cleaning and relubrication per manufacturer's instructions.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Comply with the following standards and specifications:
1. AISC 303.
2. AISC 360.
3. RCSC's "Specifications for Structural Joints Using High-Strength Bolts".

B. Connection Design:
1. AISC Option 1: Connection designs have been completed and required connections are indicated on the Drawings.

2.02 MATERIALS

A. Steel W-Shapes, Channels and WT-Shapes: ASTM A992/A992M.

B. Steel Angles, S-Shapes, Plates and Bars: ASTM A572/A572M, Grade 50 (345) high-strength, columbium-vanadium steel.

C. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade C.

D. Shear Stud Connectors: Made from ASTM A108 Grade 1015 bars, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

E. Deformed Bar Anchors: Made from ASTM A496, cold-worked deformed steel bar type, cold-finished carbon steel; AWS D1.1, Type C.

F. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, with matching compatible ASTM A563/A563M nuts and ASTM F436/F436M washers.
1. Finish: Plain
2. Finish: Hot-dip zinc coating where indicated to be galvanized on Drawings.

G. Tension Control Bolts: Twist-off type; ASTM F3125/F3125M.
1. Finish: Plain.
2. Finish: Hot-dip zinc coating where indicated to be galvanized on Drawings.

H. Extra-Thick Washers: Provide Extra-Thick (5/16") ASTM F436 washers at all connections with oversized or short-slotted holes in the outer ply of the connection with bolts larger than 1 inch

diameter.

I. Headed Anchor Rods: ASTM F1554 Grade 36, Grade 55 (Weldable), and Grade 105 as indicated on the Drawings.
   1. Nuts: ASTM A563 heavy-hex.
   2. Plate Washers: ASTM A36.
   3. Washers: ASTM F436, Type 1
   4. Finish: Plain unless indicated to be hot-dip galvanized on the Drawings.

J. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

K. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
   1. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch.
   2. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch.

L. Shop and Touch-Up Primer: Fabricator's standard lead-free and chromate-free, rust-inhibiting primer compatible with topcoat. Primer shall comply with VOC limitations of authorities having jurisdiction.

M. Touch-Up Primer for Galvanized Surfaces: ASTM A780.

N. Reinforced Thermoset Resin Structural Thermal Break Pads: High-strength structural framing accessory boards with the following characteristics.
   1. Structural Performance: Provide pads capable of withstanding or transferring structural loads.
   2. Pad Design: Allow for fabrication and construction tolerances, accommodating live load deflection, shrinkage, and creep of the building structure and other building movements; maintain structural steel deflections as required by applicable codes.
   3. Pad Thickness: As indicated on drawings.
   4. Apparent Thermal Conductivity: K-value of 1.80 Btu-in/h sq ft degrees F when tested in accordance with ASTM C177..
   5. Ultimate Compressive Strength: 38,900 psi, minimum, when tested in accordance with ASTM D695.
   6. Compressive Modulus: 519,000 psi, minimum, when tested in accordance with ASTM D695.
   7. Accessories: Manufacturer's standard bushings and washers, minimum 1/4 inch thick, designed to provide thermal break between structural steel washer/bolt and internal element.

2.03 FABRICATION

A. Shop fabricate structural steel to greatest extent possible in accordance with AISC 303 and AISC 360.
   1. Develop required camber for members.
   2. Fabricate steel beams and girders with mill rolling camber pointing upwards.
   3. Mark and match-mark materials for field erection.

B. Thermal Cutting: Use machines to greatest extent possible. Plane thermally cut edges to be welded per requirements of AWS D1.1.

C. Mill Finishing: Provide at ends of columns and other members transmitting bearing forces.

D. Bolt Holes: Punch, drill, or mechanically thermally cut holes. Where field access for nut tightening is limited, tack weld nuts to members to receive field bolt.

E. Shear Stud Connectors and Deformed Bar Anchors: Prepare steel surfaces to receive shear stud connectors or deformed bar anchors in accordance with AWS D1.1. Weld using automatic end welding in accordance with AWS D1.1 and written instructions from manufacturer of shear stud connectors and deformed bar anchors.

F. Bolted Connections: Shop connections using high-strength bolts shall adhere to RCSC's "Specification for Structural Joints Using High-Strength Bolts".

G. Welded Connections: Shop welded connections shall adhere to AWS D1.1 and AWS D1.8 and maintain tolerances is AISC 303 for mill material.

2.04 FINISH

A. Prepare structural component surfaces in accordance with SSPC-SP 3.

B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or slip-critical bolted..

C. Where indicated, galvanize structural steel members to comply with ASTM A123/A123M. Provide minimum 1.7 oz/sq ft galvanized coating.
   1. Unless noted to remain as weep holes, fill all vent and drain holes that are exposed in the final condition. Plug with zinc solder and file smooth.
   2. Galvanize steel lintels in exterior walls that attach to the structural steel frame unless noted to have other AESS finish.
   3. For members that receive field paint, do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.

2.05 SOURCE QUALITY CONTROL

A. High-Strength Bolts: Provide testing and verification of shop-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts".

B. Welded Connections: Visually inspect all shop-welded connections and test complete-joint-penetration welds using the following:
   1. Ultrasonic testing performed in accordance with ASTM E164.
   2. Test 100% of CJP welds in Risk Category III and IV structures.
   3. Reductions and increases in the rate of ultrasonic testing shall be in accordance with Paragraphs N5.5e and N5.5f of AISC 360.
   4. Prepare submittal of testing and inspection reports.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.02 ERECTION

A. Erect structural steel in compliance with AISC 303.

B. Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.

C. Column Baseplates and Beam/Joist Bearing Plates
   1. Clean concrete and masonry surfaces to receive base plates or bearing plates.
   2. Use steel shims, leveling nuts, or leveling plates to establish correct bearing elevation.
   3. Snug-tighten anchor rods only after framing area has been positioned and made plumb.
   4. Grout solidly between base plates/bearing plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

D. Align and adjust structural steel members to comply with tolerances in AISC 303 prior to permanently connecting to supporting members. Take into account the effect of temperature differences in the structural steel between the time of erection and building completion.

E. Field weld components indicated on drawings and in compliance with AWS D1.1.
   1. Remove paint or galvanizing adjacent to field welds in accordance with AISC 303 and AISC 360.
   2. Remove backing bars and runoff tabs as required for ultrasonic testing of complete-joint-penetration welds.
   3. Weld assemblies in such a manner that maintains mil material tolerances in AISC 303.

F. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts".
   1. Ream holes that must be enlarged for bolted connections. Do not enlarge holes by other means.
   2. Snug-tighten bolts unless noted otherwise. Tension-control bolts are allowed to be used in all connections if preferred by the erector.
   3. Use Extra Thick (5/16") ASTM F436 washers at all connections with oversized or short-slotted holes in outer ply of the connections with bolts larger than 1 inch diameter. Use standard ASTM F436 washers otherwise.

G. Deformed Bar Anchors and Headed Shear Connectors: Prepare steel surfaces as recommended by manufacturer of deformed bar anchors and headed shear connectors. Use automatic end welding of deformed bar anchors and headed shear connectors in accordance with AWS D1.1 and manufacturer's instructions.

H. Do not field cut or alter structural members without approval of Architect.

3.03 FIELD QUALITY CONTROL

A. The Owner's Special Inspector and independent testing agency shall perform field quality control tests and special inspections.
   1. Structural steel material verification and inspection of structural steel joints.
   2. Weld material verification and inspection of welds.
   3. Bolt and connection material verification and inspection of bolted connections.
   4. All testing and inspections of Structural Steel Framing and Architecturally Exposed Structural Steel Framing shall be done in conformance with Chapter 17 of the Construction Code and AISC Chapter N.

B. High-Strength Bolts: The Owner's Special Inspector and independent testing agency shall provide testing and verification of field-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts".

C. Welded Connections: The Owner's Special Inspector and independent testing agency shall visually inspect all field-welded connections and test complete-joint-penetration welds using the following:
   1. Ultrasonic testing performed in accordance with ASTM E164.
   2. Test 100% of CJP welds in Risk Category III and IV structures.
   3. Reductions and increases in the rate of ultrasonic testing shall be in accordance with Paragraphs N5.5e and N5.5f of AISC 360.

D. Deformed Bar Anchors and Headed Shear Connectors: The Owner's Special Inspector and independent testing agency shall visually inspect field-welded deformed bar anchors and headed shear connectors in accordance with AWS D1.1 for stud welding. In addition, the Owner's Special Inspector shall perform the following tests:
   1. Bend tests of connectors if visual inspections indicate previous welding repairs or a non-continuous 360 degree flash.
   2. Test additional connectors according to the requirements of AWS D1.1 if weld fractures occur on previously tested anchors.

END OF SECTION

SECTION 051213
ARCHITECTURALLY-EXPOSED STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Additional requirements for structural steel members designated as architecturally-exposed structural steel (AESS).

B. Monumental Steel Stairs shall be treated as AESS 3.

1.02 RELATED REQUIREMENTS

A. Section 051200 - Structural Steel Framing: General requirements for structural steel members, including AESS framing specified in this section.

B. Section 099113 - Exterior Painting: Finish coat requirements and coordination with primer and surface preparation specified in this section.

C. Section 099123 - Interior Painting: Finish coat requirements and coordination with primer and surface preparation specified in this section.

D. Section 099600 - High-Performance Coatings: Finish coat requirements and coordination with primer and surface preparation specified in this section.

1.03 DEFINITIONS

A. Architecturally-Exposed Structural Steel: Structural steel complying with designated AESS category as defined in AISC 303.

1.04 REFERENCE STANDARDS

A. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges.

B. AISC 325 - Steel Construction Manual.

C. AISC 360 - Specification for Structural Steel Buildings.

D. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.

E. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.

F. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

G. ASTM A992/A992M - Standard Specification for Structural Steel Shapes.

H. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.

I. AWS D1.1/D1.1M - Structural Welding Code - Steel.

J. SSPC-SP 6 - Commercial Blast Cleaning.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Schedule and conduct a preinstallation meeting at project site at least one week prior to start of work of this section; require attendance by all affected installers. Coordinate requirements for shipping, special handling, storage, attachment of safety cables and temporary erection bracing, final coating, touch-up painting, mock-up coordination, Architect's observations, and other requirements for AESS.

1.06 SUBMITTALS

A. Product data for each type of product specified. Submit paint systems in accordance with Section 099113.

B. Shop Drawings: Detailing for fabrication of AESS components.

1. Provide erection documents clearly indicating which members are AESS members and the AESS category of each part.
2. Include details that clearly identify AESS requirements found in this specification. Provide connections for AESS consistent with concepts shown on drawings.
3. Indicate welds by AWS A2.4 symbols, distinguishing between shop and field welds, and show size, length and type of each weld. Identify grinding, finish and profile of welds as defined by the designated AESS category.
4. Indicate orientation of hollow structural section (HSS) seams and mill marks (where applicable).
5. Indicate type, size, finish and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tensioned shear/bearing connections. Indicate orientation of bolt heads.
6. Indicate which surfaces or edges are exposed and what class of surface preparation is being used.
7. Indicate special tolerances and erection requirements as noted on drawings or defined by the designated AESS category.
8. Indicate vent or drainage holes for HSS members.

C. AESS 1, AESS 2, and AESS 3 Samples: Provide samples of specific AESS characteristics. Samples may be small size samples or components of conventional structural steel demonstrating specific AESS characteristics, including surface preparation, sharp edges ground smooth, continuous weld appearance, weld show through, and fabrication mark removal.

D. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M..

E. Qualification data for fabricator and erector to demonstrate their capabilities and experience. Include lists of completed projects names and address, names and addresses of architects and owners, photographs showing detail of installed AESS, and other information specified.

1.07 LEED SUBMITTALS

A. MR Credit 2: Environmental Product Declarations.
1. Steel, if available.

B. MR Credit 3: Sourcing of Raw Materials.
1. Recycled Content: Steel. Include material cost values.
2. Regionally Sourced Recycled Content: Steel.

C. MR Credit 4: Material Ingredients.
1. Report: Structural steel, if available.
2. Optimization Report or Action Plan: Structural steel, if available.

1.08 SUBMITTAL PROCEDURES

A. Submit shop drawings and product data in complete packages so that all parts of a given component or area may be reviewed together.

B. Indicate the applicable Contract Drawings and Specification Sections used to develop the submittal.

C. All modifications or revisions to submittals must be clearly clouded with a revision number and date indicated. Clouding of entire sheets, plans, sections, or details is not acceptable unless the sheet, plan, section, or detail is completely new to the revised submittal. The following may be considered cause for rejection of the submittal without review by the Engineer of Record.
1. Failure to clearly indicate revisions with clouds and revision date.
2. Submittal contains revisions or modifications to a previously reviewed submittal that were not requested by the Engineer of Record.

D. Resubmittals: Make corrections and completely address all previous comments prior to resubmitting shop drawings and product data. The Engineer of Record will only review those sheets, plans, sections, and details that have been clouded and tagged with a revision triangle.

1.09 REQUESTS FOR INFORMATION (RFI) PROCEDURES

A. RFIs shall be submitted by the Contractor. RFIs submitted by any other entity will not be reviewed.

B. Limit RFIs to one main subject. RFIs including more than one main subject will be returned with a request to break them up into multiple RFIs.

C. Submit RFIs only for clarification or interpretation of the Contract Documents. RFIs shall include a list of sheets, plans, sections, details, and specifications in the Contract Documents where the Contractor has already looked for the information being requested.

D. RFIs requesting a substitution will be rejected. Any substitution requests shall follow Substitution Procedures indicated in Division 01 Specifications.

E. RFIs submitted for correction of field work shall include the Contractor's proposed solution. Provide an engineered solution from the Contractor's engineer in applicable situations.

1.10 QUALITY ASSURANCE

A. Fabricator Qualifications: In addition to those qualifications listed in Section 051200, engage a Fabricator, experienced in fabricating AESS similar to that indicated for this project with a record of successful in-service performance, as well as sufficient production capacity to fabricate AESS without delaying the work.

B. Erector Qualifications: In addition to those qualifications listed in Section 051200, engage an Erector, experienced in erecting AESS work similar in material, design, and extent to that indicated for this project and with a record of successful in-service performance.

C. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M.

D. Comply with applicable provisions of AISC 303, Section 10 for the designated AESS category.

E. Contractor to engage a quality assurance agency per requirements of AISC 360, Chapter N and AISC 303, Section 10.

1.11 MOCK-UP

A. Provide mock-ups for AESS 3 of nature and extent indicated in Contract Documents.

B. Notify Architect one week in advance of dates and times when mock-ups will be available for review.

C. Demonstrate applicable AESS characteristics for specified category of AESS on elements and joints in mock-up.

D. Build mock-ups using member sizes and materials indicated for final work.

E. Mock-up to demonstrate weld quality, contouring of welds at aligned walls of members, specified surface preparation, and finish coating.

F. Obtain Architect’s written approval of mock-ups before starting fabrication.

G. Retain and maintain mock-ups during construction in an undisturbed condition as a standard for judging completed work.

H. Approved mock-ups in an undisturbed condition at Date of Substantial Completion may become part of completed work.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Handle finished pieces in accordance with Section 10 of AISC 303, using nylon-type slings, or chains with softeners, or wire ropes with softeners such that they are not damaged.

B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration. Use special care in handling to prevent twisting or warping of AESS members.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Comply with Section 051200, except as amended in this section for aesthetic purposes.

B. Comply with AISC 303, Section 10 for specific AESS category designated on drawings.

2.02 FABRICATION

A. Fabricate and assemble AESS in shop to greatest extent possible. Locate field joints in AESS assemblies at concealed locations or as approved by Architect. Detail AESS assemblies to minimize field handling and expedite erection.

B. Permissible tolerances for member depth, width, out of square, and camber and sweep to be as specified in ASTM A6/A6M, ASTM A500/A500M, and ASTM A1085/A1085M.

C. Use special care in handling and shipping of AESS both before and after shop painting to minimize damage to any shop finish. Use nylon-type slings or softeners when using chains or wire rope slings.

D. Bolted Connections:
   1. Make in accordance with Section 051200. Provide bolt type and finish as noted herein.

E. Welded Connections:
   1. Comply with AWS D1.1/D1.1M and Section 051200.
   2. Assemble and weld built-up sections by methods that will maintain alignment of members without warp exceeding tolerances of this section.

F. Surface Preparation:
   1. Remove blemishes or unsightly surfaces resulting from temporary braces or fixtures.
   2. Remove backing and run out tabs.

G. Fabricate AESS in accordance with categories defined in AISC 303, as follows:
   1. AESS 1: Basic elements.
   2. AESS 2: Feature elements viewed at a distance greater than 20 feet (feature elements not in close view).
   3. AESS 3: Feature elements viewed at a distance less than 20 feet (feature elements in close view).

2.03 PAINT SYSTEM

A. Compatibility: All components/procedures of AESS paint system to comply with coating system specified, submitted, and approved per Sections 099113, 099123, and 099600. As a minimum, identify required surface preparation, primer, intermediate coat (if applicable), and finish coat. Primer, intermediate coating, and finish coating to be from a single manufacturer combined in a system documented by manufacturer with adequate guidance for fabricator to procure and execute.

B. Primer: Organic, epoxy/zinc rich meeting class B surface requirements for slip critical connections, as found in AISC 360. Primer to comply with all federal standards for VOC, lead and chromate levels.

C. Finish Coating: Field apply intermediate and top coats per Sections 099113, 099123, and 099600.

2.04 SHOP PRIMING

A. Surface Preparation:
   1. Provide surface preparations to meet SSPC-SP 6.
   2. Coordinate required surface profile with approved paint submittal prior to beginning surface preparation.
   3. Prior to blasting, remove any grease and oil using solvent cleaning to meet SSPC-SP 1.
   4. Remove weld spatter, slivers and similar surface discontinuities.
   5. Ease sharp corners resulting from shearing, flame cutting or grinding.

B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted with slip-critical connections.
   1. Extend priming of members partially embedded in concrete or mortar to a depth of 2 inches.

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
   2. Apply two coats of shop primer to surfaces that are inaccessible after assembly or erection.

2.05 MATERIALS

A. General: Meet requirements of 051200.

B. Tension Control, High-Strength Bolts, Nuts, and Washers: Per section 051200, Tension Control Bolts. Provide standard carbon steel finish rounded bolt heads with twist off bolts; ASTM F3125/F3125M.

2.06 SOURCE QUALITY CONTROL

A. Structural Requirements:
   1. Comply with quality control requirements per AISC 360, Chapter N and AISC 303, Section 10. Refer to Section 051200 for additional requirements.
   2. Quality assurance agency to review work for compliance with requirements of AISC 360, Chapter N and AISC 303, Section 10.

B. AESS 1 and 2 Acceptance: Architect to observe AESS in the shop at a viewing distance consistent with final installation and determine acceptability based on qualification data and submittals. Quality assurance agency has no responsibility for enforcing requirements related to aesthetic effect.

C. AESS 3,4, and C Acceptance: Architect to observe AESS in the shop at a viewing distance consistent with final installation and determine acceptability based on approved mock-up. Quality assurance agency has no responsibility for enforcing requirements related to aesthetic effect.

PART 3 EXECUTION

3.01 EXAMINATION

A. Erector to check all AESS members upon delivery for twist, kinks, gouges or other imperfections which may result in rejection of appearance of member. Coordinate remedial action with fabricator prior to erecting steel.

3.02 PREPARATION

A. Provide connections for temporary shoring, bracing and supports only where noted on approved fabrication documents. Temporary connections not shown are to be made at locations not exposed to view in final structure or as approved by Architect.

B. Handle, lift and align pieces using nylon straps or chains with softeners required to maintain appearance of AESS through process of erection.

3.03 ERECTION

A. AESS 1 and 2: Basic elements; feature elements not in close view:
   1. Employ special care to handle and erect AESS. Erect finished pieces using nylon straps or chains with softeners such that they are not damaged.
   2. Place weld tabs for temporary bracing and safety cabling at points concealed from view in completed structure or where approved by Architect during pre-installation meeting. Obtain Architect approval of methods for removing temporary devices and finishing AESS members prior to erection.
   3. AESS Erection Tolerances: Erect to standard frame tolerances for structural steel per Chapter 7 of AISC 303.

4. Set AESS accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
5. Remove blemishes or unsightly surfaces resulting from temporary braces or fixtures.
6. Remove all backing and run out tabs.
7. When temporary braces or fixtures are required to facilitate erection, take care to avoid any blemishes, holes or unsightly surfaces resulting from use or removal of such temporary elements.
8. Bolted Connections: Align bolt heads on same side of connection as indicated on approved fabrication or erection documents.
9. Welded Connections: Comply with AWS D1.1/D1.1M and Section 051200. Appearance and quality of welds to be consistent. Employ methods that will maintain alignment of members without warp exceeding tolerance of this section.
10. Remove weld spatter exposed to view.
11. Grind off projections larger than 1/16 inch at field butt and plug welds.
12. Continuous Welds: Where continuous welding is noted on drawings, provide continuous welds of a uniform size and profile.
13. Do not enlarge holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts. Replace connection plates that are misaligned where holes cannot be aligned with acceptable final appearance.
14. Splice members only where indicated.
15. Obtain permission for any torch cutting or field fabrication from Architect. Finish sections thermally cut during erection to a surface appearance consistent with mock-up.

B. AESS 3: Feature elements in close view:
1. Erect to requirements of AESS 1 and 2 and as follows:
2. Field Welding: Weld profile, quality, and finish to be consistent with mock-ups approved prior to fabrication.
3. Provide a continuous appearance to all welded joints including tack welds. Provide joint filler at intermittent welds.

3.04 FIELD QUALITY CONTROL

A. Structural Requirements: Comply with Section 051200 "Structural Steel Framing".

B. AESS 1 and 2 Acceptance: Architect to observe AESS in place and determine acceptability based on qualification data and submittals. Quality assurance agency has no responsibility for enforcing requirements related to aesthetic effect.

C. AESS 3,4, and C Acceptance: Architect to observe AESS in place and determine acceptability based on qualification data and submittals as well as on approved mock- up. Quality assurance agency has no responsibility for enforcing requirements related to aesthetic effect.

3.05 CLEANING

A. Touch-up Painting: Complete cleaning and touch-up painting of field welds, bolted connections, and abraded areas of shop paint to blend with adjacent surfaces of AESS. Perform touch-up work in accordance with manufacturer's instructions and as specified in Section 099113, 099123, and 099600.

END OF SECTION

SECTION 052100
STEEL JOIST FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Open web steel joists and shear stud connectors, with bridging, attached seats and anchors.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Placement of anchors and bearing plates for casting into cast-in-place concrete.

B. Section 042200- Concrete Unit Masonry: Placement of anchors and bearing plates for embedding into masonry.

C. Section 051200 - Structural Steel Framing: Grouting base plates and bearing plates. Superstructure framing. Field-welded shear connectors.

D. Section 053100 - Steel Decking:

E. Section 055000 - Metal Fabrications: Bearing plates embedded in other construction. Non-framing steel fabrications attached to joists.

F. Section 078100 - Applied Fire Protection: Fireproof protection of joist framing and metal deck systems.

1.03 REFERENCE STANDARDS

A. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric).

B. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments.

C. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.

D. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength.

E. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification.

F. AWS D1.1/D1.1M - Structural Welding Code - Steel.

G. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections.

H. SJI 100 - Standard Specifications for K-Series, LH-Series, and DLH-Series Open Web Steel Joists, and for Joist Girders.

I. SJI Technical Digest No. 9 - Handling and Erection of Steel Joists and Joist Girders.

J. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.

K. SSPC-SP 2 - Hand Tool Cleaning.

1.04 DEFINITIONS

A. SJI Specifications: Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders".

B. Special Joists: Steel joists or joist girders requiring custom design because non-uniform, unequal, net-uplift, or special loading conditions fall outside of the scope of standard joist design load tables in SJI Specifications.

1.05 SUBMITTALS

A. Product Data: For each type of joist, accessory, and associated product.

B. Shop Drawings: Indicate standard designations, joist coding, configurations, sizes, spacings, cambers, locations of joists, joist leg extensions, bridging, connections, and attachments.

C. Engineering Calculations: For all special design joists and joist girders, provide comprehensive engineering calculations sealed by the responsible professional engineer registered in the state in which the project is located.

D. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M.

E. Designer's Qualification Statement.

F. Manufacturer's Qualification Statement.

G. Fabricator's Qualification Statement.

H. Erector's Qualification Statement.

I. Paint Compatibility Certification: From manufacturer's of topcoat applied over shop primer, indicating that shop primer is compatible with the topcoat.

J. Mill Certificates: For each type of bolt used in shop and field connections.

K. Certificate of Compliance: At completion of fabrication, the approved fabricator shall submit a certificate of compliance to the Authority Having Jurisdiction stating that the work was performed in accordance with the approved construction documents.

1.06 LEED SUBMITTALS

A. MR Credit 2: Environmental Product Declarations.
   1. Steel joist, if available.

B. MR Credit 3: Sourcing of Raw Materials.
   1. Recycled Content: Steel. Include material cost values.
   2. Regionally Sourced Recycled Content: Steel.

1.07 SUBMITTAL PROCEDURES

A. Submit shop drawings and product data in complete packages so that all parts of a given component or area may be reviewed together.

B. Indicate the applicable Contract Drawings and Specification Sections used to develop the submittal.

C. All modifications or revisions to submittals must be clearly clouded with a revision number and date indicated. Clouding of entire sheets, plans, sections, or details is not acceptable unless the sheet, plan, section, or detail is completely new to the revised submittal. The following may be considered cause for rejection of the submittal without review by the Engineer of Record.
   1. Failure to clearly indicate revisions with clouds and revision date.
   2. Submittal contains revisions or modifications to a previously reviewed submittal that were not requested by the Engineer of Record.

D. Resubmittals: Make corrections and completely address all previous comments prior to resubmitting shop drawings and product data. The Engineer of Record will only review those sheets, plans, sections, and details that have been clouded and tagged with a revision triangle.

1.08 REQUESTS FOR INFORMATION (RFI) PROCEDURES

A. RFIs shall be submitted by the Contractor. RFIs submitted by any other entity will not be reviewed.

B. Limit RFIs to one main subject. RFIs including more than one main subject will be returned with a request to break them up into multiple RFIs.

C. Submit RFIs only for clarification or interpretation of the Contract Documents. RFIs shall include a list of sheets, plans, sections, details, and specifications in the Contract Documents where the Contractor has already looked for the information being requested.

D. RFIs requesting a substitution will be rejected. Any substitution requests shall follow Substitution Procedures indicated in Division 01 Specifications.

E. RFIs submitted for correction of field work shall include the Contractor's proposed solution. Provide an engineered solution from the Contractor's engineer in applicable situations.

1.09 QUALITY ASSURANCE

A. Design all special joists and connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

B. Perform Work, including that for headers and other supplementary framing, in accordance with SJI 100 Standard Specifications Load Tables and SJI Technical Digest No. 9.

C. Manufacturer Qualifications: Manufacturer shall be certified by SJI to manufacture joists and joist girders in accordance with SJI standard specifications and load tables.

D. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Transport, handle, store, and protect products to SJI requirements. This includes protecting joists from corrosion, damage, and deformation during delivery, storage, and handling.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Steel Joists:
   1. Canam Group Inc
   2. New Millennium Building Systems
   3. Nucor-Vulcraft Group

2.02 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide joist girders and special joists and connections capable of supporting loads indicated on the drawings.
   1. Use Allowable Stress Design: Loads given on the drawings are service-level loads.
   2. Live Load Deflection Limits:
      a. K-Series Joists: Vertical Deflection of 1/360 of the span.
      b. LH-Series and DLH-Series Joists: Vertical Deflection of 1/480 of the span.
      c. Joist Girders: Vertical Deflection of 1/360 of the span.

2.03 MATERIALS

A. Open Web Joists: SJI Type K Joists and KCS Joists:
   1. Provide bottom chord extensions as indicated.
   2. Minimum End Bearing on Steel Supports: As shown on the drawings.
   3. Minimum End Bearing on Concrete or Masonry Supports: As shown on drawings.
   4. Finish: Shop primed.
   5. Camber: Camber joists per SJI Specifications unless noted otherwise.
   6. Sloping Seats: Provide for member slopes greater than 1/4" per foot.
   7. Extended Ends: Provide SJI Type R extended ends where indicated on drawings.

B. Joist Substitutes: Comprised of steel angles or channels manufactured in accordance with SJI Specifications.

C. Open Web Joists: SJI 100 Type LH Joists:
   1. Provide bottom chord extensions as indicated.
   2. Minimum End Bearing on Steel Supports: As shown on drawings.
   3. Minimum End Bearing on Masonry or Concrete Supports: As shown on the drawings.
   4. Finish: Shop primed.
   5. Camber: Camber joists per SJI Specifications unless noted otherwise.
   6. Sloping Seats: Provide for member slopes greater than 1/4" per foot.

D. Open Web Composite Joists: SJI 100 Type CJ Joists or Vulcraft Ecospan Joists:
   1. Minimum End Bearing on Steel Supports: As shown on drawings.
   2. Minimum End Bearing on Masonry or Concrete Supports: As shown on the drawings.
   3. Finish: Shop primed.

4. Camber: Camber joists for 75% of the anticipated dead load deflection of wet concrete slab.
5. Composite Construction Connectors: Design headed shear studs or headed shear screws to create 100% composite joist/slab section properties.
6. Sloping Seats: Provide for member slopes greater than 1/4" per foot.

E. Anchor Bolts, Nuts and Washers: ASTM F1554 Grade 36 unless noted otherwise.

F. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563/A563M nuts and ASTM F436/F436M washers.

G. Tension Control Bolts: Twist-off type; ASTM F3125/F3125M.

H. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

I. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.04 FINISH

A. Primer: SSPC-Paint 15, or manufacturer's standard shop primer which complies with the performance requirements of SSPC-Paint 15.

B. Shop prime joists as specified.
1. Do not prime surfaces that will be fireproofed.

C. Prepare surfaces to be finished in accordance with SSPC-SP 2.

2.05 STEEL JOIST ACCESSORIES

A. Bridging: Provide horizontal and diagonal bridging that complies with SJI specifications for associated joists. Provide additional bridging as required for net-uplift on roof joists or non-uniform loading of special design joists. Provide additional erection bridging if required for joist stability.

B. Ceiling Supports: Where indicated, provide extended bottom chords or separate extensions with enough strength to support ceilings. Extend to within 1 inch of wall.

2.06 SOURCE QUALITY CONTROL

A. High-Strength Bolts: Provide testing and verification of shop-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts".

B. Welded Connections: Visually inspect all shop-welded connections and test all complete-joint-penetration welds using the following:
1. Ultrasonic testing performed in accordance with ASTM E164.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify joist support conditions for compliance with construction documents and construction tolerances prior to beginning work. Do not start joist installation until any deficiencies have been corrected.

3.02 ERECTION

A. Verify all supporting construction is in place and secured prior to erecting joists.

B. For joists delivered to the site in more than one piece, field-bolt joists on the ground prior to erection.

C. Erect joists with correct bearing on supports.

D. Install joist bridging as joist erection progresses. Joist briding must be installed before any construction loads are applied ot the joists.

E. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment.

F. Coordinate the placement of anchors for securing loose bearing members furnished as part of the work of this section.

G. After joist alignment and installation of framing, field weld joist seats to steel bearing surfaces.

H. Position and field weld joist chord extensions and wall attachments as detailed.

I. Install supplementary framing for floor and roof openings.

J. Do not permit erection of decking until joists are braced, bridged, and secured or until completion of erection and installation of permanent bridging and bracing.

K. Do not field cut or alter structural members without approval of joist manufacturer.

L. After erection, prime welds, damaged shop primer, damaged galvanizing, and surfaces not shop primed , except surfaces specified not to be primed.

3.03 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch.

B. Maximum Offset From True Alignment: 1/4 inch.

3.04 REPAIRS

A. Touch-Up Painting: Perform immediately after installation.
   1. Clean and prepare field welded areas, rust spots, and abraded surfaces of joists and abutting bearing plates and structural steel.
      a. SSPC-SP2 Hand-Tool Cleaning or SSPC-SP3 Power-Tool Cleaning
   2. Use primer compatible with that used in the manufacturing plant.

3.05 FIELD QUALITY CONTROL

A. The Owner will engage an independent testing agency to perform field quality control tests and inspections of the following:
   1. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts".
   2. Welded Connections: Visually inspect all field-welded connections and test all complete-joint-penetration welds using the following:
      a. Ultrasonic testing performed in accordance with ASTM E164.
   3. Correct member size, spacing, orientation, and mark number.

B. Correct all deficiencies in the Work that inspection reports indicate are not in compliance with the Construction Documents.

C. Coordinate re-inspection of the work that has been corrected after initial reported deficiencies.

END OF SECTION

SECTION 053100
STEEL DECKING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof deck.

B. Composite floor deck.

C. Stud shear connector installation through decking.

1.02 RELATED REQUIREMENTS

A. Section 032000 - Concrete Reinforcing.

B. Section 033000 - Cast-in-Place Concrete: Concrete topping over metal deck and placement of anchors and embed plates into cast-in-place concrete.

C. Section 042200 - Concrete Unit Masonry: Placement of anchors and embed plates within masonry.

D. Section 051200 - Structural Steel Framing: Support framing for openings and shear stud connectors.

E. Section 099113 - Exterior Painting: Repair painting of primed deck and finish painting of deck.

F. Section 099123 - Interior Painting: Repair painting of primed deck and finish painting of deck.

G. Section 055000 - Metal Fabrications: Embed plates and angles cast in concrete construction or set in masonry construction.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

B. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

D. AWS D1.1/D1.1M - Structural Welding Code - Steel.

E. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel.

F. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172.

G. ICC-ES AC70 - Acceptance Criteria for Power-Actuated Fasteners Driven into Concrete, Steel and Masonry Elements.

H. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks.

I. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer.

J. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic).

1.04 SUBMITTALS

A. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.

B. Shop Drawings: Indicate deck plan, fastening, support locations, projections, openings, reinforcement, pertinent details, and accessories.

C. Fabricator's Qualification Statement: Provide documentation showing steel deck fabricator is accredited under IAS AC172.

D. Test and Evaluation Reports:

1. Product Test Reports: For tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
   a. Power-actuated mechanical fasteners.
   b. Acoustical roof deck.

2. Research Reports: For steel deck, from ICC-ES showing compliance with the building code.

E. Qualification Statements and Welding Certificates: For deck welding personnel.

1.05 LEED SUBMITTALS

A. MR Credit 2: Environmental Product Declarations.
   1. Steel decking, if available.

B. MR Credit 3: Sourcing of Raw Materials.
   1. Recycled Content: Steel. Include material cost values.
   2. Regionally Sourced Recycled Content: Steel.

C. MR Credit 4: Material Ingredients.
   1. Report: Steel decking.
   2. Optimization Report or Action Plan: Steel decking, if available.

1.06 SUBMITTAL PROCEDURES

A. Submit shop drawings and product data in complete packages so that all parts of a given component or area may be reviewed together.

B. Indicate the applicable Contract Drawings and Specification Sections used to develop the submittal.

C. All modifications or revisions to submittals must be clearly clouded with a revision number and date indicated. Clouding of entire sheets, plans, sections, or details is not acceptable unless the sheet, plan, section, or detail is completely new to the revised submittal. The following may be considered cause for rejection of the submittal without review by the Engineer of Record.
   1. Failure to clearly indicate revisions with clouds and revision date.
   2. Submittal contains revisions or modifications to a previously reviewed submittal that were not requested by the Engineer of Record.

D. Resubmittals: Make corrections and completely address all previous comments prior to resubmitting shop drawings and product data. The Engineer of Record will only review those sheets, plans, sections, and details that have been clouded and tagged with a revision triangle.

1.07 REQUESTS FOR INFORMATION (RFI) PROCEDURES

A. RFIs shall be submitted by the Contractor. RFIs submitted by any other entity will not be reviewed.

B. Limit RFIs to one main subject. RFIs including more than one main subject will be returned with a request to break them up into multiple RFIs.

C. Submit RFIs only for clarification or interpretation of the Contract Documents. RFIs shall include a list of sheets, plans, sections, details, and specifications in the Contract Documents where the Contractor has already looked for the information being requested.

D. RFIs requesting a substitution will be rejected. Any substitution requests shall follow Substitution Procedures indicated in Division 01 Specifications.

E. RFIs submitted for correction of field work shall include the Contractor's proposed solution. Provide an engineered solution from the Contractor's engineer in applicable situations.

1.08 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified steel deck fabricator that is a member of the Steel Deck Institute (SDI).

B. Welding Qualifications: Qualify procedures and personnel in accordance with SDI QA/QC and the following welding codes;
   1. AWS D1.1/D1.1M.
   2. AWS D1.3/D1.3M.

C. FM Approvals' RoofNav Listing: Provide steel roof deck evaluated by FM Approvals and listed in its "RoofNav" for Class 1 fire rating and Class 1-90 windstorm rating. Identify materials with FM Approvals Certification markings.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage and handling.

B. Protect with a waterproof covering and ventilate to avoid condensation.

C. Store products in accordance with SDI MOC3. Separate sheets and store deck on dry wood sleepers; slope for positive drainage.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck in accordance with AISI S100.

B. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify deck products with markings from testing agency demonstrating compliance.
   1. Indicate design designations from UL's "Fire Resistance Directory" or from listings of another qualified agency.

2.02 STEEL DECK

A. Roof Deck: Non-composite type, fluted steel sheet:
   1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade Grade 50/340, Class 1, 2, or 4, with G60/Z180 galvanized coating.
   2. Primer: Shop coat of manufacturer's standard primer paint over bottom of galvanized deck at areas where deck is to receive field paint.
   3. Structural Properties:
      a. Span Design: Triple-span or more.
   4. Nominal Height: As indicated.
   5. Profile: Fluted.
   6. Side Joints: Lapped, mechanically fastened.
   7. End Joints: Lapped, mechanically fastened.

B. Composite Floor Deck: Fluted steel sheet embossed to interlock with concrete:
   1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 50/340, Class 1, 2, or 4, with G60/Z180 galvanized coating.
   2. Span Design: Triple-span or more.
   3. Nominal Height: As indicated.
   4. Profile: Fluted.
   5. Side Joints: Lapped, welded.
   6. End Joints: Lapped, welded.

2.03 ACCESSORY MATERIALS

A. Stud Shear Connectors: Made from ASTM A108 Grade 1015 bars.

B. Welding Materials: AWS D1.1/D1.1M.

C. Fasteners: Galvanized hardened steel, self tapping.

D. Powder Actuated Mechanical Fasteners: Steel; with knurled shank and forged ballistic point. Comply with applicable requirements of ICC-ES AC70.

E. Mechanical Fasteners: Steel; hex washer head, self-drilling, self-tapping.

F. Weld Washers: Mild steel, uncoated, 3/4 inch outside diameter, 1/8 inch thick.

G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

H. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, complying with VOC limitations of authorities having jurisdiction.

I. Flute Closures: Closed cell foam rubber profiled to fit tight to the deck.

J. Acoustical Insulation: Glass fiber type, minimum 1.1 lb/cu ft density; profiled to suit deck.

2.04 FABRICATED DECK ACCESSORIES

A. Sheet Metal Deck Accessories: Metal closure strips, wet concrete stops, and cover plates, 20 gauge, 0.0359 inch thick sheet steel; of profile and size as indicated; finished same as deck.

B. Pour Stops and Girder Fillers: Steel sheet of same material and finish as deck with thickness and profile recommended by SDI standards for overhang distance and slab depth.

C. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet of same material, finish, and thickness as deck unless noted otherwise.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions of supporting framing prior to beginning work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate bundles of deck in such a manner as to avoid overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting framing before installing permanent fasteners. Do not stretch or contract interlocking side-laps.

E. Place deck panels flat and square to fasten to supporting frame without warp or deflection.

F. Fit deck panels neatly around openings by cutting and using appropriate deck accessories.

G. On concrete and masonry surfaces provide minimum 4 inch bearing.

H. On steel supports provide minimum 1-1/2 inch bearing.

I. Fasten deck to steel support members at ends and intermediate supports as indicated.
   1. Welding: Use fusion welds through weld washers for decks that are less than 22 gauge thickness.

J. At mechanically fastened male/female side laps fasten at spacing indicated.

K. Drive mechanical sidelap connectors completely through adjacent lapped sheets; positively engage adjacent sheets with minimum three-thread penetration.

L. At welded male/female side laps weld at spacing indicated.

M. Weld deck in accordance with AWS D1.3/D1.3M.

N. End Joints: Butted for composite deck. Lapped 2" for all other deck types.

O. At floor edges, install concrete stops upturned to top surface of slab, to contain wet concrete. Provide stops of sufficient strength to remain stationary without distortion.

P. At openings between deck and walls, columns, and openings, provide sheet steel closures and angle flashings in order to close openings, reinforce deck, provide deck continuity, and support other work.

Q. Close openings above walls and partitions perpendicular to deck flutes with single row of foam cell closures.

R. Weld stud shear connectors through steel deck to structural members below.

3.03 REPAIR

A. Galvanizing Repairs: Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up galvanizing repair paint.

B. Painting Repairs:
   1. Prepare rust spots, welds, and abraded areas on bottom surface of prime-painted deck using wire brush immediately after deck installation.

2. Repair prepared areas of bottom of deck using the same primer and color as applied in the shop.

3.04 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:
   1. Special Inspections and qualifications of welding Special Inspectors for cold-formed steel floor and roof deck in accordance with quality-assurance inspection requirements of SDI QA/QC.
      a. Field welds and mechanical fastening of deck are subject to inspection.
   2. Steel decking will be considered defective if it does not pass tests and inspections.
   3. Headed Shear Stud Connectors: In addition to visual inspection, test and inspect field-welded shear stud connectors in accordance with requirements in AWS D1.1/D1.1M for stud welding and as follows:
      a. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs made to any shear connector.
      b. Conduct tests in accordance with requirements of AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors that are already tested.

C. Prepare test and inspection reports.

END OF SECTION

SECTION 054000
COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior non-load-bearing wall framing.

B. interior non-load bearing wall framing exceeding height limitations of standard non-structural cold-formed framing.

C. Exterior wall sheathing.

D. Formed steel joist and purlin framing and bridging.

E. Bracing for interior CMU partition walls.

1.02 RELATED REQUIREMENTS

A. Section 092116 - Gypsum Board Assemblies: Cold-formed steel nonstructural framing.

B. Section 092116 - Gypsum Board Assemblies: Gypsum-based sheathing.

C. Section 092216 - Non-Structural Metal Framing.

1.03 DEFINITIONS

A. General: See AISI S240 for definitions of terms used in this section.

B. Connection: A combination of structural elements and joints used to transmit forces between two or more members.

C. Connector: A device used to transmit forces between cold-formed steel structural members or between a cold-formed steel structural member and another structural element.

1.04 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members.

B. AISI S201 - North American Standard for Cold-Formed Steel Framing - Product Data.

C. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing.

D. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

F. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

G. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members.

H. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.

I. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

J. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with work of other sections that is to be installed in or adjacent to metal framing systems, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

B. Preinstallation Meeting: Conduct a preinstallation meeting at least one week prior to the start of the work of this section; require attendance by affected installers.

1.06 SUBMITTALS

A. Product Data: Provide data on cold-formed steel structural members; include material descriptions and base steel thickness.

B. Product Data: Provide manufacturer's data on factory-made connectors and mechanical fasteners, showing compliance with requirements.

C. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.
   1. Indicate stud and ceiling joist layout.
   2. Describe method for securing studs to tracks and other framing connections.

D. Design Data:
   1. Shop drawings signed and sealed by a professional structural engineer.
   2. Design calculations sufficient to demonstrate compliance with design criteria; signed and sealed by a professional structural engineer.
   3. Details and calculations for factory-made connectors, signed and sealed by a professional structural engineer.

E. Evaluation Service Reports: Provide reports indicating compliance with specified requirements for cold-formed steel structural members, connectors, mechanical fasteners, and hold-downs.

F. Inspection Reports: Provide material verification Inspection Reports in accordance with requirements of AISI S240.

G. Inspection Reports: Provide Inspection Reports for welding, mechanical fastening, and cold-formed steel light-frame construction in accordance with requirements of AISI S240.

H. Manufacturer's Installation Instructions: Provide installation instructions for connectors.

I. Installation Drawings: Indicate dimensioned locations of cold-formed steel structural framing.
   1. Include materials.

J. Designer's Qualification Statement.

K. Manufacturer's Qualification statement.

L. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M.

M. SSMA Manufacturer Qualification: Submit documentation of manufacturer association membership.

1.07 LEED SUBMITTALS

A. MR Credit 2: Environmental Product Declarations.
   1. Cold-formed metal framing, if available.

B. MR Credit 3: Sourcing of Raw Materials.
   1. Recycled Content: Steel. Include material cost values.

C. MR Credit 4: Material Ingredients.
   1. Report: Cold-formed metal, if available.

1.08 SUBMITTAL PROCEDURES

A. Submit shop drawings and product data in complete packages so that all parts of a given component or area may be reviewed together.

B. Indicate the applicable Contract Drawings and Specification Sections used to develop the submittal.

C. All modifications or revisions to submittals must be clearly clouded with a revision number and date indicated. Clouding of entire sheets, plans, sections, or details is not acceptable unless the sheet, plan, section, or detail is completely new to the revised submittal. The following may be considered cause for rejection of the submittal without review by the Engineer of Record.
   1. Failure to clearly indicate revisions with clouds and revision date.
   2. Submittal contains revisions or modifications to a previously reviewed submittal that were not requested by the Engineer of Record.

D. Resubmittals: Make corrections and completely address all previous comments prior to resubmitting shop drawings and product data. The Engineer of Record will only review those sheets, plans, sections, and details that have been clouded and tagged with a revision triangle.

1.09 REQUESTS FOR INFORMATION (RFI) PROCEDURES

A. RFIs shall be submitted by the Contractor. RFIs submitted by any other entity will not be reviewed.

B. Limit RFIs to one main subject. RFIs including more than one main subject will be returned with a request to break them up into multiple RFIs.

C. Submit RFIs only for clarification or interpretation of the Contract Documents. RFIs shall include a list of sheets, plans, sections, details, and specifications in the Contract Documents where the Contractor has already looked for the information being requested.

D. RFIs requesting a substitution will be rejected. Any substitution requests shall follow Substitution Procedures indicated in Division 01 Specifications.

E. RFIs submitted for correction of field work shall include the Contractor's proposed solution. Provide an engineered solution from the Contractor's engineer in applicable situations.

1.10 QUALITY ASSURANCE

A. Designer Qualifications: Design framing system under direct supervision of a professional structural engineer experienced in designing this work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Member of Steel Stud Manufacturers Association (SSMA): www.ssma.com/#sle.

C. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.3/D1.3M.

D. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Connectors:
   1. ClarkDietrich
   2. MarinoWARE
   3. Simpson Strong-Tie
   4. The Steel Network
   5. Substitutions: See Section 016000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Design Requirements: Design cold-formed framing systems, components and connectors to withstand specified design loads in compliance with ICC (IBC), ASCE 7, AISI S100, and AISI S240.

B. Regulatory Requirements: Comply with applicable building code criteria for loads, including seismic loads.

C. Design Criteria: As indicated on the drawings.
   1. Live load deflection meeting the following, unless otherwise indicated:
      a. Floors: Maximum vertical deflection under live load of 1/480 of span.
      b. Roofs: Maximum vertical deflection under live load of 1/360 of span.
      c. Exterior Walls (Typical): Maximum horizontal deflection under wind load of 1/360 of span.
      d. Exterior Walls with Brick or Stucco Finish: Maximum horizontal deflection under wind load of 1/600 of span.
      e. Design non-axial loadbearing framing to accommodate not less than 3/4 in vertical deflection.

2. Able to tolerate movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
3. Able to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

2.03 MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.
   1. Structural Grade: ST33H for 33 and 43 mil members, ST50H for 54 mil and thicker members.
   2. Corrosion Protection Coating Designation: CP 60 in accordance with AISI S240.

2.04 STRUCTURAL FRAMING COMPONENTS

A. Wall Studs and Track Sections: AISI S240; c-shaped studs and u-shaped track sections in stud-matching nominal width and compatible height.
   1. Structural Grade: As required to meet design criteria.
   2. Corrosion Protection Coating Designation: CP 60 in accordance with AISI S240.
   3. Thickness and Depth: Depth as indicated on the drawings; thickness and structural grade as required to meet design criteria.

B. Joists: AISI S240; manufactured, engineered open-web steel joists.
   1. Structural Grade: As required to meet design criteria.
   2. Corrosion Protection Coating Designation: CP 60 in accordance with AISI S240.
   3. Thickness and Depth: Depth as indicated on drawings; thickness and structural grade as required to meet specified design criteria.

2.05 CONNECTIONS

A. Performance Requirements: Provide connections in compliance with requirements of AISI S240.

B. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.
   1. Structural Grade: As required to meet design criteria.
   2. Corrosion Protection Coating Designation: CP 90 in accordance with AISI S240.

C. Structural Performance: Maintain load and movement capacity required by applicable building code and specified design criteria.

D. Movement Connections: Provide mechanical anchorage devices that accommodate movement using slotted holes, shouldered screws or screws and anti-friction or stepped bushings, while maintaining structural performance of framing. Provide movement connections where indicated on drawings.
   1. Where continuous studs bypass elevated floor slab, connect stud to slab in manner allowing vertical and horizontal movement of slab without affecting studs; allow for minimum movement of 3/4 inch.
   2. Where top of stud wall terminates below structural floor or roof, connect studs to structure in manner allowing vertical and horizontal movement of slab without affecting studs; allow for minimum movement of 3/4 inch.
   3. Provide top track preassembled with connection devices spaced to fit stud spacing indicated on drawings; minimum track length of 10 feet.
   4. Provide top track with long leg track and head of wall movement connectors; minimum track length of 10 feet.

E. Fixed Connections: Provide non-movement devices for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.

F. Bridging Connections: Provide mechanical load-transferring devices that accommodate wind load torsion and weak axis buckling induced by axial compression loads. Provide bridging connectors where indicated on the drawings.

2.06 MISCELLANEOUS CONNECTIONS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot-dip galvanized per ASTM A153/A153M.

B. Anchorage Devices: Powder actuated.

C. Welding: Comply with AWS D1.1/D1.1M and AWS D1.3/D1.3M.

2.07 SHEATHING

A. Glass-mat-faced gypsum board; ASTM C1177/C1177M, square long edges, 1/2 inch thick.

2.08 ACCESSORIES

A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.

B. Plates, Gussets, Clips: Formed Sheet Steel, thickness determined for conditions encountered; finish to match framing components.

C. Galvanizing Repair: Touch up bare steel with zinc-rich paint in compliance with ASTM A780/A780M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify field measurements and adjust installation as required.

3.02 PREPARATION

A. Structural Wall Foundations: For gaps between wall bottom track and top of foundation 1/4 inch or greater, level substrate with loadbearing shims or grout between track and foundation.

3.03 INSTALLATION - GENERAL

A. Install structural members and connections in compliance with ASTM C1007.

3.04 INSTALLATION OF STUDS

A. Install wall studs plumb and level.

B. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.

C. Install load-bearing studs full length in one piece. Splicing of studs is not permitted.

D. Install load-bearing studs; brace, and reinforce to develop full strength and achieve design requirements.

E. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

F. Install intermediate studs above and below openings to align with wall stud spacing.

G. Provide deflection allowance in stud track, directly below horizontal building framing at non-loadbearing framing.

H. Attach cross studs to studs for attachment of fixtures anchored to walls.

I. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

J. Touch-up field welds and damaged corrosion-protected surfaces zinc-rich paint in compliance with ASTM A780/A780M.

3.05 INSTALLATION OF JOISTS AND PURLINS

A. Install framing components in accordance with manufacturer's instructions.

B. Make provisions for erection stresses. Provide temporary alignment and bracing.

C. Place joists at 16 inches on center maximum; not more than 2 inches from abutting walls, and connect joists to supports using fastener method.

D. Set floor and ceiling joists parallel and level, with lateral bracing and bridging.

E. Locate joist end bearing directly over load-bearing studs or provide load distribution on top of stud track.

F. Provide web stiffeners at reaction points.

G. Touch-up field welds and damaged galvanized surfaces with primer.

3.06 INSTALLATION OF WALL SHEATHING

A. Install wall sheathing with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using self-tapping screws.

3.07 FIELD QUALITY CONTROL

A. Provide material verification inspections in accordance with requirements of AISI S240.

B. Owner will employ Special Inspector and independent testing agency for inspections of welding, mechanical fastening, and cold-formed steel light-frame construction in accordance with requirements of AISI S240.
   1. Size, flange width, steel grade, steel thickness, and spacing of members.
   2. Field and shop connections of cold-formed steel members to each other.
   3. Field and shop connections of cold-formed steel members to other structure.

3.08 TOLERANCES

A. Studs - Vertical Alignment (Plumbness): 1/960 of span or 1/8 inch in 10 ft, in accordance with ASTM C1007.

B. Studs - Maximum Variation from True Position: 1/8 inch in accordance with ASTM C1007.

C. Stud Spacing: 1/8 inch from the designated spacing, provided that the cumulative error does not exceed the requirements of the finishing materials in accordance with ASTM C1007.

END OF SECTION

SECTION 055000
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel and aluminum items.
B. Steel door and gate frames.
C. Loose bearing and leveling plates.
D. Loose steel lintels.
E. Anchor bolts, sleeves, channel inserts.
F. Downspout boots.

1.02 RELATED REQUIREMENTS

A. Section 055100 - Metal Stairs.
B. Section 055133 - Metal Ladders. Interior and exterior ladders for mechanical or maintenance access.

1.03 REFERENCE STANDARDS

A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
D. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2022.
E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
G. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.
H. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.
I. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.
J. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

K. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.
L. ASTM B211/B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire; 2019.
M. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
N. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
O. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.
P. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal; 1997 (Reapproved 2018).
Q. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.
R. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).
S. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
T. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2014, with Errata (2020).
U. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.
V. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.
W. SSPC-SP 2 - Hand Tool Cleaning; 2018.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.
B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
    1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
    2. Design data: Submit drawings and supporting calculations, signed and sealed by a qualified professional structural engineer.
        a. Include the following, as applicable:
            1) Design criteria.
            2) Engineering analysis depicting stresses and deflections.
            3) Member sizes and gauges.
            4) Details of connections.

5) Bracing requirements.

3. Exterior gates and fencing showing connections, elevations, details, accessories where applicable.
4. Elevator sill support angles.
5. Elevator pit sump covers.

C. Delegated Design Submittals: For ladders, countertop supports, dumpster gates.

D. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

E. Designer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Design structural items under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

E. Slotted Channel Fittings: ASTM A1011/A1011M.

F. Mechanical Fasteners: Compatible with materials being fastened; type consistent with design and specified quality level. Stainless steel at exposed exterior locations; zinc-plated fasteners with hot-dipped galvanized coating in exterior walls.

G. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.

H. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

I. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

J. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

B. Sheet Aluminum: ASTM B209/B209M, 5052 alloy, H32 or H22 temper.

C. Aluminum-Alloy Bars: ASTM B211/B211M, 6061 alloy, T6 temper.

D. Bolts, Nuts, and Washers: Stainless steel.

E. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.03 MISCELLANEOUS MATERIALS

A. Bituminous Paint: ASTM D1187/D1187M. Cold-applied asphalt emulsion.

B. Shrink Resistant Grout: ASTM C1107/C1107M. Nonmetallic, nonstaining, noncorrosive, nongaseous grout recommended by metal fabricator and grout manufacturer for applications indicated.

2.04 FABRICATION

A. Field Conditions: Verify field dimensions for accurate fit of shop or field constructed elements relative to adjacent construction.

B. Fit and shop assemble items in largest practical sections, for delivery to site.

C. Fabricate items with joints tightly fitted and secured.

D. Continuously seal joined members by intermittent welds and plastic filler.

E. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

F. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

G. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.05 FABRICATED ITEMS

A. Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Joist Hangers: Strap anchors, fabricated with sheet steel, 18 gauge, 0.0478 inch (1.21 mm) minimum base metal thickness; galvanized finish.

C. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking; galvanized finish.

D. Lintels: As detailed; galvanized finish.

E. Dumpster Gates, Mechanical Yard Enclosure and Gates: Galvanized steel shapes, shaped metal panels, as indicated in Drawings.

F. Door Frames for Overhead Door Openings: Channel sections; galvanized finish.

G. Recessed Mat Frames : As detailed; steel, galvanized finish.

H. Elevator Hoistway Beams: Beam sections; prime paint finish.

I. Elevator Pit Sump Covers: Fabricate from welded or pressure-locked steel bar grating. Limit grating spacing to 1/2 inch.

1. Provide steel angle supports cast into concrete.

J. Slotted Channel Framing: Fabricate channels and fittings from structural steel complying with the referenced standards; factory-applied, rust-inhibiting thermoset acrylic enamel finish.

2.06 DOWNSPOUT BOOTS

A. Downspout Boots: Smooth interior without boxed corners or choke points; include integral lug slots and on-body cleanout and cover with neoprene gaskets.
   1. Configuration: Angular.
   2. Material: Cast iron; ASTM A48/A48M; casting thickness 3/8 inch (9.5 mm), minimum.
   3. Finish: Manufacturer's standard factory applied powder coat finish.
   4. Color: To be selected by Architect from manufacturer's standard range.
   5. Accessories: Manufacturer's standard stainless steel fasteners, stainless steel building wall anchors, and rubber coupling.

2.07 FINISHES - STEEL

A. High Performance Coatings: All exterior metal work, primed or galvanized, to have high performance coating with appropriate primer. See Section 099600 - High-Performance Coatings.

B. Prime paint steel items.
   1. Exceptions: Galvanize items in exterior assemblies, items to be embedded in concrete and items to be embedded in masonry.
   2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.

C. Prepare surfaces to be primed in accordance with SSPC-SP2.

D. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

E. Prime Painting: Two coats.

F. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating. (Provide minimum 530 g/sq m galvanized coating.)

G. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

H. Slotted Channel Framing: ASTM A653/A653M, Grade 33.

2.08 FINISHES - ALUMINUM

A. Exterior Aluminum Surfaces: superior performance organic coating.

B. Interior Aluminum Surfaces: high performance organic coating.

C. High Performance Organic Coating System: AAMA 2604 multiple coat, thermally cured fluoropolymer system; color as indicated.

D. Superior Performance Organic Coating System: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride system; color as indicated.

2.09 FABRICATION TOLERANCES

A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).

C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).

D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).

E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Obtain approval prior to site cutting or making adjustments not scheduled.

3.03 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION

SECTION 055100
METAL STAIRS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Stairs with concrete treads.
B. Structural steel stair framing and supports.
C. Handrails and guards.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Placement of metal anchors in concrete.
B. Section 042000 - Unit Masonry, Mortar and Grout: Placement of metal fabrications in masonry.
C. Section 057300 - Decorative Metal Railings: Handrails and balusters other than specified in this section.

1.03 REFERENCE STANDARDS

A. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures; 2006.
B. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling; 2023.
C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.
G. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.
H. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.
I. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.

J. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.

K. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2023.

L. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

M. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

N. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

O. SSPC-SP 2 - Hand Tool Cleaning; 2018.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
2. Include the design engineer's seal and signature on each sheet of shop drawings.

C. Designer's Qualification Statement.

D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is certified under AISC 201.

1.05 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.

B. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and dated no more than 12 months before start of scheduled welding work.

C. Fabricator Qualifications:

1. A qualified steel fabricator that is certified by the American Institute for Steel Construction (AISC) under AISC 201.

PART 2 PRODUCTS

2.01 METAL STAIRS - GENERAL

A. Decorative Metal Stairs: For requirements of main open stair, see Section 057100 - Decorative Metal Stairs. Below requirements apply to standard egress and similar stairs as indicated on Drawings.

B. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.

1. Regulatory Requirements: Provide stairs and railings that comply with most stringent requirements of local, state, and federal regulations; where requirements of Contract Documents exceed those of regulations, comply with Contract Documents.
2. Handrails: Comply with applicable accessibility requirements of ADA Standards.
3. Structural Design: Provide complete stair and railing assemblies that comply with the applicable local code.
4. Dimensions: As indicated on drawings.
5. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
6. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
7. Separate dissimilar metals using paint or permanent tape.

C. Metal Jointing and Finish Quality Levels:

1. Quality Level Applications: Apply finish levels as follows:
    a. Architectural: Feature or monumental stairs with decorative handrails and guards, treads of stone, terrazzo, tile, or similar finish, highly visible.
    b. Commercial: Stairs that may be seen from important vantage points outside the immediate stair area, and may or may not include decorative railings.
    c. Service: Stairs contained within unglazed shafts, used primarily for egress, not generally seen from vantage points outside the stair shaft.
2. Architectural: All joints as inconspicuous as possible, whether welded or mechanical.
    a. Welded Joints: Continuously welded and ground smooth and flush.
    b. Mechanical Joints: Butted tight, flush, and hairline; concealed fastenings only.

c. Exposed Edges and Corners: Eased to small uniform radius.
d. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for highest quality gloss finish.

3. Commercial: Exposed joints as inconspicuous as possible, whether welded or mechanical; underside of stair not covered by soffit IS considered exposed to view.
   a. Welded Joints: Intermittently welded on back side, filled with body putty, and sanded smooth and flush.
   b. Welds Exposed to View: Ground smooth and flush.
   c. Mechanical Joints: Butted tight, flush, and hairline.
   d. Bolts Exposed to View: Countersunk flat or oval head bolts; no exposed nuts.
   e. Exposed Edges and Corners: Eased to small uniform radius.
   f. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for satin or matte finish.
4. Service: Exposed joints tight with face surfaces aligned; underside of stair not covered by soffit is not considered exposed to view.
   a. Welded Joints: Welded on back side wherever possible.
   b. Welds Exposed to View: Ground smooth; not required to be flush.
   c. Bolts Exposed to View: Countersunk flat or oval head bolts; no exposed nuts or screw threads.
   d. Metal Surfaces to be Painted: Sanded smooth, suitable for satin or matte finish.

D. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.
E. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.02 METAL STAIRS WITH CONCRETE TREADS

A. Jointing and Finish Quality Level: Service, as defined above.
B. Risers: Closed.
C. Treads: Metal pan with field-installed concrete fill.
   1. Concrete Depth: 1-1/2 inches (38 mm), minimum.
   2. Tread Pan Material: Steel sheet.

3. Tread Pan Thickness: As required by design; 14 gauge, 0.075 inch (1.9 mm) minimum.
4. Pan Anchorage to Stringers: Welded or bolted to carrier angles welded or bolted to stringers.
5. Concrete Reinforcement: Welded wire mesh.
6. Concrete Finish: For resilient floor covering.

D. Risers: Same material and thickness as tread pans.
1. Riser/Nosing Profile: Sloped riser with rounded nosing of minimum radius.
2. Nosing Depth: Not more than 1-1/2 inch (38 mm) overhang.
3. Nosing Return: Flush with top of concrete fill, not more than 1/2 inch (12 mm) wide.

E. Stringers: Rolled steel channels.
1. Stringer Depth: As indicated on drawings.
2. End Closure: Sheet steel of same thickness as risers welded across ends.

F. Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity.

G. Railings: Steel pipe railings.

H. Finish: Shop- or factory-prime painted.

2.03 HANDRAILS AND GUARDS

A. Decorative Stair Railings: For main open stair, see Section 057300 - Decorative Metal Railings.

B. Wall-Mounted Rails: Round pipe or tube rails unless otherwise indicated.
1. Outside Diameter: 1-1/4 inch (32 mm), minimum, to 1-1/2 inches (38 mm), maximum.

C. Guards:
1. Top Rails: Round pipe or tube rails unless otherwise indicated.
a. Outside Diameter: 1-1/4 inch (32 mm), minimum, to 1-1/2 inches (38 mm), maximum.
2. Infill at Picket Railings: Vertical pickets.
a. Horizontal Spacing: Maximum 4 inches (100 mm) on center.
b. Material: Solid steel bar.
c. Shape: Square.
d. Size: 1/2 inch (13 mm) square.
e. Top Mounting: Welded to underside of top rail.
f. Bottom Mounting: Welded to top surface of stringer.

3. Infill at Pipe Railings: Pipe or tube rails sloped parallel to stair.
    a. Outside Diameter: 1 inch (25 mm).
    b. Material: Steel pipe or tube, round.
    c. Vertical Spacing: Maximum 4 inches (100 mm) on center.
    d. Jointing: Welded and ground smooth and flush.
4. End and Intermediate Posts: Same material and size as top rails.
    a. Horizontal Spacing: As indicated on drawings.
    b. Mounting: Welded to top surface of stringer.

2.04 MATERIALS

A. Steel Sections: ASTM A36/A36M.
B. Steel Tubing: ASTM A500/A500M or ASTM A501/A501M structural tubing, round and shapes as indicated.
C. Steel Plates: ASTM A6/A6M or ASTM A283/A283M.
D. Pipe: ASTM A53/A53M Grade B Schedule 40, black finish.
E. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
    1. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
    2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).
F. Concrete Reinforcement: Mesh type as detailed, galvanized.

2.05 ACCESSORIES

A. Steel Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.
B. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
C. Shop and Touch-Up Primer: SSPC-Paint 15, and comply with VOC limitations of authorities having jurisdiction.

2.06 SHOP FINISHING

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
B. Do not prime surfaces in direct contact with concrete or where field welding is required.
C. Prime Painting: Use specified shop- and touch-up primer.
    1. Preparation of Steel: In accordance with SSPC-SP 2 Hand Tool Cleaning.
    2. Number of Coats: One.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. When field welding is required, clean and strip primed steel items to bare metal.

B. Supply items required to be cast into concrete and embedded in masonry with setting templates.

3.03 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Provide anchors, plates, angles, hangers, and struts required for connecting stairs to structure.

C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

D. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.

F. Obtain approval prior to site cutting or creating adjustments not scheduled.

G. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

END OF SECTION

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SECTION 055133
METAL LADDERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop-fabricated metal ladders.

1.02 REFERENCE STANDARDS

A. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008 (Reaffirmed 2018).

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.

F. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

G. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.

H. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

I. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

J. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.

K. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

L. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

M. SSPC-SP 2 - Hand Tool Cleaning; 2018.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:

1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
2. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Designer's Qualification Statement.

D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.04 QUALITY ASSURANCE

A. Design ladders under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

E. Mechanical Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

F. Bolts, Nuts, and Washers: ASTM A307, plain.

G. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

H. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

I. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.03 FABRICATED LADDERS

A. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; galvanized finish.

1. Side Rails: 3/8 by 2 inches (9 by 50 mm) members spaced at 20 inches (500 mm).

2. Rungs: One inch (25 mm) diameter solid round bar spaced 12 inches (300 mm) on center.
3. Space rungs 7 inches (175 mm) from wall surface.

2.04 FINISHES - STEEL

A. Prime paint steel items not exposed to weather. Galvanize items exposed to weather.
   1. Do not prime surfaces where field welding is required.
B. Prepare surfaces to be primed in accordance with SSPC-SP2.
C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
D. Prime Painting: Two coats.
E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating. (Provide minimum 530 g/sq m galvanized coating.)
F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.05 FABRICATION TOLERANCES

A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.
B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).
C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).
D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).
E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.
B. Supply setting templates to the appropriate entities for steel items required to be embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.
B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
C. Perform field welding in accordance with AWS D1.1/D1.1M.
D. Obtain approval prior to site cutting or making adjustments not scheduled.
E. After erection, prime welds, abrasions, and surfaces not shop primed , except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION

SECTION 057100
DECORATIVE METAL STAIRS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Decorative metal stairs.

1.02 RELATED REQUIREMENTS

A. Section 057300 - Decorative Metal Railings: Railing and guardrail assemblies.

B. Section 096623 - Resinous Matrix Terrazzo Flooring: Terrazzo infill in treads and landings.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures; 2006.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

D. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

E. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.

F. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.

G. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

H. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

I. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel; 2017, with Amendment (2021).

J. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of railings and guards with work specified in this section.

B. Preinstallation Meeting: Schedule and conduct a preinstallation meeting one week before starting work of this section. Attendees shall include, but not be limited to:

1. Contractor.

2. Architect.
3. Terrazzo subcontractor.
4. Decorative metals subcontractor.
5. Other subcontractors of adjacent work as required.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate stair plans, elevations, and sections, details of profiles, dimensions, sizes, connection attachments, anchorage, size and type of fasteners, and accessories. Indicate anchor and joint locations, brazed connections, transitions, and terminations.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
   2. Indicate NOMMA joint finish level applied in each location.
   3. Include the design engineer's seal and signature on each sheet of shop drawings.

C. Samples: Submit one (1) each of below for each type and condition shown.
   1. Example of exposed steel shape showing proposed finish.
   2. Example of perforated steel panel showing proposed finish.
   3. Example of precast terrazzo stair tread fabricated in proposed matrix and color.
   4. Example of wood hand rail with steel support bracket demonstrating connection and finishes.

D. Designer's qualification statement.

E. Fabricator's qualification statement:

F. Installer's qualification statement.

G. Welders' qualification statement.

H. Executed warranty.

1.06 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located or personnel under direct supervision of such an engineer.

B. Fabricator Qualifications:
   1. Certified by American Institute for Steel Construction (AISC) under AISC 201.

C. Installer Qualifications: Installation by manufacturer.

1.07 MOCK-UPS

A. See Section 014000 - Quality Requirements for additional requirements.

B. Provide mock-up of decorative stair with railing system, wall-mounted handrail, and guardrail, six feet (two m) long by three feet (one m) wide, indicating each type of material, connection, and finish.
   1. Include a section of the LED light strip as indicated in Drawings.
C. Locate where directed.
D. Mock-up may remain as part of the work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.
B. Deliver materials in factory-provided protective coverings and packaging.
C. Protect materials against damage during transit, delivery, storage, and installation at site.
D. Prior to installation, store materials and components under cover in a dry location.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.
B. Manufacturer Warranty: Provide 2-year manufacturer warranty for materials, fabrication, finishes, and installation. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 DECORATIVE METAL STAIRS

A. General Description: Main Open Stair is composed of the following, more fully described below and in the Drawings:
   1. Structure:
      a. Exposed steel shapes.
      b. Steel pan.
      c. Reinforced concrete plinth.
   2. Treads: Precast epoxy terrazzo. See Section 096623 - Resinous Matrix Terrazzo Flooring
   3. Risers: Solid steel sheet at steel structure. Concrete at concrete plinth.
   4. Handrails: Wood handrail specified in Section 057300 - Decorative Metal Railings.
   5. Guards: Steel framing supporting perforated steel sheet. See Section 057300 - Decorative Metal Railings.

B. Decorative Metal Stairs: Provide stairs of the design specified, complete with concrete landing platforms, vertical and horizontal supports, railings, guards, and built-in benches and counters attached to the stair structure, fabricated for anchorage to each other and to building structure.
   1. Regulatory Requirements: Comply with the most stringent requirements of local, state, and federal regulations; where requirements of Contract Documents exceed those of regulations, comply with Contract Documents.
      a. Comply with ADA Standards and ANSI A117.1.
   2. Structural Design: Comply with the following:
      a. Stair Capacity:
         1) Live Load: Uniform live load of 100 psi (4.7 kPa) and maximum concentrated load of 300 lb (136 kg).
         2) Dead Load: Weight of stair, associated railing system, concrete fill, cladding and other finishes.
         3) Deflection Limits: Deflection of stringer or landing framing not to exceed 1/360 of span.
      b. Benches and Countertops attached to stair structure: Include structural design for each type element attached to the stair and guardrails.
   3. Configuration and Dimensions: As indicated on Drawings.
   4. Assembly:
      a. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
      b. Eliminate sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
      c. Separate dissimilar metals using paint or permanent tape.
      d. Join lengths, seal open ends, and conceal exposed mounting bolts and nuts using slip-on nonweld mechanical fittings, flanges, escutcheons, and wall brackets.
      e. Welded Joints: Make visible joints butt tight, flush, and hairline; use methods that avoid discoloration and damage of finish; grind smooth, polish, and restore to required finish.
         1) Welded Joints: See also Metal Jointing and Finish Quality Levels.
            (a) Carbon Steel: Perform welding in accordance with AWS D1.1/D1.1M.
            (b) Stainless Steel: Perform welding in accordance with AWS D1.6/D1.6M.

C. Metal Jointing and Finish Quality Levels: Architectural, as defined below.

1. Architectural: Inconspicuous joints, whether welded or mechanical.
    a. Welded Joints: Continuously welded and ground smooth and flush.
        1) Joint Finish - Exposed To View: NOMMA; Finish #1 - No evidence of a welded joint.
        2) Joint Finish - Not Exposed To View: NOMMA; Finish #4 - Good quality, uniform undressed weld with minimal spatter.
    b. Mechanical Joints: Butted tight, flush, and hairline; concealed fastenings only.
    c. Exposed Edges and Corners: Eased to small uniform radius.
    d. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for highest quality gloss finish.

D. Provide required fasteners and anchors:
    1. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.
    2. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise.

2.02 COMPONENTS

A. Treads: Precast resinous matrix terrazzo treads on steel plate subtreads and concrete plinth.
    1. Steel Plate Subtread Thickness: 1/4 inch (6 mm), minimum, or as required to meet minimum deflection criteria.
    2. Precast Resinous Terrazzo Treads: See Section 096623.
B. Risers: Closed.
C. Risers: Solid steel sheet.
    1. Riser Thickness: As required by design; 14 gauge, 0.075 inch (1.9 mm) minimum.
    2. Riser/Nosing Profile: As indicated on Drawings.
    3. Nosing Depth: As indicated on Drawings.
    4. Nosing Return: As indicated on Drawings.
D. Stringers: Steel channels.
    1. Stringer Depth: As indicated on drawings.
E. Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity.
F. Handrail: Wood handrail specified with Decorative Metal Railings, Section 057300.
G. Metal Finish: Shop- or factory-prime painted with High Performance Coating.

H. Under Side of Stair: Exposed to view, to be finished same as specified for other exposed to view surfaces.

2.03 MATERIALS

A. Steel Components:
   1. Sections, Shapes, Plate and Bar: ASTM A36/A36M.
   2. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
      a. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
      b. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).
   3. Steel Finishes:
      a. Steel Exposed to View: See Section 099600 - High-Performance Coatings.

2.04 ACCESSORIES

A. Anchors and Fasteners: Provide anchors and other materials as required to attach to structure, made of same materials as stair components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.
   1. For anchorage to concrete, provide inserts to be cast into concrete for bolt anchors.
   2. For anchorage to masonry, provide brackets to be embedded in masonry for bolt anchors.
   3. For anchorage to stud walls, provide backing plates for bolt anchors.
   4. Exposed Fasteners: No exposed bolts or screws.

B. Steel Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.

C. Sealant: Silicone; color as selected by Architect.

D. Finish Touch-Up Materials: As recommended by manufacturer for field application.

E. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of specified sustainability goals.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate and site conditions are acceptable and ready to receive work.

B. Verify field dimensions of locations and areas to receive work.

C. Notify Architect immediately of conditions that would prevent satisfactory installation.

D. Do not proceed with work until detrimental conditions have been corrected.

E. Furnish components to be installed in other work to installer of that other work, including but not limited to blocking, sleeves, inserts, anchor bolts, embedded plates, and supports for attachment of anchors.

3.02 PREPARATION

A. Review installation drawings before beginning installation. Coordinate diagrams, templates, instructions, and directions for installation of anchorages and fasteners.

B. Clean surfaces to receive units. Remove materials and substances detrimental to installation.

3.03 INSTALLATION

A. Comply with manufacturer's drawings and written instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, and with tight joints, except where necessary for expansion.

C. Anchor securely to structure.

D. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

E. Weld connections that cannot be shop welded due to size limitations.

1. Match shop welding and bolting.
2. Clean welds, bolted connections, and abraded areas.
3. Touch up shop primer and factory-applied finishes.

F. Isolate dissimilar materials with bituminous coating, bushings, grommets, or washers to prevent electrolytic corrosion.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

C. Maximum Out-of-Position: 1/4 inch (6 mm).

3.05 CLEANING

A. Remove protective film from exposed metal surfaces.

B. Metal: Clean exposed metal finishes with potable water and mild detergent, in accordance with manufacturer recommendations; do not use abrasive materials or chemicals, detergents, or other substances that may damage the material or finish.

3.06 PROTECTION

A. Protect installed components and finishes from damage after installation.

B. Repair damage to exposed finishes to be indistinguishable from undamaged areas.

1. If damage to finishes and components cannot be repaired to be indistinguishable from undamaged finishes and components, replace damaged items.

END OF SECTION

SECTION 057300
DECORATIVE METAL RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Railing systems, interior and exterior.

1.02 REFERENCE STANDARDS

A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

C. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures; 2006.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

E. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

F. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

G. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

H. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.

I. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

J. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

K. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.

L. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.

M. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.

N. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2021.

O. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2023.

P. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

Q. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

R. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.

S. NAAMM AMP 500-06 - Metal Finishes Manual; 2006.

T. NOMMA - Guideline 1: Joint Finishes; 1994.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene preinstallation meeting one week before starting work of this section. Attendees include:

1. Contractor.
2. Architect.
3. Owner's representative.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturer's product data, including description of materials, components, finishes, fabrication details, glass, anchors, and accessories.

C. Shop Drawings: Indicate railing system elevations and sections, details of profile, dimensions, sizes, connection attachments, anchorage, size and type of fasteners, and accessories. Indicate anchor and joint locations, brazed connections, transitions, and terminations.

1. Indicate NOMMA joint finish level applied in each location.
2. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
3. Include design engineer's seal and signature on each sheet of shop drawings.

D. Samples: Submit one of each item below for each type and condition shown.

1. Railing: 12-inch (305 mm) long section of handrail showing color, finish, and connection detail.
2. Perforated metal panels: 24 by 24 inch panel showing hole spacing, edge and border finish, factory finish and color.

E. Test Reports: Submit test reports from independent testing agency showing compliance with specified design and performance requirements.
F. Manufacturer's Instructions: Indicate installation.
G. Designer's qualification statement.
H. Fabricator's qualification statement.
I. Installer's qualification statement.
J. Maintenance Data: Manufacturer's instructions for care and cleaning.

1.05 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located or personnel under direct supervision of engineer.
B. Fabricator Qualifications: Certified in accordance with AISC 201 and IAS AC172.
C. Installer Qualifications:
    1. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.06 MOCK-UPS

A. See Section 014000 - Quality Requirements for additional requirements.
B. Provide mock-ups of interior and exterior railing system and perforated panel, full height of rail and in width sufficient to show panel attachments and edge conditions, indicating each type of material, cladding, and finish, including weld quality.
    1. Interior railing mock-up to accompany mock-up of Main Stair. See Section 057100 - Decorative Metal Stairs.

1.07 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.
B. Deliver materials in factory-provided protective coverings and packaging.
C. Protect materials against damage during transit, delivery, storage, and installation at site.
D. Inspect materials upon delivery for damage. Replace damaged items.
E. Prior to installation, store materials and components under cover in dry location.

1.08 FIELD CONDITIONS

A. Ambient Conditions:
    1. Do not install railings until project is enclosed and ambient temperature of space is minimum 65 degrees F (18.3 degrees C) and maximum 95 degrees F (35 degrees C).

2. Maintain ambient temperature of space at minimum 65 degrees F (18.3 degrees C) and maximum 95 degrees F (35 degrees C) for 24 hours before, during, and after railing installation.

PART 2 PRODUCTS

2.01 RAILING SYSTEMS - GENERAL

A. General: Factory- or shop-fabricated to suit project conditions, for proper connection to building structure, and in largest sizes practical for delivery to site.

B. Summary Description, Railing Systems: Welded
   1. Interior - Main Open Stair: Steel tube framing guardrail composed of steel shapes with perforated steel infill panels, wood handrail.
   2. Interior - Egress Stair: Steel tube and pipe railings, guard and wall mounted rails, steel pickets, painted.
   3. Interior - Guardrails: Similar to Main Open Stair design with added cantelevered countertop elements to be included in design calculations.
   4. Exterior: Galvanized steel tube handrails attached to guardrail composed of galvanized steel shapes, pickets, painted with high performance coating.

C. Performance Requirements: Applying loads simultaneously not required; design and fabricate railings and anchorages to resist loads without failure, damage, or permanent set, including:
   1. Lateral Force: 75 lb (333 N) minimum, when tested in accordance with ASTM E935.
   2. Distributed Load: 50 lbf/ft (8756 N/m) minimum, applied vertically and horizontally at top of handrail, when tested in accordance with ASTM E935.
   3. Concentrated Loads: 200 lb (888 N) minimum, applied to handrail horizontally and vertically, in accordance with ASTM E935.
   4. Handrails: Comply with ADA Standards and ANSI A117.1.

D. Welded Joints: Continuously welded and ground smooth and flush.
   1. Joint Finish - Exposed To View: NOMMA; Finish #1 - No evidence of a welded joint.
      a. Exterior Railings: Use Finish #1 for railings in public areas and adjacent or attached to the building.
   2. Joint Finish - Not Exposed To View: NOMMA; Finish #4 - Good quality, uniform undressed weld with minimal spatter.
      a. Exterior Railings: Use Finish #4 for landscape railings not in public areas.

E. Field Connections: Provide sleeves to accommodate site assembly and installation.

2.02 RAILING SYSTEMS - INTERIOR

A. Metal Railing - Open Stair, Guardrails Similar: Engineered, post-supported guard railing system with wood hand rail and perforated metal infill panels.
   1. Configuration: As shown on drawings.
   2. Top Rail - Guardrail: 2- by 2-inch (51 by 51 mm) rectangular tube, steel.
   3. Hand Rail - Main Open Stair: 1-1/2-inch (38 mm) diameter wood.
      a. Hardwood rail, clear:
         1) Species: Walnut.
         2) Finish: Transparent polyurethane.
         3) Staining: None.
   4. Wall / Post -Mounted Components: Support hand railing with 1-1/2-inch (38 mm) clearance from wall / post and as shown on drawings.
      a. Wall Return without Support: Terminates 1/4 inch (6 mm) from side wall.
   5. Handrail Brackets: Same metal as guard railing.
   6. Infill at Railings: Metal perforated panels.
      a. Metal Infill Panels: Perforated steel sheet, 11-gauge, 0.1196-inch (3.04 mm) minimum base metal thickness.
         1) Pattern: 3/8" round perforations on 9/16" staggered centers, 40% open area.
         2) Edging: "U" shaped aluminum edging of same alloy as perforated sheet.
            (a) Thickness: 0.063 inch thick (14 gauge)
            (b) Size: 1 inch width and sized to fit thickness of perforated sheet.
         3) Finish: Powder coated, custom color to match Architect's Sample.
         4) Fasteners: Stainless steel bolts.
         5) Metal Isolation: Provide continuous neoprene isolation strip between aluminum sheet and steel supports. Trim in manner to minimize visibility of isolation strip.
         6) Basis-of-Design Manufacturer: Subject to compliance with requirements, provide McNichols Perforated Metal, or approved comparable product from one of the following:
            (a) Argus Steel Products.
            (b) Diamond Manufacturing.
      b. Carbon Steel Panel Finish: Manufacturer's standard factory finish; comply with AAMA 2604.

B. Metal Railing - Egress Stairs:
   1. Top Rail - Guardrail: Solid steel rectangular bar.
   2. Handrail: 1-1/2 inch outside diameter steel tube.
   3. Handrail Brackets: 1/2 inch steel rods.
   4. Pickets: 1/2 inch by 1 inch solid steel flat bar.

2.03 RAILING SYSTEMS - EXTERIOR

A. Metal Railing: Engineered, post-supported railing system with metal infill.
   1. Configuration: As shown on drawings.
   2. Top Rail: Use type indicated on Drawings:
      a. Top Rail: 1-1/2 inch outside diameter tube, steel, galvanized.
   3. Handrail Brackets: Same metal as railing.
   4. Fasteners: Concealed.
   5. Infill at Picket Railings: Vertical pickets.
      a. Horizontal Spacing: As indicated on Drawings
      b. Material: Solid steel bar, galvanized.
      c. Size: 3/4-inch (19 mm) square.
      d. Top Mounting: Welded to underside of top rail.
      e. Bottom Mounting: As indicated on drawings.
   6. Finish: Painted. Refer to Section 099600 - High Performance Coatings

2.04 MATERIALS

A. Steel Components:
   1. Sections, Shapes, Plate and Bar: ASTM A36/A36M.
      a. Galvanized in exterior and wet locations.
   2. Tubing: ASTM A501/A501M structural tubing, round and shapes as indicated.
   3. Ungalvanized Steel Sheet: Hot- or cold-rolled; use cold-rolled where finished work is exposed to view.
      a. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
      b. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).
   4. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 33 (230) with G40 (Z120) coating.
   5. Galvanized Metal - Cleaner: Etching cleaner compatible with specified finish.
   6. Galvanized Finish Repair: High-zinc-dust-content paint compatible with specified finish.
   7. Galvanized Finish Shop Primer: Water based galvanized metal primer recommended by manufacturer of specified finish coat.
   8. Nonshrink Grout: ASTM C1107/C1107M; Nonmetallic, nonstaining grout recommended for use in interior and exterior applications.

9. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, galvanized in accordance with ASTM A153/A153M.
10. Welding Materials: AWS D1.1/D1.1M.

2.05 FABRICATION

A. Welded and Brazed Joints: Make visible joints butt tight, flush, and hairline prior to welding or brazing; use methods that avoid discoloration and damage of finish; grind smooth, polish, and restore to required finish.
   1. Ease exposed edges to small uniform radius.
   2. Welded Joints:
      a. Carbon Steel: Perform welding in accordance with AWS D1.1/D1.1M.
      b. Joint Finish - Exposed To View: NOMMA; Finish #1 - No evidence of a welded joint.

2.06 FINISHES

A. General: Comply with NAAMM AMP 500-06.
   1. Complete mechanical finishes before fabrication. After fabrication, finish joints, bends, abrasions, and surface blemishes to match sheet.
   2. Protect mechanical finishes on exposed surfaces from damage.
   3. Apply organic and anodic finishes to formed metal after fabrication.
   4. Appearance: Limit variations in appearance of adjacent pieces to one-half of range represented in approved samples. Noticeable variations in same piece are not acceptable. Install components within range of approved samples to minimize contrast.

B. Steel Finishes:
   1. Exterior Painted Metal Finishes: See Section 099600 - High-Performance Coatings.
   2. Interior Painted Metal Finishes: See Section 099123 - Interior Painting epoxy handrail paint, metal doors and frames, and other metal finishes.
   3. Galvanize in accordance with ASTM A123/A123M.
   4. Coated Steel: Clean surface in accordance with SSPC-SP 1 before applying coating.

2.07 ACCESSORIES

A. Welding Fittings: Factory- or shop-welded from matching pipe or tube; joints and seams ground smooth.

B. Anchors and Fasteners: Provide anchors, fasteners, and other attachment devices required to attach to structure. Ensure attachment devices are of same material as components unless indicated otherwise.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate and site conditions are acceptable and ready to receive work.
B. Verify field dimensions of locations and areas to receive work.
C. Notify Architect immediately of conditions that would prevent satisfactory installation.
D. Do not proceed with work until detrimental conditions are corrected.

3.02 PREPARATION

A. Review installation drawings before beginning installation. Coordinate diagrams, templates, instructions, and directions for installation of anchorages and fasteners.
B. Clean surfaces to receive railings. Remove materials and substances detrimental to installation.
C. Stainless Steel: After polishing, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install components plumb and level, accurately fitted, free from distortion or defects, and with tight joints, except where necessary for expansion.
C. Anchor securely to structure.
D. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.
E. Weld connections that cannot be shop welded due to size limitations.
    1. Weld in accordance with AWS D1.1/D1.1M.
    2. Match shop welding and bolting.
    3. Clean welds, bolted connections, and abraded areas.
    4. Touch up shop primer and factory-applied finishes.
    5. Repair galvanizing with galvanizing repair paint in accordance with ASTM A780/A780M.
F. Isolate dissimilar materials with bituminous coating, bushings, grommets, or washers to prevent electrolytic corrosion.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per floor level, noncumulative.
B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

C. Maximum Out-of-Position: 1/4 inch (6 mm).

3.05 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Manufacturer Services: Provide services of manufacturer's field representative to observe railing installation.

3.06 CLEANING

A. Remove protective film from exposed metal surfaces.

B. Metal: Clean exposed metal finishes with potable water and mild detergent in accordance with manufacturer recommendations; do not use abrasive materials or chemicals, detergents, or other substances that may damage material or finish.

3.07 PROTECTION

A. Protect installed components and finishes from damage after installation.

B. Repair damage to exposed, making finishes indistinguishable from undamaged areas.

C. Replace finishes and components that have irreparable damage. Ensure damaged areas are indistinguishable from undamaged finishes and surfaces.

END OF SECTION

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SECTION 061053
MISCELLANEOUS ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof-mounted curbs.
B. Roofing nailers.
C. Preservative treated wood materials.
D. Communications and electrical room mounting boards.
E. Concealed wood blocking, nailers, and supports.

1.02 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
B. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2017).
C. ASTM D3498 - Standard Specification for Adhesives for Field-Gluing Wood Structural Panels (Plywood or Oriented Strand Board) to Wood Based Floor System Framing; 2019a.
D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
E. AWPA U1 - Use Category System: User Specification for Treated Wood; 2024.
F. PS 1 - Structural Plywood; 2023.
G. PS 20 - American Softwood Lumber Standard; 2021.
H. SPIB (GR) - Standard Grading Rules; 2021.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide technical data on wood preservative materials and application instructions.

1.04 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

1.05 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.
B. Correct defective work within a two-year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
   2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
   3. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

B. Provide sustainably harvested wood; see Section 016000 - Product Requirements.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).

B. Sizes: Nominal sizes as indicated on drawings, S4S.

C. Moisture Content: S-dry or MC19.

D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No.2 or Standard Grade.
   2. Boards: Standard or No.3.

2.03 CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: PS 1, A-D plywood, or medium density fiberboard; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.04 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
   2. Anchors: Toggle bolt type for anchorage to hollow masonry.

B. Construction Adhesives: Adhesives complying with ASTM C557 or ASTM D3498.

2.05 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Preservative Treatment:
   1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A.
      a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
      b. Treat lumber in contact with roofing, flashing, or waterproofing.
      c. Treat lumber in contact with masonry or concrete.

PART 3 EXECUTION

3.01 PREPARATION

A. Coordinate installation of rough carpentry members specified in other sections.

3.02 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.03 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

E. Provide the following specific nonstructural framing and blocking:
   1. Cabinets and shelf supports.
   2. Wall brackets.

3. Handrails.
4. Grab bars.

3.04 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

B. Provide wood curb at roof openings except where specifically indicated otherwise. Form corners by alternating lapping side members.

3.05 INSTALLATION OF CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on edges and into studs in field of board.

1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
3. Install adjacent boards without gaps.
4. Size and Location: As indicated on drawings.

3.06 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.

B. Allow preservative to dry prior to erecting members.

3.07 CLEANING

A. Waste Disposal: See Section 017419 - Construction Waste Management and Disposal.

1. Comply with applicable regulations.
2. Do not burn scrap on project site.
3. Do not burn scraps that have been pressure treated.
4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 064100
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Hardware.

C. Factory finishing.

D. Preparation for installing utilities.

1.02 RELATED REQUIREMENTS

A. Section 061053 - Miscellaneous Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 088000 - Glazing: Glass for casework.

C. Section 123600 - Countertops.

1.03 REFERENCE STANDARDS

A. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications; 2022.

B. AWI (QCP) - Quality Certification Program; Current Edition.

C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

E. BHMA A156.9 - Cabinet Hardware; 2020.

F. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

1. Scale of Drawings: 1-1/2 inch to 1 foot (125 mm to 1 m), minimum.
2. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
3. Include certification program label.

C. Product Data: Provide data for hardware accessories.

D. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches (300 mm) square, illustrating proposed cabinet and shelf unit substrate and finish.

E. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.

F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

G. Fabricators Qualifications.

H. Sustainable Design Submittal: Documentation for sustainably harvested wood-based components.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.
2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
3. Single Source Responsibility: Provide and install this work from single fabricator.

B. Quality Certification:

1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
2. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
3. Provide designated labels on shop drawings as required by certification program.
4. Provide designated labels on installed products as required by certification program.
5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.
6. Replace, repair, or rework all work for which certification is refused.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.08 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 CABINETS

A. Quality Standard: Premium Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Plastic Laminate Faced Cabinets:

1. Finish - Exposed Exterior Surfaces: Decorative laminate.
2. Finish - Exposed Interior Surfaces: Decorative laminate.
3. Finish - Semi-Exposed Surfaces: Decorative laminate
4. Finish - Concealed Surfaces: Manufacturer's option.
5. Door and Drawer Front Edge Profiles: Square edge with thin applied band.
6. Door and Drawer Front Retention Profiles: Fixed panel.
7. Casework Construction Type: Type A - Frameless.
8. Interface Style for Cabinet and Door: Style 2 - Finish Inset; reveal overlay.
9. Cabinet Design Series: As indicated on drawings.
10. Adjustable Shelf Loading: 40 psf (19.5 gm/sq cm).
11. Cabinet Style: Flush overlay.
12. Cabinet Doors and Drawer Fronts: Flush style.
13. Drawer Side Construction: Multiple-dovetailed.
14. Drawer Construction Technique: Dovetail joints.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

B. Provide sustainably harvested wood, certified or labeled; see Section 016000.

2.03 PANEL CORE MATERIALS

A. Medium Density Fiberboard (MDF): Composite panel composed of cellulosic fibers, additives, and bonding system; cured under heat and pressure; comply with ANSI A208.2.

1. Grade: 115; moisture resistance: MR10.
2. Panel Thickness: 3/4 inch (19.1 mm).
3. Products:
    a. Roseburg Forest Products: www.roseburg.com/#sle.
    b. Substitutions: See Section 016000 - Product Requirements.

2.04 LAMINATE MATERIALS

A. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.

B. Provide specific types as indicated.

1. Horizontal Surfaces: HGS, 0.048 inch (1.22 mm) nominal thickness, color as selected, finish as indicated.
2. Vertical Surfaces: VGS, 0.028 inch (0.71 mm) nominal thickness, color as selected, finish as indicated.
3. Cabinet Liner: CLS, 0.020 inch (0.51 mm) nominal thickness, color as selected, finish as indicated.
4. Laminate Backer: BKL, 0.020 inch (0.51 mm) nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.05 COUNTERTOPS

A. Countertops: See Section 123600.

2.06 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

1. Manufacturers:
   a. Franklin International, Inc; Titebond Original Wood Glue: www.titebond.com/#sle.
   b. Substitutions: See Section 016000 - Product Requirements.

B. Plastic Edge Banding: Extruded PVC, convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness.

1. Thickness:
   a. 0.5 mm on cabinet doors and drawers.
   b. 0.5 mm on edges of open body cabinets.
   c. 0.5 mm on all cabinet body and shelf edges.
2. Color: As selected by Architect from manufacturer's standard range.

C. Aluminum Trim and Mouldings: Extruded, alloy 6063 T5.

1. Type: Profile as selected from manufacturer's standard range.
2. Flange: 0.188 inch (4.7752 mm).
3. Depth: 3/4 inch (19.05 mm).
4. Finish and Color: As selected by Architect from Manufacturer's full line.

D. Glass: Type A, see Section 088000.

E. Fasteners: Size and type to suit application.

F. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

G. Concealed Joint Fasteners: Threaded steel.

H. Grommets: Standard plastic grommets for cut-outs, in color to match adjacent surface.

2.07 HARDWARE

A. Cabinet Hardware: Comply with BHMA A156.9 for hardware types and grades indicated below:
   1. Hardware Types: As indicated on drawings.
   2. Product Grade: Grade 2.

B. Metal Z-Shaped Wall Cabinet Support Clips: Paired, cleated, structural anchorage components applied to back of cabinets and walls for wall cabinet mounting.
   1. Material: Extruded Aluminum.
   2. Products:
      a. Eagle Aluminum; Eagle Z-Clips: www.eagle-aluminum.com/#sle.
      b. Substitutions: See Section 016000 - Product Requirements.

C. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, polished chrome finish, for nominal 1 inch (25 mm) spacing adjustments.

D. Drawer and Door Pulls: "U" shaped wire pull, 4 inch (100mm) centers, material and finish as selected by Architect from fabricator's full range of pulls.

E. Touch-Opening Handleless Drawer Hardware:
   1. Manufacturers:
      a. Titus Cabinet Hardware; Tekform Slimline Tacto: www.titusplus.com/us/en/#sle.
   2. Substitutions: See Section 016000 - Product Requirements.

F. Keyed Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish.

G. Cabinet Catches and Latches:
   1. Manufacturers:
      a. Knape & Vogt Manufacturing Company: www.knapeandvogt.com/#sle.
      b. Sugatsune America, Inc: www.sugatsune.com/#sle.
   2. Substitutions: See Section 016000 - Product Requirements.

H. Drawer Slides:

1. Type: Full extension.
2. Static Load Capacity: Commercial grade.
3. Mounting: Side mounted.
4. Stops: Integral type.
5. Features: Provide self closing/stay closed type.
6. Manufacturers:
    a. Accuride International, Inc; Heavy-Duty Drawer Slides: www.accuride.com/#sle.
    b. Knape & Vogt Manufacturing Company; Heavy-Duty Drawer Slides: www.knapeandvogt.com/#sle.
    c. Substitutions: See Section 016000 - Product Requirements.

I. Hinges: European style concealed self-closing type, steel with nickel-plated finish.

2.08 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs. (Locate counter butt joints minimum 600 mm from sink cut-outs.)
    1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
    2. Cap exposed plastic laminate finish edges with material of same finish and pattern.

E. Mechanically fasten back splash to countertops as recommended by laminate manufacturer at 16 inches (400 mm) on center.

F. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Prime paint cut edges.

G. Shop glaze glass materials using Interior Dry method; see Section 088000.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

C. Use fixture attachments in concealed locations for wall mounted components.

D. Use concealed joint fasteners to align and secure adjoining cabinet units.

E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim for this purpose.

F. Secure cabinets to floor using appropriate angles and anchorages.

G. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.03 ADJUSTING

A. Adjust installed work.

B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

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SECTION 066400
PLASTIC PANELING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Plastic panel assemblies.

1.02 RELATED REQUIREMENTS

A. Section 061053 - Miscellaneous Rough Carpentry.

1.03 REFERENCE STANDARDS

A. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

C. ASTM F1941/F1941M - Standard Specification for Electrodeposited Coatings on Mechanical Fasteners, Inch and Metric; 2016.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate liner panel installation requirements with layout of stud framing and furring supporting members.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: For each panel and trim type.

C. Shop Drawings:

1. For each wall paneling layout, indicate:
    a. Elevations: Dimensioned locations of panels and penetrations. Include field measurements indicating extents of paneling.
    b. Drawing Scale: 1/4 inch to 1 foot (1:50), minimum.
2. Details: Include panel-to-trim connections.
    a. Drawing Scale: 1-1/2 inches to 1 foot (1:10), minimum.

D. Samples: For each panel type, two samples, 6 inches by 6 inches (150 mm by 150 mm) in size, indicating specified color and texture.

E. Samples: For each trim type, two samples, 4 inches (101 mm) in length, indicating specified color and texture.

F. Manufacturer's Instructions: For each panel type and associated trim, provide installation instructions.

G. Installer's qualification statement.

H. Maintenance Data: Panel maintenance and cleaning recommendations.

I. Executed warranty.

J. Specimen warranty.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.07 MOCK-UPS

A. See Section 014000 - Quality Requirements for additional requirements.

B. Construct panel mock-up, 10 feet (3 meters) long by full height of each type, indicating panels, trim, and joints.

C. Locate where directed.

D. Mock-up may remain as part of work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Deliver products to site in manufacturer's original, unopened packaging, with labels clearly identifying product name and manufacturer.

C. Store products in clean, dry, interior areas in accordance with manufacturer's instructions.

D. Store plastic panels and trim flat.

1.09 FIELD CONDITIONS

A. Ambient Field-Cutting Conditions: Before field-cutting panels in temperatures below 40 degrees F (4.4 degrees C), warm space to 60 degrees F (16 degrees C) minimum. Maintain temperature for 24 hours before, during, and after field-cutting.

B. Ambient Conditions for Installation: When ambient temperatures are below 40 degrees F (4.4 degrees C), warm space to 60 degrees F (16 degrees C) minimum. Maintain temperature for 24 hours before, during, and after installation.

C. Ambient Conditions for Installation: When ambient temperatures are above 70 degrees F (21 degrees C), cool space to 60 degrees F (16 degrees C). Maintain temperature for 24 hours before, during, and after installation.

1.10 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 10-year manufacturer warranty for products free from manufacturing defects. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Plastic Paneling: Subject to compliance with requirements provide panels by 3form, LLC or comparable.
   1. Substitutions: See Section 016000 - Product Requirements.

2.02 PLASTIC PANELING

A. Material: Engineered pigmented acrylic resin.
   1. Surface Burning Requirements, Interior Use: Flame spread index of 25 or less and smoke-development index of 450 or less; Class A classification when tested in accordance with ASTM E84.
   2. Panel Size: As indicated.
   3. Panel Thickness: As indicated.
   4. Panel Pattern and Color: As selected by Architect from manufacturer's full range.
B. Trim: Extruded aluminum sized to fit panel thickness, profiles and dimensions as indicated.
   1. Finish and Color: As selected by Architect from manufacturer's full range.

2.03 ACCESSORIES

A. Threaded Fasteners: Type and size as recommended by paneling manufacturer for substrate, application, and corrosion risk.
   1. Low Corrosion Risk: Carbon steel with electrodeposited zinc coatings ASTM F1941/F1941M Coating Designation Fe/Zn 5.
B. Adhesives: Type recommended by panel manufacturer for application; not containing formaldehyde or volatile organic compounds.
C. Joint Sealants: Clear silicone; ASTM C920, Type S, Grade NS, Class 50, Uses NT and G.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify field measurements are as indicated on shop drawings.
B. Verify substrates are prepared to receive plastic paneling.
C. If substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
D. Verify mechanical, electrical, and other building components affecting work of this section are placed and ready to receive work of this section.

3.02 PREPARATION

A. Surface Preparation: Clean substrate surfaces prior to installing paneling.

3.03 INSTALLATION - GENERAL

A. Maintain manufacturer recommended gap tolerances between panels and adjacent abutments.

B. Field-cut panels in accordance with manufacturer's written instructions. Make straight and square cuts; do not damage panels.

3.04 INSTALLATION - PLASTIC PANELS

A. Install panels and trim in accordance with manufacturer's written instructions.

B. Install panel layout as indicated on approved shop drawings.

C. Install wall panels plumb within specified tolerances.

D. Install sealant to prevent water intrusion in accordance manufacturer's written instructions.

3.05 TOLERANCES

A. Maximum Variation from True Position: 1/4 inch (6.4 mm).

B. Maximum Variation from Plumb: 1/4 inch in 10 feet (2 mm in 1 m).

C. Maximum Variation from Level: 1/4 inch in 10 feet (2 mm in 1 m).

3.06 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Clean exposed surfaces of panels and trim in accordance with manufacturer's instructions.

3.07 PROTECTION

A. Protect installed plastic paneling from subsequent construction operations.

END OF SECTION

SECTION 071300
SHEET WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Composite sheet membrane applied prior to rebar and concrete placement.

B. Molded-sheet drainage panels.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete substrate.

B. Section 071400 - Fluid-Applied Waterproofing: Coordinate installation of each type of waterproofing.

C. Section 076200 - Sheet Metal Flashing and Trim: Metal counterflashing and terminations.

1.03 ABBREVIATIONS

A. SBS - Styrene-Butadiene-Styrene.

1.04 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).

B. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 2022.

C. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds; 1998 (Reapproved 2017).

D. ASTM D1876 - Standard Test Method for Peel Resistance of Adhesives (T-Peel Test); 2008 (Reapproved 2023).

E. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.

F. ASTM D5295/D5295M - Standard Guide for Preparation of Concrete Surfaces for Adhered (Bonded) Membrane Waterproofing Systems; 2018.

G. ASTM D5385/D5385M - Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes; 2020.

H. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for membrane and drainage panel.

C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.
D. Certificate: Certify that products meet or exceed specified requirements.
E. Manufacturer's Installation Instructions: Indicate perimeter conditions requiring special attention.
F. Manufacturer's qualification statement.
G. Installer's qualification statement.
H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
I. Specimen Warranty.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.07 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F (5 degrees C) for 24 hours before and during application and until liquid or mastic accessories have cured.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.
B. Contractor to correct defective Work within period of five years after Date of Substantial Completion; remove and replace materials concealing waterproofing at no extra cost to Owner.
C. Provide five year manufacturer warranty for waterproofing failing to resist penetration of water, except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

PART 2 PRODUCTS

2.01 SHEET WATERPROOFING APPLICATIONS

A. Composite Sheet Membrane Applied Prior to Rebar and Concrete Placement:
    1. Location: Below Basement Level Slab and where indicated on Drawings.

2.02 SHEET WATERPROOFING MATERIALS

A. Composite Sheet Membrane Applied Prior to Rebar and Concrete Placement:
    1. Type: Polypropylene membrane laminated to a chemically enhanced non-woven geotextile fleece with a dimpled surface.

2. Thickness: 43.5 mil, 0.0435 inch (1.1 mm), nominal.
3. Sheet Width: 39-3/8 inches (1.0 m), minimum.
4. Tensile Strength: 2,400 psi (16.5 MPa), minimum, measured in accordance with ASTM D412.
5. Elongation: 800 percent, minimum, measured in accordance with ASTM D412.
6. Water Vapor Permeance: 0.01 perm (0.58 ng/(Pa s sq m)), maximum, measured in accordance with ASTM E96/E96M, Method B.
7. Low Temperature Flexibility: Unaffected when tested in accordance with ASTM D1970/D1970M at minus 20 degrees F (minus 29 degrees C).
8. Peel Adhesion to Concrete: 5 lb/inch (875 N/m), minimum, when tested in accordance with ASTM D903.
9. Lap Peel Adhesion: 6.9 lb/inch (1200 N/m), minimum, when tested in accordance with ASTM D1876.
10. Water Absorption: 0.4 percent increase in weight, maximum, measured in accordance with ASTM D570, 24-hour immersion.
11. Hydrostatic Pressure Resistance: Membrane resists leakage for at least one hour from pressure equivalent to 231 feet (70.4 m) head of water applied in accordance with test method ASTM D5385/D5385M.
12. Adhesives, Sealants, Tapes, and Accessories: As recommended by membrane manufacturer.
13. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide Henry Company Blueskin Preseal 435, or an approved comparable product from one of the following
    a. Polyglass USA, Inc: www.polyglass.us/#sle.
    b. Polyguard Products, Inc: www.polyguard.com/#sle.
    c. Substitutions: See Section 016000 - Product Requirements.

2.03 ACCESSORIES

A. All materials and accessories required for complete waterproofing installation shall be provided as a complete system.
B. Seaming Materials: As recommended by membrane manufacturer.
C. Membrane Sealant: As recommended by membrane manufacturer.
D. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrates and waterproofing materials.
E. Bentonite Composite Waterstop: Bentonite-based waterstop with nonwoven fabric and tear-resistant netting; seals static construction joints.

F. Protection Board: Rigid insulation; see Section 072100.
G. Cant Strips: As recommended by waterproofing manufacturer.
H. Preformed Flashing Shapes: Injected or vacuum molded one piece shapes used for detailing of inside and outside corners, protrusions, and transitions.
    1. Shapes: Provide 90 degree inside corner, 90 degree outside corner, and shapes as indicated on drawings.
    2. Color: Black.
I. Flexible Flashings: Type recommended by membrane manufacturer.
J. Counterflashings: See Section 076200.
K. Termination Bars: Stainless steel; compatible with membrane and adhesives.
L. Adhesives: As recommended by membrane manufacturer.
M. Thinner and Cleaner: As recommended by adhesive manufacturer, compatible with sheet membrane.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions are acceptable prior to starting work.
B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.
C. Verify that items penetrating surfaces to receive waterproofing are securely installed.
D. Where existing conditions are responsibility of another installer, notify Architect of unsatisfactory conditions.
E. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Protect adjacent surfaces from damage not designated to receive waterproofing.
B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.
C. Do not apply waterproofing to surfaces unacceptable to membrane manufacturer.
D. Fill nonmoving joints and cracks with a filler compatible with waterproofing materials.
E. Seal moving cracks with sealant and nonrigid filler, using procedures recommended by sealant and waterproofing manufacturers.
F. Prepare building expansion joints at locations as indicated on drawings.
G. Surfaces for Adhesive Bonding: Apply surface conditioner at a rate recommended by manufacturer, and protect conditioner from rain or frost until dry.
H. Concrete Surfaces for Adhesive Bonding: Prepare concrete substrate in accordance with ASTM D5295/D5295M.

1. Remove substances that inhibit adhesion including form release agents, curing compounds admixtures, laitance, moisture, dust, dirt, grease and oil.
2. Repair surface defects including honeycombs, fins, tie holes, bug holes, sharp offsets, rutted cracks, ragged corners, deviations in surface plane, spalling and delaminations, as described in reference standard.
3. Remove and replace areas of defective concrete; see Section 033000.
4. Prepare concrete for adhesive bonded waterproofing using mechanical or chemical methods described in referenced standard.
5. Test concrete surfaces as described in referenced standards, and verify surfaces are ready to receive adhesive bonded waterproofing membrane system.

3.03 INSTALLATION - MEMBRANE

A. Install membrane waterproofing in accordance with manufacturer's instructions.
B. Coordinate installation with adjacent waterproofing materials. See Section 071400 - Fluid-Applied Waterproofing.
C. Roll out membrane, and minimize wrinkles and bubbles.
D. Self-Adhering Membrane: Remove release paper layer, and roll out onto substrate with a mechanical roller to provide full contact bond.
E. Overlap edges and ends, minimum 3 inches (76 mm), seal permanently waterproof by method recommended by manufacturer, and apply uniform bead of sealant to joint edge.
F. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.
G. Weather lap joints on sloped substrate in direction of drainage, and seal joints and seams.
H. Install building expansion joints at locations as indicated on drawings.
I. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.
J. Seal membrane and flashings to adjoining surfaces.
    1. Install termination bar along edges.
    2. Install counterflashing over exposed edges.
K. Composite Waterstop: Install composite waterstop according to manufacturer's instructions.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

3.05 PROTECTION

A. Do not permit traffic over unprotected or uncovered membrane.

END OF SECTION

SECTION 071400
FLUID-APPLIED WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cold-applied rubberized asphalt waterproofing.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete substrate.

B. Section 076200 - Sheet Metal Flashing and Trim: Metal miscellaneous flashings for termination of waterproofing layers.

1.03 REFERENCE STANDARDS

A. ASTM C836/C836M - Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course; 2018 (Reapproved 2022).

B. ASTM C1306/C1306M - Standard Test Method for Hydrostatic Pressure Resistance of a Liquid-Applied Waterproofing Membrane; 2008 (Reapproved 2023).

C. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).

D. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics; 2016 (Reapproved 2023).

E. ASTM D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers; 2022.

F. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

G. ASTM E154/E154M - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover; 2008a (Reapproved 2019).

H. ICC-ES AC29 - Acceptance Criteria for Cold, Liquid-Applied, Below-Grade, Exterior Dampproofing and Waterproofing Materials; 2011, with Editorial Revision (2020).

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for membrane, surface conditioner, flexible flashings, joint cover sheet, and joint and crack sealants.

C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and acceptable installation temperatures.
F. Installer's qualification statement.
G. Warranty Documentation:
    1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
    2. Submit installer's documentation that installation complies with warranty conditions for the field-applied waterproofing.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 MOCK-UPS

A. See Section 014000 - Quality Requirements for additional requirements.
B. Construct mock-up consisting of 100 sq ft (10 sq m) of horizontal and vertical fluid-applied waterproofing; to represent finished work including internal and external corners, drainage panel, base flashings, control joints, counterflashings, and protective cover.
C. Locate where directed.
D. Mock-up may remain as part of work.

1.07 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F (5 degrees C) for 24 hours before and during application and until cured.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.
B. Installer Warranty: Provide 2-year warranty for waterproofing failing to resist penetration of water commencing on Date of Substantial Completion. Complete forms in Owner's name and register with installer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cold-Applied Rubberized Asphalt Waterproofing:
    1. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide Henry Company CM100 Waterproofing, or an approved comparable product from one of the following:

a. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
b. W. R. Meadows, Inc: www.wrmeadows.com/#sle.

2.02 FLUID-APPLIED WATERPROOFING MATERIALS

A. Cold-Applied Rubberized Asphalt Waterproofing: Rubberized asphaltic compound, suitable for installation on concrete and concrete masonry.
1. Cured Thickness: 60 mil, 0.060 inch (1.52 mm), minimum.
a. Horizontal Applications: Two layers, 60 mil each, with reinforcing fabric between each layer.
b. Vertical Applications: One layer, 60 mil.
2. Comply with ICC-ES AC29 acceptance criteria.
3. Hydrostatic Pressure Resistance: Tested in accordance with ASTM C1306/C1306M, 50 psi (340 kPa), minimum by rapid test, and 35 psi (240 kPa), minimum by long term test.
4. Low Temperature Resistance: No cracking, loss of adhesion, splitting or pinholes when tested at minus 15 degrees F (minus 26 degrees C) in accordance with ASTM C836/C836M.
5. Adhesion: 150 psi (1.03 MPa), minimum, measured in accordance with ASTM D4541.
6. Decay Resistance: No decay when tested in accordance with ASTM E154/E154M.
7. Wet Film Sag Resistance: Maximum sag within plus/minus 5 mils (0.1 mm) when tested in accordance with ASTM C836/C836M.
8. Water Vapor Permeance: 0.05 perm (3.09 ng/(Pa s sq m)), maximum, when tested in accordance with ASTM E96/E96M, Procedure A.
9. Heat Aging Resistance: No cracking, splitting, or pinholes when tested in accordance with ASTM C836/C836M.
10. Elongation at Break: 550 percent, minimum, when tested in accordance with ASTM D412.

2.03 ACCESSORIES

A. General: Provide accessories recommended by waterproofing manufacturer for applications indicated and jobsite and/or environmental conditions at time of installation.
B. Sealant for Joints and Cracks in Substrate: Type compatible with waterproofing material and as recommended by waterproofing manufacturer.

C. Reinforcing Fabric for Between Liquid Applied Membranes (LAM): Polyester fabric, unsaturated spun bond and nonwoven, used as reinforcement between LAM waterproofing systems.
   1. Thickness: 9.5 mil, 0.0095 inch (0.241 mm), minimum.
D. Drainage Panel: Drainage layer with geotextile filter fabric on earth side.
   1. Composition: Dimpled polyethylene, polypropylene, or polystyrene core; polypropylene or polyester filter fabric.
   2. Vertical Application Thickness: 1/2 inch (12.7 mm).
   3. Horizontal Application Thickness: 1/4 inch
   4. Veritcal Application Core Compressive Strength: 15,000 psf (0.72 MPa), minimum, in accordance with ASTM D1621
   5. Horizontal Application Core Compresive Strength: 30,000 psf
   6. Products:
      a. Vertical Applications:
         1) Basis-of-Design Manufacturer: Subject to compliance with requirements, provide Carlisle Miradrain 6200 Drainage Composite, or an approved equal product from another manufacturer.
      b. Horizontal Applications:
         1) Basis-of-Design Manufacturer: Subject to complianc with requirements, provide Henry DrainBoard DB350 or an approved equal product from another manufacturer.
E. Counterflashings: See Section 076200.
F. Manufacturer's standard accessories and products required for sealing around pipe penetrations through waterproofing membranes.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify substrate surfaces are free of frozen matter, dampness, loose particles, cracks, pits, projections, penetrations, or foreign matter detrimental to adhesion or application of waterproofing system.
C. Verify that substrate surfaces are smooth, free of honeycomb or pitting, and not detrimental to full contact bond of waterproofing materials.
D. Verify that items penetrating surfaces to receive waterproofing are securely installed.
E. Where existing conditions are responsibility of another installer, notify Architect of unsatisfactory conditions.
F. Do not proceed with this work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.
B. Do not apply waterproofing to surfaces unacceptable to waterproofing manufacturer.
C. Fill non-moving joints and cracks with a filler compatible with waterproofing materials.
D. Seal moving cracks with sealant and non-rigid filler, using procedures recommended by sealant and waterproofing manufacturers.

3.03 INSTALLATION

A. Install waterproofing to specified minimum thickness in accordance with manufacturers instructions applicable requirements.
B. Apply primer or surface conditioner at a rate recommended by manufacturer, and protect conditioner from rain or frost until dry.
C. At joints and cracks less than 1/2 inch (13 mm) in width including joints between horizontal and vertical surfaces, apply 12 inch (300 mm) wide strip of joint cover sheet.
D. Center joint cover sheet over joints, roll sheet into 1/8 inch (3.2 mm) thick coating of waterproofing material and apply second coat over sheet extending at least 6 inches (152 mm) beyond sheet edges.
E. Extend membrane up intersecting surfaces at membrane perimeter minimum 6 inches (150 mm) above horizontal surface for first ply and as recommended by manufacturer at subsequent plies laid in shingle fashion.
F. Apply extra thickness of waterproofing material at corners, intersections, and angles.
G. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.
H. Seal membrane and flashings to adjoining surfaces.

3.04 INSTALLATION - DRAINAGE PANEL

A. Place drainage panel directly against membrane, butt joints, place to encourage drainage downward, and scribe and cut boards around projections, penetrations, and interruptions.
B. Place protection board directly against drainage panel; butt joints, and scribe and cut boards around projections, penetrations, and interruptions.

3.05 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.
B. Owner will provide testing services, and Contractor to provide temporary construction and materials for testing.

C. Provide daily on-site attendance of waterproofing and insulation manufacturer's representative during installation of this work.

D. Upon completion of horizontal membrane installation, dam installation area in preparation for flood testing.

1. Flood to minimum depth of 1 inch (25 mm) with clean water, and after 48 hours inspect for leaks.
2. If leaking is found, remove water, repair leaking areas with new waterproofing materials as directed by Architect; repeat flood test, and repair damage to building.
3. When area is proven watertight, drain water and remove dam.

3.06 PROTECTION

A. Do not permit traffic over unprotected or uncovered membrane.

END OF SECTION

SECTION 072100
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation at cavity wall construction, perimeter foundation wall, and underside of floor slabs.

B. Batt insulation in exterior wall construction.

C. Batt insulation for filling interior acoustic walls.

1.02 RELATED REQUIREMENTS

A. Section 042000 - Unit Masonry, Mortar and Grout: Unit masonry ties and insulation support.

B. Section 072700 - Air Barriers: Separate air barrier materials.

C. Section 074213 - Metal Wall Panels: Supporting girts behind metal wall panels.

1.03 DEFINITIONS

A. Mineral Fiber Material Composition: Insulation referred to as mineral fiber block, board, and blanket insulation is composed of fibers from mineral based substances such as rock, slag, or glass and processed from the molten state into fibrous form.

1. Based on type of insulation substance, the material will be referred to as a mineral fiber when having a rock or slag base, and glass fiber with a glass or silica sand base, also considered a mineral.
2. Insulation blankets are flexible units consisting of felted, bonded, or unbonded fibers formed into rolls or flat cut pieces referred to as batts; rolls are simply longer versions of batts.
3. For additional information about mineral fiber and the various classification types, refer to the following reference standards; ASTM C553, ASTM C612, ASTM C665, and ASTM C726.

1.04 REFERENCE STANDARDS

A. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).

B. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2023.

C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014 (Reapproved 2019).

D. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.

E. ASTM C726 - Standard Specification for Mineral Wool Roof Insulation Board; 2017.
F. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2023a.
G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
H. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.
I. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C; 2024.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
C. Shop Drawings: Submit drawings that indicate location of joint or termination detail conditions and setting plan for insulation.
    1. Include details, written or graphic, of fastening methods used in each type of wall assembly.
    2. Include narrative on special considerations being made for applications over the air barrier system.
D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
E. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.06 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation Under Concrete Slabs: Extruded polystyrene (XPS) board.
B. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.
C. Continuous Insulation on Masonry Backup, Masonry: Polyisocyanurate board.
D. Continuous Insulation Over Metal Stud Framed: Polyisocyanurate board.
E. Insulation in Metal Framed Walls - Interior: Glass fiber thermal/acoustic batt insulation with no vapor retarder.

F. Insulation in Metal Framed Walls - Exterior: Mineral fiber batt insulation with no vapor retarder.

2.02 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene (XPS) Board Insulation: Comply with ASTM C578 with either natural skin or cut cell surfaces.
   1. Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum.
   2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   4. Type and Thermal Resistance, R-value (RSI-value): Type IV, 5.0 (0.88), minimum, per 1 inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature.
   5. Thickness: R-10 minimum unless noted otherwise.
   6. Board Edges: Square.

B. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, comply with ASTM C1289.
   1. Classifications:
      a. Type I: Faced with aluminum foil on both major surfaces of the core foam.
         1) Class 1 - Non-reinforced core foam.
         2) Compressive Strength: 16 psi (110 kPa), minimum.
         3) Thermal Resistance, R-value (RSI-value): At 1-1/2 inch (38.1 mm) thick; 9.0 (1.59), minimum, at 75 degrees F (24 degrees C).
   2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   4. Water Vapor Permeance: 1.2 perm (68 ng/(Pa s sqm)), maximum, at 1 inch (25 mm) thickness, and when tested in accordance with ASTM E96/E96M, desiccant method.
   5. Board Size: 48 inch by 96 inch (1220 mm by 2440 mm), or sized to match wall tie spacing.
   6. Board Thickness: As indicated on Drawings.

2.03 MINERAL FIBER BLANKET INSULATION MATERIALS

A. Interior Frame Walls - Flexible Glass Fiber Blanket Thermal/Acoustic Insulation: Preformed insulation, complying with ASTM C665; friction fit.

1. Combustibility: Non-combustible, when tested in accordance with ASTM E136.
2. Formaldehyde Content: Zero.
3. Thickness: As indicated, or if not indicated, fill stud cavity of walls indicated to have sound insulation.
4. Facing: Unfaced.

B. Exterior Frame Walls - Mineral Fiber Blanket Thermal Insulation: Semi-rigid preformed insulation, complying with ASTM C665.
1. Flame Spread Index: 0 (zero), when tested in accordance with ASTM E84.
2. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
3. Thermal Resistance: R-value of 4.0 per inch, minimum, at 75 degrees F (24 degrees C), minimum when tested according to ASTM C518.
4. Thickness: As indicated on Drawings.

2.04 ACCESSORIES

A. Miscellaneous Gaps - Foamed-In-Place Insulation: Low-density, flexible, open cell or closed cell, water vapor permeable polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.
1. Regulatory Requirements: Comply with applicable code for flame and smoke, concealment, and fire protection requirements.
2. Surface Burning Characteristics: Flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.

B. Sill Plate Sealer: Closed-cell foam tape with rubberized adhesive membrane; bridges gap between foundation structure and sill plate or skirt board.
1. Width: 3-1/2 inches (89 mm).
2. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 30 days of weather exposure.
3. Products: Subject to compliance with requirements, provide one of the following or comparable product;
   a. Protecto Wrap Company; Triple Guard Energy Sill Sealer: www.protectowrap.com/#sle.
   b. Substitutions: See Section 016000 - Product Requirements.

C. Insulation Fasteners - Inside Framed Walls: Lengths of galvanized, 13-gauge, 0.072-inch (1.83 mm) high carbon spring steel with chisel or mitered tips, held in place by tension, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.

D. Insulation Fasteners: Impaling clip of galvanized steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.

E. Support for Cladding and Continuous Insulation: See respective cladding section.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of fins or irregularities.

C. Verify air barrier is completely intact with no untreated penetrations, tears, or punctures. Alert Architect if air barrier is not ready to be covered with insulation.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Adhere a 6 inches (152 mm) wide strip of polyethylene sheet over construction and control joints with double beads of adhesive each side of joint.
   1. Tape seal joints.
   2. Extend sheet full height of joint.

B. Apply adhesive to back of boards:
   1. Three continuous beads per board length.

C. Install boards as indicated in Drawings on foundation perimeter.
   1. Place boards to maximize adhesive contact.
   2. Install in running bond pattern.
   3. Butt edges and ends tightly to adjacent boards and to protrusions.

D. Extend boards over expansion joints, unbonded to foundation on one side of joint.

E. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

F. Immediately following application of board insulation, place protective boards over exposed insulation surfaces.
   1. Apply adhesive in five continuous beads per board length.
   2. Install boards horizontally from base of foundation to top of insulation.
   3. Butt boards tightly, with joints staggered from insulation joints.

3.03 BOARD INSTALLATION AT EXTERIOR WALLS

A. Adhere 6 inches (152 mm) wide strip of polyethylene sheet over expansion joints with double beads of adhesive each side of joint.
   1. Tape seal joints between sheets.
   2. Extend sheet full height of joint.

B. Apply adhesive to back of boards:

1. Three continuous beads per board length.

C. Install boards horizontally on walls.
   1. Place boards to maximize adhesive contact.
   2. Install in running bond pattern.
   3. Butt edges and ends tightly to adjacent boards and protrusions.

D. Extend boards over expansion joints, unbonded to wall on one side of joint.

E. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.04 BOARD INSTALLATION AT CAVITY WALLS

A. Secure insulation fasteners to substrate at following frequency:
   1. Six (6) per insulation board.

B. Adhere a 6 inches (152 mm) wide strip of polyethylene sheet over expansion joints with double beads of adhesive each side of joint.
   1. Tape seal joints between sheets.
   2. Extend sheet full height of joint.

C. Install boards to fit snugly between wall ties and girts.

D. Install boards horizontally on walls.
   1. Install in running bond pattern.
   2. Butt edges and ends tightly to adjacent boards and protrusions.
   3. Place impale fastener locking discs.

E. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.05 BOARD INSTALLATION USING CLADDING AND CONTINUOUS INSULATION SUPPORTS

A. Install supports in accordance with manufacturer's installation instructions.

B. Install supports in compliance with system orientation, sizes, and locations as indicated on drawings and in accordance with approved shop drawings.

C. Install supports to fill in exterior wall spaces without gaps or voids in insulation.

D. Trim insulation neatly to fit spaces and provide a continuous thermal layer.

3.06 BOARD INSTALLATION UNDER CONCRETE SLABS

A. Place insulation under slabs on grade after base for slab has been compacted.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

3.07 BATT INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Install in exterior wall spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation. Use retaining clips, sprung wire, or other method to hold batts in place in deep stud cavities.

3.08 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

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SECTION 072119
FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Foamed-in-place insulation.
   1. In underside of roofs and ceilings, where indicated on Drawings.
   2. In underside of floor decks, where indicated on Drawings.

B. Sprayed thermal barrier.

1.02 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

C. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

D. FM 4880 - Examination Standard for Class 1 Fire Rating of Building Panels or Interior Finish Materials; 2022.

E. NFPA 275 - Standard Method of Fire Tests for the Evaluation of Thermal Barriers; 2022.

F. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2024.

G. UL 1040 - Standard for Safety Fire Test of Insulated Wall Construction; Current Edition, Including All Revisions.

H. UL 1715 - Standard for Safety Fire Test of Interior Finish Material; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product description, insulation properties, overcoat properties, and preparation requirements.

C. Certificates: Certify that products of this section meet or exceed specified requirements.

D. Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

E. Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of all contractor accreditation and installer certification on site during and after installation. Present on-site documentation upon request.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified, with minimum three years documented experience, and approved by manufacturer.

1.06 FIELD CONDITIONS

A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.

B. Do not apply foam when temperature is within 5 degrees F (2.78 degrees C) of dew point.

PART 2 PRODUCTS

2.01 MATERIALS

A. Foamed-In-Place Insulation: Low-density, flexible, closed cell, water vapor permeable polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.

1. Regulatory Requirements: Comply with applicable code for flame and smoke, concealment, and fire protection requirements.
    a. Fire Protection: Provide 15-minute thermal barrier of 1/2 inch (12.7 mm) gypsum board or equivalent material complying with NFPA 275 test method, or foamed-in-place insulation either exposed or with covering that complies with FM 4880, NFPA 286, UL 1040, or UL 1715.
2. Thermal Resistance: R-value (RSI-value) of 3.0 (0.53), minimum, per 1 inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature when tested in accordance with ASTM C518.
3. Air Permeance: 0.04 cfm per square foot (0.2 L/(s/sq m)), maximum, when tested at intended thickness in accordance with ASTM E2178 at 1.57 psf (75 Pa).
4. Surface Burning Characteristics: Flame spread/smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.

5. Products: Subject to compliance with requirements provide one of the following or comparable product;
    a. BASF Corporation; ENERTITE NM: www.spf.basf.com/#sle.
    b. Carlisle Spray Foam Insulation; SealTite PRO High Yield: www.carlislesfi.com/#sle.
    c. Huntsman Building Solutions; Classic Ultra: www.huntsmanbuildingsolutions.com/#sle.
    d. Johns Manville; JM Corbond Open-Cell Spray Polyurethane Foam: www.jm.com/#sle.
    e. Substitutions: See Section 016000 - Product Requirements.

2.02 ACCESSORIES

A. Primer: As required by insulation manufacturer.

B. Protective Coating: Sprayed, treated with flame retardants as required to comply with applicable codes.
    1. Coating Type: Recycled paper.
    2. Thermal Resistance, R-value (RSI-value): 4.5 (0.79), at 1 1-2 inch (38.1 mm) thickness when tested in accordance with ASTM C518.
    3. Noise Reduction Coefficient (NRC): 0.95 for 1-1/4-inch (31.7 mm) thickness installed over foam.
    4. Bond Strength: 100 psf (488 kPa), minimum.
    5. Flame Spread/Smoke Developed Index: 5/5, Class A, when tested in accordance with ASTM E84.
    6. Color: Black.
    7. Products: Subject to compliance with requirements provide the following or comparable product;
        a. International Cellulose Corporation; Ure-K 15-Minute Thermal Barrier: www.spray-on.com/#sle.
        b. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify work within construction spaces or crevices is complete before insulation application.

B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation adhesion.

3.02 PREPARATION

A. Mask and protect adjacent surfaces from over spray or dusting.

B. Apply primer in accordance with manufacturer's instructions.

3.03 APPLICATION

A. Apply insulation in accordance with manufacturer's instructions.

B. Apply insulation by spray method, to a uniform monolithic density without voids.

C. Apply protective coating monolithically, without voids, to fully cover foam insulation, to achieve fire rating required.

D. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts.

E. Trim excess away for applied trim or remove as required for continuous sealant bead.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

3.05 PROTECTION

A. Do not permit subsequent construction work to disturb applied insulation.

END OF SECTION

SECTION 072700
AIR BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air barriers, fluid applied.

1.02 DEFINITIONS

A. Air Barrier: Airtight barrier made of material that is virtually air impermeable but water vapor permeable, both to amount as specified, with sealed seams and sealed joints to adjacent surfaces.

1.03 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016 (Reapproved 2021).

B. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

D. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2023.

E. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials; 2021a.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on material characteristics, performance criteria, and limitations.

1. Highlight applicable technical data, dry film thickness, and tested performance properties of products.

C. Coordinated Shop Drawings for Air Barrier Assemblies: Provide drawings of special joint conditions, penetrations, terminations, and tie-ins / transitions to adjacent construction regardless of which subcontractor is responsible for their installation, including, but not limited to, the following:

1. Roof to air barrier.
2. Air barrier to waterproofing.
3. Wall penetrations including veneer anchors.
4. Through wall flexible flashing.

5. Openings.
6. Drawings shall be prepared by an eperienced air barrier system designer.

D. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection required by ABAA QAP.

E. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

F. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification; keep copies of each contractor accreditation and installer certification on site during and after installation, and present on-site documentation upon request.

G. Manufacturer's qualification statement.

H. Installer's qualification statement.

1.05 QUALITY ASSURANCE

A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); www.airbarrier.org/#sle:

1. Installer Qualification: Use accredited contractor, certified installers, evaluated materials, and third-party field quality control audit.

B. Preinstallation Conference: After all related shop drawings have been submitted and prior to commencement of related work, arange meeting to discuss air barrier installation as follows:

1. Attendance: Contractor, Architect, Owner's representative, and representatives of all subcontractors whose scope of work impacts air barrier including, but not limited to, the following:
   a. Below grade waterproofing
   b. Concrete
   c. Masonry
   d. Sealants
   e. Metal panels
   f. Insulation
   g. Sheathing
   h. Storefronts
2. Review air-barrier requirements and installation, special details, mockups, testing, air-barrier protection, and work scheduling.
3. Review all transitions in air barrier and identify responsibility for completion of transition.

4. Review all post-installed penetrations, including veneer anchors, rainscreen supports, and other penetrations. Determine responsibility, materials, and methods of sealing penetrations acceptable to air barrier manufacturer.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

D. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture, and use secondary materials approved in writing by primary material manufacturer.

1.06 MOCK-UPS

A. See Section 014000 - Quality Requirements for additional requirements.

B. Construct air barrier mock-up, 15 feet (5 m) long by 10 feet (3 m) wide, indicating dry film thickness, transition to typical adjacent materials, sealant at penetrations like veneer anchors, and transition to base flashing and roofing.

C. Locate where directed. Subject to compliance with requirements, may be combined with mock-up(s) required by 042000 - Unit Masonry, Mortar and Grout or 074213 - Metal Wall Panels.

D. Mock-up may remain as part of work.

1.07 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

1.08 WARRANTY

PART 2 PRODUCTS

2.01 AIR BARRIER MATERIALS (AIR IMPERMEABLE AND WATER VAPOR PERMEABLE)

A. Air Barrier, Fluid Applied: Vapor permeable, elastomeric waterproofing.

1. Air Barrier Coating:

a. Dry Film Thickness (DFT): As recommended by manufacturer for each substrate, 37 mil, minimum. Adjust coverage rate as recommended by manufacturer for CMU substrate.

b. Air Permeance: 0.001 cfm/sq ft (0.02 L/(s sq m)), maximum, when tested in accordance with ASTM E2178.

c. Water Vapor Permeance: 11 perms (629 ng/(Pa s sq m)), minimum, when tested in accordance with ASTM E96/E96M using Procedure B - Water Method, at 73.4 degrees F (23 degrees C).

d. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 180 days of weather exposure.

e. Elongation: 250 percent, minimum, when tested in accordance with ASTM D412.

f. Surface Burning Characteristics: Flame spread index of 10 or less, smoke developed index of 15 or less, Class A when tested in accordance with ASTM E84.

g. Nail Sealability: Pass, when tested in accordance with ASTM D1970/D1970M.

h. VOC Content: 13.3 oz/gal (100 g/L) maximum.

i. Sealants, Tapes and Accessories: As recommended by coating manufacturer.

j. Products:

1) Carlisle Coatings and Waterproofing, Inc; Fire Resist Barritech VP: www.carlisleccw.com/#sle.
2) Henry Company; Air-Bloc 17MR: www.henry.com/#sle.
3) W.R. Meadows, Inc; Air-Shield LMP: www.wrmeadows.com/#sle.
4) Substitutions: See Section 016000 - Product Requirements.

2.02 ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Air Barrier and Adjacent Substrates: As indicated or in compliance with air barrier manufacturer's installation instructions.

B. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrate and air barrier materials.

1. Application: Apply at 30 to 40 mil, 0.030 to 0.040 inch (0.76 to 1.02 mm), nominal thickness.
2. Color: Manufacturer's standard.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready for work of this section.

B. Do not proceed with this work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's installation instructions.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's installation instructions.

B. Air Barriers: Install continuous airtight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.

D. Fluid-Applied Coatings or Membranes:

1. Prepare substrate in accordance with manufacturer's installation instructions; treat joints in substrate and between dissimilar materials as indicated.
2. Where exterior masonry veneer is being installed, install masonry anchors before installing air barrier over masonry; provide airtight seal around anchors.
3. Use flashing to seal to adjacent construction and to bridge joints in coating substrate.

E. Openings and Penetrations in Exterior Air Barriers:

1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches (125 mm) onto air barrier and at least 6 inches (150 mm) up jambs; mechanically fasten stretched edges.
2. At openings with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches (100 mm) wide; do not seal sill flange.
3. At openings with nonflanged frames, seal air barrier to each side of framing at opening using flashing at least 9 inches (230 mm) wide, and covering entire depth of framing.
4. At head of openings, install flashing under air barrier extending at least 2 inches (50 mm) beyond face of jambs; seal air barrier to flashing.
5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
6. Service and Other Penetrations: Form flashing around penetrating item and seal to air barrier surface.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Coordination of ABAA Tests and Inspections:

1. Provide testing and inspection required by ABAA QAP.
2. Notify ABAA in writing of schedule for air barrier work, and allow adequate time for testing and inspection.
3. Cooperate with ABAA testing agency.
4. Allow access to air barrier work areas and staging.

5. Do not cover air barrier work until tested, inspected, and accepted.

C. Do not cover installed air barriers until required inspections have been completed.

D. Obtain approval of installation procedures from air barrier manufacturer based on mock-up installed in place, prior to proceeding with remainder of installation.

3.05 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

SECTION 074213
METAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured metal panels for exterior wall panels, soffit panels, and equipment screens, with fascia, trim and related flashings and accessory components.

1.02 RELATED REQUIREMENTS

A. Section 054000 - Cold-Formed Metal Framing: Wall and soffit panel substrate.
B. Section 055000 - Metal Fabrications: Wall panel substrate.
C. Section 072100 - Thermal Insulation: Cavity insulation.
D. Section 079200 - Joint Sealants: Sealing joints between metal wall panel system and adjacent construction.

1.03 REFERENCE STANDARDS

A. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.
B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.
C. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2023.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.
B. Product Data - Wall System: Manufacturer's data sheets on each product to be used, including:
    1. Physical characteristics of components shown on shop drawings.
    2. Storage and handling requirements and recommendations.
    3. Installation instructions and recommendations.
C. Shop Drawings: Indicate dimensions, layout, joints, construction details, support clips, girts, and methods of anchorage.
D. Samples: Submit two samples of wall panel and soffit panel, 12 inches by 12 inches (305 mm by 305 mm) in size illustrating finish color, sheen, and texture.
E. Test Reports: Submit test report verifying compliance with NFPA 285 for previously-tested exterior wall assembly.
F. Manufacturer's qualification statement.
G. Installer's qualification statement.

H. Testing agency's qualification statement.

I. Warranty Documentation for Installation of Building Rainscreen Assembly: Submit installer warranty and ensure that forms have been completed in Owner's name and registered with installer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in installing products specified in this section with minimum three years of documented experience.

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.06 MOCK-UPS

A. See Section 014000 - Quality Requirements for additional requirements.

B. Construct mock-up, 10 feet (3.3 m) long by 10 feet (3.3 m) wide; include panel and soffit system, glazing, attachments to building frame, associated vapor retarder and air seal materials, weep drainage system, sealants and seals, and related insulation in mock-up.

C. Locate as directed by Architect.

D. Mock-up may remain as part of work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.

C. Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.

D. Prevent contact with materials that may cause discoloration or staining of products.

1.08 FIELD CONDITIONS

A. Do not install wall panels when air temperature or relative humidity are outside manufacturer's limits.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Finish Warranty: Provide 10-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

C. Special Warranty: Provide 5-year warranty covering water tightness and integrity of seals of metal wall panels. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.01 METAL WALL PANEL SYSTEM

A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled, with concealed clips and fasteners.
   1. Provide exterior wall panels, soffit panels, and girt assembly.
   2. Design and size components to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.
   3. Design Pressure: In accordance with applicable codes.
   4. Fire Performance: Tested in accordance with, and complying with acceptance criteria of NFPA 285.
   5. Maximum Allowable Deflection of Panel: L/180 for length(L) of span.
   6. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
   7. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
   8. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.
   9. Corners: Factory-fabricated in one continuous piece with minimum 2-inch (51 mm) returns.

B. Exterior Wall Panels, Type FMWP-1:
   1. Profile: Vertical; Flat-seamed style.
   2. Side Seams: Mechanically Double-interlocked, tight-fitting, sealed with concealed continuous bead of sealant.
   3. Material: Precoated aluminum sheet, 20 gauge, 0.032 inch (0.81 mm) minimum thickness.

4. Panel Width: 12 inches (305 mm).
5. Panel Depth: 1 inch (25 mm).
6. Color: As selected by Architect from manufacturer's full line.
7. Fasteners: Concealed.
8. Trim, Closure Pieces, and Facias: Same material, thickness and finish as exterior sheets; brake formed to required profiles.
9. Product: Subject to compliance with requirements, provide Morin (a Kingspan Group Company) #F-8-0 panel system or comparable product.
    a. Substitutions: See Section 016000-Product Requirements.

C. Exterior Wall Panels, Type FMWP-2:
1. Profile: Vertical; Standing-seamed style.
2. Side Seams: Mechanically interlocked seamed, sealed with concealed continuous bead of sealant.
3. Material: Precoated aluminum sheet, 20 gauge, 0.032 inch (0.81 mm) minimum thickness.
4. Panel Width: 16 inches (406 mm).
5. Panel Depth: 2 inches (51 mm).
6. Color: As selected by Architect from manufacturer's full line.
7. Fasteners: Concealed.
8. Trim, Closure Pieces, and Facias: Same material, thickness and finish as exterior sheets; brake formed to required profiles.
9. Product: Subject to compliance with requirements, provide Morin (a Kingspan Group Company) #SLR-16-0 panel system or comparable product.
    a. Substitutions: See Section 016000-Product Requirements.

D. Exterior Equipment and Generator Screen Panels, Type FMWP-3:
1. Profile: Vertical; Fluted style.
2. Side Seams: Mechanically interlocked seamed.
3. Material: Perforated precoated aluminum sheet, 0.040 inch (1.02 mm) minimum thickness.
4. Panel Width: 12 inches (305 mm).
5. Panel Depth: 7/8 inch (22 mm).
6. Perforation Pattern: 1/8 inch (3.1 mm) hole, 1/4 inch (6.3 mm) spacing, 23 percent open area.
7. Color: As selected by Architect from manufacturer's full line.
8. Fasteners: Concealed.

9. Trim, Closure Pieces, and Facias: Same material, thickness and finish as exterior sheets; brake formed to required profiles.
10. Product: Subject to compliance with requirements, provide Morin (a Kingspan Group Company) Integrity #X-12 panel system or comparable product.
    a. Substitutions: See Section 016000-Product Requirements.

E. Soffit Panels:
1. Profile: flush, with venting provided where indicated on Drawings.
2. Material: Precoated aluminum sheet, 20 gauge, 0.032 inch (0.81 mm) minimum thickness.
3. Color: As selected by Architect from manufacturer's full line.
4. Product: Subject to compliance with requirements, provide Morin (a Kingspan Group Company), Primo Soffit #PS-12 panel system or comparable product.
    a. Substitutions: See Section 016000-Product Requirements.

F. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.

G. Expansion Joints: Same material, thickness and finish as exterior sheets; manufacturer's standard brake formed type, of profile to suit system.

H. Trim, Closure Pieces, and Facias: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

I. Anchors: Galvanized steel or Stainless steel.

2.02 MATERIALS

A. Precoated Aluminum Sheet: ASTM B209/B209M, 3105 alloy, O temper, with smooth surface texture; continuous-coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.

B. Select materials with surface flatness, smoothness, and lack of surface blemishes where exposed to view in finished system.

2.03 FINISHES

A. Panel Backside Finish: Panel manufacturer's standard siliconized polyester wash coat.

B. Fluoropolymer Coil Coating System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of coil coated metal surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch (0.023 mm); color and gloss to match sample.
1. Products:

a. Arkema, Inc; Kynar 500: www.arkema.com/#sle.
b. PPG; Duranar: www.ppgmetalcoatings.com/#sle.
c. Sherwin-Williams Company; Fluropon: www.coil.sherwin.com/#sle.
d. Substitutions: See Section 016000 - Product Requirements.

2.04 ACCESSORIES

A. Support for Cladding and Continuous Insulation: Continuous thermal Z-girts.
1. Fiberglass reinforced plastic (FRP) girts that provide cladding attachment support for metal wall panels.
2. Depth: As required for thickness of insulation.
3. Length: 6 inches (152 mm) for clips and 96 inches (2438 mm) for girts.
4. Spacing: 16 inches (406 mm) on center, vertically.
5. Fasteners: As recommended by clip manufacturer.
6. Products: Subject to compliance with requirements provide one of the following or comparable products;
a. Cladiator; Slotted-Z FG: www.cladiator.com/#sle.
b. exo Surfaces; exoGIRT: www.exo-surfaces.com/#sle.
c. Substitutions: See Section 016000 - Product Requirements.

B. Support for Equipment and Generator Screen Cladding:
1. Horizontal Rail: Cladding support, extruded aluminum with 0.094-inch (2.4 mm) minimum thickness and unique profile, 118-1/8 inches (3000 mm) long; attached to vertical structure, See Section 054000.
2. Fasteners: Provide support system and cladding attachment fasteners as recommended by system manufacturer in accordance with requirements.

C. Concealed Sealants: Non-curing butyl sealant or tape sealant, see Section 079200

D. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers, steel, hot dip galvanized. Fastener cap same color as exterior panel.
1. Metal-to-Metal Fasteners: Self-drilling, self-tapping screws.

E. Field Touch-up Paint: As recommended by panel manufacturer.

F. Bituminous Paint: Asphalt base.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building framing members are ready to receive panels.

3.02 PREPARATION

A. Install subgirts perpendicular to panel length, securely fastened to substrates and shimmed and leveled to uniform plane, and spaced at intervals indicated.

B. Protect surrounding areas and adjacent surfaces from damage during execution of this work.

3.03 INSTALLATION

A. Install panels on walls and soffits in accordance with manufacturer's instructions.
B. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint; allow to dry prior to wall panel installation.
C. Fasten panels to structural supports; aligned, level, and plumb.
D. Locate joints over supports.
E. Lap panel ends 2 inches (51 mm), minimum.
F. Provide expansion and control joints where indicated.
G. Use concealed fasteners unless otherwise indicated by Architect.
H. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.04 TOLERANCES

A. Offset From True Alignment Between Adjacent Members Abutting or In Line: 1/16 inch (1.6 mm), maximum.
B. Variation from Plane or Location As Indicated on Drawings: 1/4 inch (6.4 mm), maximum.

3.05 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.
B. Remove site cuttings from finish surfaces.
C. Remove protective material from wall panel surfaces.
D. Upon completion of installation, thoroughly clean prefinished aluminum surfaces in accordance with AAMA 609 & 610.

3.06 PROTECTION

A. Protect metal wall panels until completion of project.
B. Touch-up, repair, or replace damaged wall panels or accessories before Date of Substantial Completion.

END OF SECTION

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SECTION 075300
ELASTOMERIC MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Elastomeric roofing membrane application.
B. Insulation, flat and tapered.
C. Vapor retarder.
D. Deck sheathing.
E. Cover boards.
F. Roofing stack boots and walkway pads.

1.02 REFERENCE STANDARDS

A. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.
B. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2023a.
C. ASTM D4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method; 1983 (Reapproved 2018).
D. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane; 2015, with Editorial Revision (2022).
E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers; review preparation and installation procedures and coordination and scheduling necessary for related work.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.
C. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, setting plan for tapered insulation, mechanical fastener layout, and tie-in with air barrier.
D. Sustainable Design Submittals:

1. Health Product Declaration (HPD): Provide documentation confirming product compliance with one of the following:
    a. Inventory or HPD to at least 0.01 percent by weight, with at least 95 percent assessed using GreenScreen Benchmark assessment.
    b. Cradle to Cradle v3 certification with minimum Silver level of Material Health.
    c. Living Product Challenge certification indicating achievement of Imperative 09, "Transparent Material Health".

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.

G. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures, humidity, wind velocity during application, and supplementary instructions given.

H. Manufacturer's Field Representative qualification statement.

I. Installer's qualification statement.

J. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

B. Manufacturer Field Representative: Individual(s) with thorough knowledge of manufacturer's products and and installation requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact.

C. Store materials in weather protected environment, clear of ground and moisture.

D. Ensure storage and staging of materials does not exceed static and dynamic load-bearing capacities of roof decking.

E. Protect foam insulation from direct exposure to sunlight.

1.07 FIELD CONDITIONS

A. Do not apply roofing membrane during unsuitable weather.

B. Do not apply roofing membrane when ambient temperature is below 40 degrees F (5 degrees C) or above 90 degrees F (32 degrees C).
C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
E. Schedule applications so that no partially completed sections of roof are left exposed at end of workday.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.
B. Contractor's Workmanship Warranty: Correct defective work within a two year period after Date of Substantial Completion.
C. Special Warranty: Manufacturer's total system, non-prorated, without monetary limitation, in which manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
    1. Special warranty includes roof membrane, flashings, roof insulation, fasteners, cover boards, and other components of roofing system.
    2. Warranty Period: 20 years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing system and base flashings to withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and flashings to remain watertight.
B. Material Compatibility: Roofing materials to be compatible with one another and adjacent materials under conditions of service and application required, as domenstrated by roof mamebrane manufacturer based on testing and field experience.
    1. Air Barrier: Provide transition materials compatible with roofing and air barrier.
C. Wind Uplift Resistance: Design roofing system to resist wind uplift pressures indicated on Drawings.

2.02 MANUFACTURERS

A. EPDM Membrane Materials:
    1. Carlisle SynTec Systems; Sure-Tough EPDM: www.carlisle-syntec.com/#sle.

2. Elevate; RubberGard Max (Reinforced) EPDM Membrane: www.holcimelevate.com/#sle.
3. Johns Manville; JM EPDM: www.jm.com/#sle.
4. Versico Roofing Systems; VersiGard EPDM: www.versico.com/#sle.
5. Substitutions: See Section 016000 - Product Requirements.

B. Insulation: Subject to compliance with requirements, insulation compatible with roofing system(s) specified.

C. Cover Boards: Subject to compliance with requirements, cover boards compatible with roofing system(s) specified.

2.03 ROOFING

A. Elastomeric Membrane Roofing: One ply membrane, fully adhered, over cover board and insulation.

B. Acceptable Insulation Types - Constant Thickness Application: Any of types specified.

C. Acceptable Insulation Types - Tapered Application: Any of types specified.

2.04 ROOFING MEMBRANE AND ASSOCIATED MATERIALS

A. Membrane: Ethylene-propylene-diene-monomer (EPDM); internally reinforced with fabric or scrim; complying with minimum properties of ASTM D4637/D4637M.
1. Thickness: 60 mil, 0.060 inch (1.5 mm), minimum.
2. Sheet Width: 120 inches (3,048 mm), maximum.

B. Seaming Materials: As recommended by membrane manufacturer.

C. Vapor Retarder: 40-mil composite self-adhering rubberized asphalt laminated to a woven polypropylene film.; compatible with roofing and insulation materials.

D. Flexible Flashing Material: Same material as membrane.

2.05 DECK SHEATHING

A. General: Apply deck sheathing only where roofing is on metal decking.

B. Deck Sheathing: Glass mat faced gypsum panels, ASTM C1177/C1177M, fire resistant type, 5/8 inch (15.9 mm) thick.

2.06 COVER BOARDS

A. Cover Boards: Glass-mat faced gypsum panels complying with ASTM C1177/C1177M.
1. Thickness: 5/8 inch (15.9 mm), Type X, fire-resistant.

2.07 INSULATION

A. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
1. Classifications:

a. Type II: Faced with either cellulosic facers or glass fiber mat facers on both major surfaces of the core foam.
   1) Class 1 - Faced with glass fiber reinforced cellulosic facers on both major surfaces of the core foam.
   2) Compressive Strength: Classes 1-2-3, Grade 3 - 25 psi (172 kPa), minimum.
   3) Thermal Resistance, R-value (RSI-value): At 1-1/2 inches (38 mm) thick; Class 1, Grades 1-2-3 - 8.4 (1.48) at 75 degrees F (24 degrees C).

2. Board Size: 48 by 96 inches (1220 by 2440 mm).
3. Board Thickness: Minimum 2.6 inch (66 mm). Achieve roof system R-value indicated on Drawings with minimum of 2 layers of insulation installed with staggered edges.
4. Tapered Board: Slope as indicated; minimum thickness 1/2 inch (12.7 mm); fabricate of fewest layers possible.
5. Board Edges: Square.

2.08 ACCESSORIES

A. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.

B. Termination Bars: Stainless steel; compatible with membrane and adhesives.
   1. Manufacturers: Subject to compliance with requirements, provide one of the following;
      a. Hohmann & Barnard, Inc; Termination Bar: www.h-b.com/#sle.
      b. Mortar Net Solutions; Termination Bars: www.mortarnet.com/#sle.
      c. York Manufacturing, Inc; Termination Bar: www.yorkmfg.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.

C. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.
   1. Length as required for thickness of insulation material and penetration of deck substrate, with metal washers.

D. Membrane Adhesive: As recommended by membrane manufacturer.

E. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.

F. Thinners and Cleaners: As recommended by adhesive manufacturer, compatible with membrane.

G. Insulation Adhesive: As recommended by insulation manufacturer.

H. Sealants: As recommended by membrane manufacturer.

I. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.
   1. Composition: Roofing membrane manufacturer's standard.
   2. Size: 18 by 18 inches (460 by 460 mm).
   3. Surface Color: Roofing manufacturer's standard.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.
B. Verify deck is supported and secure.
C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.
D. Verify deck surfaces are dry and free of snow or ice.
E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.02 PREPARATION - CONCRETE DECK

A. Fill surface honeycomb and variations with latex filler.
B. Do not begin work until elevated concrete substrate has cured at least 28 days and moisture content is five percent or less.
   1. Test as Follows:
      a. Concrete Moisture Content: No beading water under plastic after 16 hours when tested in accordance with ASTM D4263.
      b. Relative Humidity in Concrete: Not greater than 75 percent when tested in accordance with ASTM F2170.

3.03 INSTALLATION - VAPOR RETARDER AND INSULATION, UNDER MEMBRANE

A. Install vapor retarder to substrate surface with adhesive in accordance with manufacturer's instructions.
   1. Extend vapor retarder under cant strips and blocking to deck edge.
   2. Install flexible flashing from vapor retarder to air seal material of wall construction, lap and seal to provide continuity of the air barrier plane.
B. Ensure vapor retarder is clean and dry, continuous, and ready for application of insulation.
C. Attachment of Insulation:
   1. Mechanically fasten first layer of insulation to deck in accordance with roofing manufacturer's instructions.

2. Embed second layer of insulation into full bed of adhesive in accordance with roofing and insulation manufacturers' instructions.

D. Cover Boards: Adhere cover boards in accordance with roofing manufacturer's instructions.

E. Lay subsequent layers of insulation with joints staggered minimum 6 inches (152 mm) from joints of preceding layer.

F. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.

G. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

H. Do not apply more insulation than can be covered with membrane in same day.

3.04 INSTALLATION - MEMBRANE

A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.

B. Shingle joints on sloped substrate in direction of drainage.

C. Fully Adhered Application: Apply adhesive to substrate at rate recommended by manufacturer. Fully embed membrane in adhesive except in areas directly over or within 3 inches (76 mm) of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.

D. Overlap edges and ends and seal seams by contact adhesive, minimum 3 inches (76 mm). Seal permanently waterproof. Apply uniform bead of sealant to joint edge.

E. At intersections with vertical surfaces:

1. Extend membrane over cant strips and up a minimum of 6 inches (152 mm) onto vertical surfaces.
2. Fully adhere flexible flashing over membrane and up to reglets and counterflashing.

F. Around roof penetrations, seal flanges and flashings with flexible flashing.

G. Coordinate installation of roof drains and related flashings.

H. Install walkway pads. Space pad joints to permit drainage.

3.05 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Coordinate with manufacturer representative to observe initial placement of insulation layer, initial placement of membrane and edge metal, a progress review at midpoint of roof installation, and review of completed roof installation.

3.06 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.
B. Remove bituminous markings from finished surfaces.
C. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.
D. Repair or replace defaced or damaged finishes caused by work of this section.

3.07 PROTECTION

A. Protect installed roofing and flashings from construction operations.
B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

SECTION 076200
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Formed Products:
      a. Formed wall sheet metal fabrications.
   2. Fabricated sheet metal items, including flashings flashings, counterflashings, and downspouts.

B. Related Sections:
   1. Section 075300 - Elastomeric Membrane Roofing for installing sheet metal flashing and trim integral with membrane roofing.
   2. Section 074213 - Metal Wall Panels for sheet metal flashing and trim integral with panels.
   3. Section 077100 - Roof Specialties for manufactured roof fascias and copings not part of sheet metal flashing and trim.

1.02 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

C. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

C. Sustainable Design Submittals:
   1. Provide the following supporting LEEDv4.1 documentation for permanently installed products:
      a. Sourcing of Raw Materials:
         1) Recycled Content - Provide manufacturer supporting documentation indicating post-consumer and pre-consumer recycled content.
      b. Environmental Product Declaration (EPD): Provide the published manufacturer EPD.

c. Material Ingredients: Provide the published manufacturer material ingredient report according to Division 01 Sustainability Requirements.

1.04 PERFORMANCE REQUIREMENTS

A. General: Sheet metal flashing and trim assemblies as indicated shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.

B. Thermal Movements: Provide sheet metal flashing and trim that allows for thermal movements from ambient and surface temperature changes.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.05 QUALITY ASSURANCE

A. Fabricator and Installer Qualifications: Shop that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

B. Perform work in accordance with SMACNA (ASMM) requirements, except as otherwise indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to the extent necessary for the period of sheet metal flashing and trim installation.

B. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

C. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

D. Prevent contact with materials that could cause discoloration or staining.

1.07 WARRANTY

A. Contractor's Workmanship Warranty: Corect defective work within a two year period after date of Substantial Completion.

B. Products specified in this section shall be provided and installed in a manner that includes them in the comprehensive roof system Warranty specified in Section 015300 Elastomeric Membrane Roofing.

PART 2 PRODUCTS

2.01 SHEET METALS

A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Pre-Finished Aluminum - Downspouts: ASTM B209/B209M, 3005 alloy, H12 or H14 temper; 18 gauge, 0.040 inch (1.02 mm) thick; plain finish shop pre-coated with PVDF coating.

1. Polyvinylidene Fluoride (PVDF) Coating: Superior performing organic powder coating, AAMA 2605; pretreated metal with two-coat system including primer and color coat with at least 70 percent PVDF coating.
2. Color: As selected by Architect from manufacturer's full colors.

2.02 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.

1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
    a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
    b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
2. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 300 stainless steel.
3. Fasteners for Zinc Sheet: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329 or Series 300 stainless steel.

C. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.

D. Elastomeric Sealant: ASTM C 920, elastomeric polymer sealant; low modulus; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.

F. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

G. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.03 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated. Fabricate items at the shop to greatest extent possible.

1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
2. Obtain field measurements for accurate fit before shop fabrication.
3. Form sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces exposed to view.

B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

C. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant.

D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's "Architectural Sheet Metal Manual", but not less than thickness of metal being secured.

G. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.

H. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

I. Do not use graphite pencils to mark metal surfaces.

2.04 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Downspouts: Round profile, prefinished aluminum.

B. Accessories: Profiled to suit gutters and downspouts.

C. Downspout Extenders: Same material and finish as downspouts.

D. Seal metal joints.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

3. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.
4. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.
5. Install sealant tape where indicated.
6. Torch cutting of sheet metal flashing and trim is not permitted.
7. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by SMACNA.
1. Coat back side of uncoated aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.

D. Fastener Sizes: Use fasteners of sizes that will penetrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.

E. Seal joints as shown and as required for watertight construction.
1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

F. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pre-tin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm), except reduce pre-tinning where pre-tinned surface would show in completed Work.
1. Do not solder metallic-coated steel sheet.

2. Stainless-Steel Soldering: Tin edges of uncoated sheets using solder recommended for stainless steel and acid flux. Promptly remove acid flux residue from metal after tinning and soldering. Comply with solder manufacturer's recommended methods for cleaning and neutralization.

3.03 ROOF FLASHING INSTALLATION

A. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches over base flashing. Lap counterflashing joints a minimum of 4 inches and bed with sealant. Secure in a waterproof manner by means of snap-in installation and sealant or lead wedges and sealant.

3.04 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

3.05 ERECTION TOLERANCES

A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.06 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder.

C. Clean off excess sealants.

D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, remove unused materials and clean finished surfaces. Maintain in a clean condition during construction.

E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.07 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for field inspection requirements.

B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION

SECTION 077100
ROOF SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured roof specialties, including copings and fascias.

1.02 RELATED REQUIREMENTS

A. Section 075300 - Elastomeric Membrane Roofing: Roofing-system warranty.

B. Section 077200 - Roof Accessories: Manufactured curbs and roof hatches.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

B. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems; 2022.

C. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates; 2023.

D. ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films; 2023.

E. NRCA (RM) - The NRCA Roofing Manual; 2024.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.

C. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.

D. Samples: Submit two appropriately sized samples of coping.

E. Manufacturer's Installation Instructions: Indicate special procedures, fasteners, supporting members, and perimeter conditions requiring special attention.

1.05 WARRANTY

A. Roofing-System Warranty: Include roof specialties in warranty requirements outlined in Section 075300 - Elastomeric Membrane Roofing.

B. Special Warranty on Painted Finishes: Manufacturer warrants its coil coated resin-based coating or finish material against deterioration of factory-applied finishes as follows:

1. No peeling, checking, or cracking, or failure of paint to adhere to bare metal.

2. Chalking in excess of a numerical rating of 8 when measured in accordance with the standard procedure defined by ASTM D4214.
3. Color fading more than 5 color difference units as when tested in accordance with ASTM D2244.

C. Finish Warranty Period: 30 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 SOURCE LIMITATIONS

A. Roofing-System Warranty: Roof specialties provided in this section to be approved by roofing manufacturer specified in Section 075300 - Elastomeric Membrane Roofing for inclusion in roofing-system warranty.

2.02 MANUFACTURERS

A. Roof Edge Flashings and Copings: Provide roof specialties from a single manufacturer.

2.03 COMPONENTS

A. Roof Edge Flashings: Factory fabricated to sizes required; corners mitered; concealed fasteners.
1. Configuration: Fascia, and edge securement for roof membrane.
2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test methods RE-1 and RE-2 to positive and negative design wind pressure as defined by applicable local building code.
3. Exposed Face Height: As indicated on drawings.
4. Material: Formed aluminum sheet, 0.050 inch (1.3 mm) thick, minimum.
5. Finish: 70 percent polyvinylidene fluoride.
6. Color: As selected by Architect from manufacturer's full range.
7. Basis-of-Design Product: Subject to compliance with requirements, provide Metal-Era Perma-Tite System 200 Fascia, or an approved comparable product from one of the following:
   a. ATAS International, Inc
   b. Hickman Edge Systems: www.hickmanedgesystems.com/#sle.
   c. Substitutions: See Section 016000 - Product Requirements.

B. Copings: Factory fabricated to sizes required; corners mitered; concealed fasteners.
1. Configuration: Concealed continuous hold down cleat at both legs; internal splice piece at joints of same material, thickness, and finish as cap; concealed stainless steel fasteners.

2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-3 to positive and negative design wind pressure as defined by applicable local building code.
3. Wall Width: As indicated on drawings.
4. Outside Face Height: As indicated on drawings.
5. Inside Face Height: As indicated on drawings.
6. Material: Formed steel sheet, galvanized, 24 gauge, 0.024 inch (0.6 mm) thick, minimum.
7. Finish: 70 percent polyvinylidene fluoride.
8. Color: As selected by Architect from manufacturer's standard range.
9. Basis-of-Design Product: Subject to compliance with requirements, provide Metal-Era Perma-Tite coping, or an approved comparable product from one of the following:
    a. ATAS International, Inc: www.atas.com/#sle.
    b. Peterson Aluminum, Pac-Tite.
    c. Substitutions: See Section 016000 - Product Requirements.

C. Roof Penetration Sealing Systems: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.

2.04 FINISHES

A. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system; custom color to match approved sample.

2.05 ACCESSORIES

A. Sealant for Joints in Linear Components: As recommended by component manufacturer.

B. Adhesive for Anchoring to Roof Membrane: Compatible with roof membrane and approved by roof membrane manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that deck, curbs, roof membrane, base flashing, and other items affecting work of this Section are in place and positioned correctly.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.
B. Seal joints within components when required by component manufacturer.
C. Anchor components securely.
D. Coordinate installation of components of this section with installation of roofing membrane and base flashings.
E. Coordinate installation of sealants and roofing cement with work of this section to ensure water tightness.
F. Coordinate installation of flashing flanges into reglets.

END OF SECTION

SECTION 077200
ROOF ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof curbs not specified elsewhere.

B. Roof penetrations mounting curbs.

C. Roof hatches, manual operation.

D. Roof hatch guardrail system.

1.02 RELATED REQUIREMENTS

A. Section 055133 - Ladders: Roof and ship's ladders.

B. Section 077100 - Roof Specialties: Other manufactured roof specialty items.

C. Section 230548 - Vibration and Seismic Controls for HVAC: Vibration-isolated engineered roof curbs.

1.03 REFERENCE STANDARDS

A. 29 CFR 1910.23 - Ladders; Current Edition.

B. 29 CFR 1910.29 - Fall Protection Systems and Falling Object Protection - Criteria and Practices; Current Edition.

C. 29 CFR 1926.502 - Fall protection systems criteria and practices; Current Edition.

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

1.04 SUBMITTALS

A. See Section 013300 – Submittal Procedures for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.
4. Maintenance requirements.

C. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.

1. Submit shop drawings sealed and signed by a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

D. Warranty Documentation:

1. Submit manufacturer warranty.
2. Ensure that forms have been completed in Owner's name and registered with manufacturer.
3. Submit documentation that roof accessories are acceptable to roofing manufacturer, and do not limit the roofing warranty.

1.05 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.
B. Store products in manufacturer's unopened packaging until ready for installation.
C. Store products under cover and elevated above grade.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.
B. Manufacturer Warranty: Provide 2-year manufacturer warranty for materials and workmanship. Complete forms in Owner's name and register with manufacturer.
C. Extended Correction Period: Correct defective work within 5-year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 ROOF CURBS

A. Vibration Isolation Curbs: See Section 230548.
B. Roof Curbs Mounting Assemblies: Factory fabricated hollow sheet metal construction, internally reinforced, and capable of supporting superimposed live and dead loads and designated equipment load with fully mitered and sealed corner joints welded or mechanically fastened, and integral counterflashing with top and edges formed to shed water.
    1. Applications: Roof curbs used for roof penetrations/openings as indicated on drawings.
    2. Roof Curb Mounting Substrate: Curb substrate consists of conditions indicated on Drawings.
    3. Sheet Metal Material:
        a. Aluminum: 0.080 inch (2.03 mm) minimum thickness, with 3003 alloy, and H14 temper.
    4. Provide layouts and configurations indicated on drawings.
C. Curbs Adjacent to Roof Openings: Provide curb on each side of opening, with top of curb horizontal for equipment mounting.
    1. Provide preservative treated wood nailers along top of curb.

2. Insulate inside curbs with 1-1/2 inch (38 mm) thick fiberglass insulation.
3. Height Above Finished Roof Surface: 8 inches (203 mm), minimum.

D. Pipe, Duct, or Conduit Mounting Curbs: Vertical posts, minimum 8 inches (400 mm) square unless otherwise indicated.

2.02 ROOF HATCHES

A. Roof Hatch Manufacturers: Basis-of-Design Product; Subject to compliance with requirements, provide Bilco Company, Roof Hatch, S-50TB or comparable product by one of the following;
1. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com/#sle.
2. Acudor Products Inc: www.acudor.com/#sle.
3. Babcock-Davis: www.babcockdavis.com/#sle.
4. Nystrom, Inc: www.nystrom.com/#sle.
5. Precision Ladders, LLC: www.precisionladders.com/#sle.
6. Substitutions: See Section 016000-Product Requirements.

B. Roof Hatches: Factory-assembled, thermally broken, aluminum frame and cover, complete with operating and release hardware.
1. Size: 30 x 36 inches, single leaf.
2. Material: Mill finished aluminum; outer cover 11 gauge, 0.0907 inch (2.3 mm) thick, liner 0.04 inch (1.0 mm) thick.
3. Lifting Mechanism: Compression spring operators in protective housing.
   a. Automatic lock in open position with grip handle release mechanism for closing.
4. Finish: Factory Finished, Color selected by Architect from Manufacturer's full range.
5. Cover Insulation: Manufacturer's standard 3 inch (76 mm) rigid polyisocyanurate protected by 18 gauge aluminum liner. R-20 minimum.
6. Hardware: Zinc plated and chromated sealed unless noted otherwise.
   a. Heavy stainless steel hinges.
   b. Spring latch with interior and exterior turn handles.
   c. Interior and exterior padlock hasps.
   d. Stamped latch strike bolted to curb assembly.
7. Gasket: EPDM, continuous around cover perimeter.
8. Curb Height: 8 inches (203 mm) from finished surface of roof, minimum.

C. Safety Railing System: Roof hatch safety rail system mounted directly to curb without penetration of roofing system.
    1. Gate: Same material as railing; automatic closing with latch.
    2. Products: Basis-of-Design Product; Subject to compliance with requirements, provide BILCO Company, Bil-Guard 2.0 or comparable product by one of the following;
        a. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com/#sle.
        b. Safety Rail Company: www.safetyrailcompany.com/#sle.
        c. Substitutions: See Section 016000-Product Requirements.
D. Safety Post: Telscoping safety post mounted to ladder.
    1. Products: Basis-of Design Product; Subject to compliance with requirements, provide BILCO Company, LadderUp Safety Post or comparable product,
        a. Substitutions: See Section 016000-Product Requirements.
E. Hardware: Type 316 stainless steel, unless otherwise indicated or required by manufacturer.
    1. Lifting Mechanisms: Compression or torsion spring operator with shock absorbers that automatically opens upon release of latch; capable of lifting covers despite 10 psf (475 kPa) load.
    2. Hinges: Heavy duty pintle type.
    3. Hold open arm with vinyl-coated handle for manual release.
    4. Latch: Upon closing, engage latch automatically and reset manual release.
    5. Manual Release: Pull handle on interior.
    6. Locking: Padlock hasp on interior.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.
B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.
B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

3.04 CLEANING

A. See Section 017700 – Closeout Procedures for additional requirements.

B. Clean installed work to like-new condition.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

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SECTION 077600
ROOF PAVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Roof pavers.

B. Pedestals.

1.02 RELATED REQUIREMENTS

A. Section 075300 - Elastomeric Membrane Roofing: Substrate for roof paver system.

1.03 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASTM C936/C936M - Standard Specification for Solid Concrete Interlocking Paving Units; 2023a.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data indicating paver and pedestal materials.

C. Shop Drawings: Submit shop drawings that indicate paver and pedestal layout, including overall plan and detail drawings of system components.

D. Samples of Pavers: Submit two samples for each type, color and texture indicated.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Manufacturer's Installation Instructions: Indicate substrate precautions, special procedures, and perimeter conditions requiring special attention.

G. Manufacturer's qualification statement.

H. Installer's qualification statement.

I. Sustainable Design Documentation: Test report showing solar reflectance index of paver.

J. Warranty Documentation:

1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
2. Submit documentation from installer that installation complies with warranty conditions for roof paver system.

K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:

1. See Section 016000 - Product Requirements for additional provisions.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with at least three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.

B. Deliver materials in manufacturer's original containers, dry and undamaged, with seals and labels intact.

C. Store materials at least 4 inches (102 mm) above ground in dry location, and covered with polyethylene sheet to protect from contact with materials that may cause staining or discoloration.

1.07 FIELD CONDITIONS

A. Do not install roof paver components during cold or wet weather conditions.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 2-year manufacturer warranty to replace material that shows manufacturing defects. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 ROOF PAVERS

A. Precast Concrete Roof Pavers: Precast concrete tiles, with texture and color as indicated; supported by adjustable pedestal system.

1. Comply with local wind load resistance requirements of ASCE 7.
2. Texture and Color: As selected by Architect from manufacturer's standard line.
3. Length and Width: 24 by 24 inches (609 by 609 mm), nominal.
4. Thickness: 2 inches (51 mm), nominal.
5. Compressive Strength: ASTM C936/C936M, not less than 8000 psi (55 MPa).
6. Absorption: ASTM C936/C936M, not greater than 5 percent.
7. Products:
    a. Hanover Architectural Products, Inc; Roof Pavers: www.hanoverpavers.com/#sle.
    b. Nitterhouse Masonry; Paver System.
    c. Wasau Tile; Riverside Pa

2.02 PEDESTALS

A. Adjustable Height Pedestals: High-density polyethylene with spacer ribs on upper surface to ensure even joint spacing. Pedestal heights to be precisely controlled with threaded couplers for installed system with no rocking pavers.
   1. Pedestals may be separated into halves or quarters to accommodate perimeter-edge and corner support.
   2. Unit Size: Minimum 4 inch diameter base and top. Pedestal heights to be precisely controlled with threaded couplers for installed system with no rocking pavers.
   3. Pedestal Height: Varies, as indicated on Drawings.
   4. Spacer Rib: 1/8 inch (3 mm) wide by 7/8" high .
   5. Weatherability: Not affected by freeze-thaw cycles, ozone, humidity, and is not water-absorbent.
   6. Accessories: Manufacturer's recommended top plates, couplers, spacers, leveling shims, edge restraints, and cross bracing for indicated applicatons and all other accessories and components required for complete installation.
   7. Products:
      a. Hanover Architectural Products, Inc; Elevator Pedestal System: www.hanoverpavers.com/#sle.
      b. Skydeck; Skyjack Pedestal.
      c. Wassau Tile; Terra-Stand

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive this work.
B. Verify substrate is supported and secure.
C. Verify substrate is clean and smooth, dry and free of snow or ice, flat without depressions, waves or projections, properly sloped and suitable for installation of roof paver system.
D. Verify that roof openings, curbs, and penetrations through roof are solidly set.
E. Verify system elevations, required pedestal heights, and substrate dimensions.

3.02 PREPARATION

A. Use of pedestal system is for pedestrian traffic only and each side of deck system must be restrained containing decking panels with perimeter blocking or walls; movement of decking panels laterally is not permitted.

B. Membrane waterproofing and protection board surfaces used to support pedestals to be broom clean, free of frost, dirt, oil or any rough foreign matter that may impair substrate material manufacturer's warranty requirements.

C. Provide substrate for pedestals with slope and positive drainage in accordance with applicable building codes.

D. Substrate surface that will support paver and pedestal system must be structurally capable of carrying dead and live loads anticipated.

3.03 INSTALLATION

A. Perform work in accordance with manufacturer's written installation instructions and applicable requirements in coordination with project attributes, paver type being installed, pattern, grid layout, starting point, and finished elevation as indicated on approved shop drawings.

B. Install pavers on pedestals in accordance with manufacturer's instructions.

1. Fully support edges; shim and adjust pavers to provide level surface. Use only shims and levels designed by pedestal manufacturer for use with system.
2. Maintain a minimum insertion of three threads to secure pedestal couplers and maintain stability. Where at least three threads cannot be acheived, add an additional coupler.
3. Provide approximately 1/8 inch (3.2 mm) space between pavers to permit surface water drainage.

C. Paver Edge Restraints: Install exposed paver edge restraints in accordance with roof paver manufacturer's instructions.

D. Paver Cutting:

1. Cut Pavers as required to fit tight, straight and cleanly within permiter walls of deck area. Cut paver edges shall be placed adjacent to vertical perimeter walls.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Inspect during installation to ensure that grid spacer lines are being maintained in a straight and consistent pattern and that deck roof pavers are level and not rocking.

C. Unless otherwise specified in writing to allow for expansion, inspect to ensure that spacing between pavers at perimeter walls does not exceed a tab width.

D. Inspect during installation to ensure that pedestrian entry or access points to roof paver areas are level and that pavers are not randomly raised or uneven creating a tripping or safety hazard.

E. Verify that deck pedestal heights in excess of 16 inches (406 mm) have been braced in accordance with manufacturers written installation instructions.

3.05 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Remove markings from finished surfaces, or replace defaced components of roof pavers system if markings cannot be removed.

C. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and comply with their documented instructions.

D. Repair or replace defaced or damaged finishes caused by work of this section.

3.06 PROTECTION

A. Protect installed roof pavers from construction operations.

B. Where traffic must continue over finished roof pavers, protect surfaces using durable materials.

END OF SECTION

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SECTION 078400
FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 RELATED REQUIREMENTS

A. Section 01 7700 – Closeout Procedures

1.03 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials 2022.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).

C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems 2015 (Reapproved 2019).

D. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems 2020a.

E. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers 2020a.

F. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus 2020.

G. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies 2013 (Reapproved 2017).

H. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015, with Editorial Revision (2021).

I. ITS (DIR) - Directory of Listed Products Current Edition.

J. FM 4991 - Approval Standard of Firestop Contractors 2013.

K. FM (AG) - FM Approval Guide current edition.

L. UL 1479 - Standard for Fire Tests of Penetration Firestops Current Edition, Including All Revisions.

M. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems Current Edition, Including All Revisions.

N. UL (DIR) - Online Certifications Directory Current Edition.

O. UL (FRD) - Fire Resistance Directory Current Edition.

1.04 SUBMITTALS

A. See Section 01 3300 – Submittal Procedures for submittal procedures.

B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and proposed firestopping test or design number.

C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

1.05 SUSTAINABLE DESIGN SUBMITTALS

A. See Section 01 3300 – Submittal Procedures for submittal procedures.

B. Comply with Section 01 8113.

C. Provide documentation for the following:

1. LEED EQ Credit 2: Low-emitting materials;

a. Paints and coatings applied in bilding interior:

1) Certificate stating compliance with California Department of Public Health (CDPH) Standard Method including TVOC range and product data stating VOC content in grams per liter (g/L).

1.06 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.

1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.

2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.

3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and:

1. Trained by manufacturer.
2. Approved by Factory Mutual Research Corporation under FM 4991, or meeting any two of the following requirements:
3. Verification of minimum three years documented experience installing work of this type.
4. Verification of at least five satisfactorily completed projects of comparable size and type.
5. Licensed by local authorities having jurisdiction (AHJ).

1.07 MOCK-UPS

A. See Section 014500 – Quality Control for additional requirements.
B. Install one firestopping assembly representative of each fire rating design required on project.
   1. Where one design may be used for different penetrating items or in different wall constructions, install one assembly for each different combination.
   2. Where firestopping is intended to fill a linear opening, install at least 1 linear foot of firestopping.
C. If accepted, mock-up will represent minimum standard for this work.
D. If accepted, mock-up may remain as part of this work. Remove and replace mock-ups not accepted.

1.08 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.
B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.01 MATERIALS

A. Firestopping Materials: Any materials meeting requirements.
B. Mold and Mildew Resistance: Provide firestopping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.
C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.
   1. Interior wet-applied primer/sealer and fire resistive coating: Comply with emissions requirements of CDPH Standard Test Method and VOC content limits in Section 018113.
D. Fire Ratings: Refer to drawings for required systems and ratings.

2.02 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Perimeter Fire Containment Firestopping: Use system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of floor assembly.
   1. Movement: Provide systems that have been tested to show movement capability as indicated.
   2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
   3. Where floor assembly is not required to have a fire rating, provide systems that have been tested to show L Rating as indicated.

B. Head-of-Wall (HW) Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of wall assembly.
   1. Movement: Provide systems that have been tested to show movement capability as indicated.

C. Floor-to-Floor (FF), Floor-to-Wall (FW), Head-of-Wall (HW), and Wall-to-Wall (WW) Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
   1. Movement: Provide systems that have been tested to show movement capability as indicated.
   2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
   3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
   4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

D. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
   1. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
   2. Watertightness: Provide systems that have been tested to show W Rating as indicated.

3. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

2.03 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.

1. Fire Ratings: Use system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.

B. Firestopping Between Top of Partition Wall and Roof Slab: Fiber firestopping with smoke seal coating; UL Design assembly as indicated, provide at locations as indicated on drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to prevent liquid material from leakage.

3.03 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by authorities having jurisdiction.

C. Install labeling required by code.

3.04 FIELD QUALITY CONTROL

A. Independent Testing Agency: Inspection agency employed and paid by Owner, will examine penetration firestopping in accordance with ASTM E2174 and ASTM E2393.

B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.05 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.06 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

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SECTION 079200
JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonstaining silicone joint sealants
B. Urethane joint sealants.
C. Mildew-resistant joint sealants.
D. Butyl joint sealants.
E. Latex joint sealants.
F. Acoustical joint sealants
G. Joint backings and accessories.
H. Owner-provided field quality control.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping: Fire sealant systems and labeling.

1.03 REFERENCE STANDARDS

A. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).
B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2022.
C. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2023.
D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).
E. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2022.
F. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2019 (Reapproved 2020).

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.
B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
    1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
    2. List of backing materials approved for use with the specific product.
    3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
    4. Substrates the product should not be used on.

5. Substrates for which use of primer is required.
6. Substrates for which laboratory adhesion and/or compatibility testing is required.
7. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
8. Sample product warranty.
9. Certification by manufacturer indicating that product complies with specification requirements.

C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

E. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.

F. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.

G. Installation Plan: Submit at least four weeks prior to start of installation.

H. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.

I. Field Quality Control Plan: Submit at least two weeks prior to start of installation.

J. Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.

K. Installation Log: Submit filled-out log for each length or instance of sealant installed.

L. Field Quality Control Log: Submit filled-out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.

M. Manufacturer's qualification statement.

N. Installer's qualification statement.

O. Executed warranty.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

C. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
   1. Adhesion Testing: In accordance with ASTM C794.
   2. Compatibility Testing: In accordance with ASTM C1087.
   3. Stain Testing: In accordance with ASTM C1248; required only for stone substrates.
   4. Allow sufficient time for testing to avoid delaying the work.
   5. Deliver sufficient samples to manufacturer for testing.
   6. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.
   7. Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.

D. Installation Plan: Include schedule of sealed joints, including the following:
   1. Joint width indicated in Contract Documents.
   2. Joint depth indicated in Contract Documents; to face of backing material at centerline of joint.
   3. Method to be used to protect adjacent surfaces from sealant droppings and smears, with acknowledgment that some surfaces cannot be cleaned to like-new condition and therefore prevention is imperative.
   4. Approximate date of installation, for evaluation of thermal movement influence.
   5. Installation Log Form: Include the following data fields, with known information filled out.
      a. Location on project.
      b. Sealant used.
      c. Primer to be used, or indicate no primer is used.
      d. Size and actual backing material used.
      e. Date of installation.
      f. Name of installer.
      g. Actual joint width; provide space to indicate maximum and minimum width.
      h. Actual joint depth to face of backing material at centerline of joint.
      i. Air temperature.

E. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.
   1. Identification of testing agency.
   2. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
      a. Test date.
      b. Location on project.
      c. Sealant used.
      d. Test method used.
      e. Date of test.
      f. Copy of test method documents.
      g. Age of sealant upon date of testing.
      h. Test results, modeled after the sample form in the test method document.
      i. Indicate use of photographic record of test.

F. Owner will employ an independent testing agency to perform the field quality control inspection and testing as referenced in PART 3 of this section and as follows, to prepare and submit the field quality control plan and log, and to provide recommendations of remedies in the case of failure.
   1. Contractor shall cooperate with testing agency and repair failures discovered and destructive test location damage.

G. Field Quality Control Plan:
   1. Visual inspection of entire length of sealant joints.
   2. Destructive field adhesion testing of sealant joints, except interior acrylic latex sealant.
      a. For each different sealant and substrate combination, allow for one test every 100 feet (30 m) in the first 1,000 linear feet (305 linear m), and one test per 1,000 linear feet (305 linear m) thereafter, or once per floor on each elevation.
      b. If any failures occur in the first 1,000 linear feet (305 linear m), continue testing at frequency of one test per 500 linear feet (152 linear m) at no extra cost to Owner.

3. Field Quality Control Log Form: Show same data fields as on Preinstallation Field Adhesion Test Log, with known information filled out and lines for multiple tests per sealant/substrate combinations; include visual inspection and specified field testing; allow for possibility that more tests than minimum specified may be necessary.

H. Field Adhesion Test Procedures:
1. Allow sealants to fully cure as recommended by manufacturer before testing.
2. Have a copy of the test method document available during tests.
3. Take photographs or make video records of each test, with joint identification provided in the photos/videos; for example, provide small erasable whiteboard positioned next to joint.
4. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
5. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
6. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Owner.
7. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.

I. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.
1. Sample: At least 18 inches (457 mm) long.
2. Minimum Elongation Without Adhesive Failure: Consider the tail at rest, not under any elongation stress; multiply the stated movement capability of the sealant in percent by two; then multiply 1 inch (25.4 mm) by that percentage; if adhesion failure occurs before the 1-inch mark is that distance from the substrate, the test has failed.
3. If either adhesive or cohesive failure occurs before minimum elongation, take necessary measures to correct conditions and retest; record each modification to products or installation procedures.
4. Record results on Field Quality Control Log.
5. Repair failed portions of joints.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 2-year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Owner's name and register with manufacturer.

C. Extended Correction Period: Correct defective work within 2-year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MATERIALS, GENERAL

A. Source Limitations: Obtain each type of material from a single source and from a single manufacturer.

B. Sealants and Primers: Provide products with acceptable levels of volatile organic compound (VOC) content; see Section 016116.

C. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

D. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.02 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.

B. Single-Component, Nonsag, Non-Staining, Moisture-Curing Silicone Joint Sealant ASTM C 920, Type S, Grade NS, Class 100/50, Use NT; SWRI validated.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Tremco Incorporated; Spectrem 1 or comparable product by one of the following;
    a. GE Construction Sealants; Momentive Performance Materials Inc.
    b. May National Associates, Inc.; a subsidiary of Sika Corporation.
    c. Pecora Corporation.
    d. Sika Corporation; Joint Sealants.
    e. The Dow Chemical Company.

2.03 URETHANE JOINT SEALANTS

A. Single-Component, Nonsag, Moisture-Cure, Polyurethane Hybrid Joint Sealant [UJS#__]: ASTM C 920, Type S, Grade NS, Class 35, Use NT; Greenguard certified.

1. Basis-of Design Product: Subject to compliance with requirements, provide Tremco, Incorporated, Dymonic FC or comparable product by one of the following;
    a. Pecora Corporation.
    b. Sika Corporation.
    c. Sherwin-Williams Company (The).
2. Extrusion Rate ASTM C1183: 93.1 mL/min
3. Weight Loss ASTM C1246: Pass
4. Tack Free Time ASTM C679: 3 to 4 hr
5. Volatile Organic Compound (VOC) Content: 10 g/L maximum.
6. Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.
7. Color: As selected by Architect from manufacturer's standard line of not less than 15 colors.

B. Immersible, Single-Component, Pourable, Traffic Grade Polyurethane Joint Sealant [UJS#__]: ASTM C 920, Type S, Grade P, Class 50, Use T and I.
1. Basis-of Design Product: Subject to compliance with requirements, provide Tremco, Incorporated, Vulkem 45 SSL or comparable product by one of the following;
    a. Pecora Corporation.
    b. Sika Corporation.
    c. Sherwin-Williams Company (The).
2. Volatile Organic Compound (VOC) Content: 110 g/L maximum.
3. Volatile Organic Emissions (VOE): Not greater than Greenguard Children & Schools Certification emissions levels.
4. Color: As selected by Architect from manufacturer's standard line of not less than 5 colors.

2.04 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Tremco Incorporated; Tremsil 200 or comparable product by one of the following:
    a. GE Construction Sealants; Momentive Performance Materials Inc.
    b. May National Associates, Inc.; a subsidiary of Sika Corporation.
    c. Pecora Corporation.
    d. The Dow Chemical Company.

2.05 BUTYL JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.
    1. Basis-of-Design Product: Subject to compliance with requirements, provide Tremco Incorporated; TremPro JS-773, or comparable product by one of the following
        a. Bostik, Inc.
        b. Pecora Corporation.

2.06 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
    1. Basis-of-Design Product: Subject to compliance with requirements, provide Tremco Incorporated; Tremflex 834 or comparable product by one of the following:
        a. May National Associates, Inc.; a subsidiary of Sika Corporation.
        b. Pecora Corporation.
        c. Sherwin-Williams Company (The).

2.07 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant for Exposed and Concealed Joints: ASTM C834, nonsag, paintable, nonstaining latex acoustical sealant.
    1. Basis-of-Design Product: Subject to compliance with requirements, provide Tremco Incorporated, Tremflex 834 sealant or comparable product by one of the following:
        a. GE Construction Sealants; Momentive Performance Materials Inc.
        b. Hilti Inc.
        c. Pecora Corporation.
        d. Serious Energy Inc.
        e. USG Corporation

2.08 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. BASF Corporation.
      b. Construction Foam Products; a division of Nomaco, Inc.
   2. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), Type O (open-cell material), Type B (bicellular material with a surface skin), or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
   3. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.09 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.
D. Adhesive: As recommended by pre-formed seal manufacturer.

2.10 JOINT SEALANT APPLICATIONS

A. Scope:
   1. Do Not Seal:
      a. Intentional weep holes in masonry.
      b. Joints indicated to be covered with expansion joint cover assemblies.

c. Joints where sealant is specified to be furnished and installed by manufacturer of product to be sealed.
d. Joints where sealant installation is specified in other sections.
e. Joints between suspended ceilings and walls.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.
B. Properly prepare construction components adjacent to the work of this section to prevent damage and disfigurement due to this work.
C. Verify that backing materials are compatible with sealants.
D. Verify that backer rods are of the correct size.
E. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.
    1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
    2. Notify Architect of date and time that tests will be performed, at least seven days in advance.
    3. Record each test on Preinstallation Adhesion Test Log as indicated.
    4. If any sample fails, review products and installation procedures, consult manufacturer, or take other measures that are necessary to ensure adhesion; retest in a different location; if unable to obtain satisfactory adhesion, report to Architect.
    5. After completion of tests, remove remaining sample material and prepare joints for new sealant installation.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.
B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION - SEALANT

A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
B. Provide joint sealant installations complying with ASTM C1193.

C. Measure joint dimensions and size joint backers to achieve the following, unless otherwise indicated:
   1. Width/depth ratio of 2:1.
   2. Neck dimension no greater than 1/3 of the joint width.
   3. Surface bond area on each side not less than 75 percent of joint width.
D. Install bond breaker backing tape where backer rod cannot be used.
E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.
B. Owner will employ an independent testing agency to perform field quality control inspection and testing as specified in PART 1 under QUALITY ASSURANCE article.
C. Destructive Adhesion Testing: If there are any failures in first 1,000 linear feet (300 linear m), notify Architect immediately.
D. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.
E. Repair destructive test location damage immediately after evaluation and recording of results.

3.05 JOINT-SEALANT SCHEDULE

A. Provide sealant types as indicated and if not indicated, provide in conformance with the following requirements.
B. Exterior Joints; Vertical and horizontal non-traffic surfaces, not subject to significant movement.
   1. Joint Locations;
      a. Control and expansion joints in unit masonry.
      b. Joints between metal panels.
      c. Joints between different materials, unless indicated otherwise.
      d. Perimeter joints between materials listed above and frames of doors, windows, and louvers.

e. Control and expansion joints in ceilings and other overhead surfaces.
f. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT .
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors .

C. Interior joints; Vertical surfaces and horizontal nontraffic surfaces, not subject to significant movement.

1. Joint Locations:
   a. Control joints on exposed interior surfaces of exterior walls.
   b. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
   c. Other joints as indicated on Drawings.
2. Joint Sealant: Acrylic latex.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors .

D. Mildew-resistant interior joints; Vertical and horizontal nontraffic surfaces.

1. Joint Locations:
   a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
   b. Tile control and expansion joints where indicated.
   c. Other joints as indicated on Drawings.
2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT .
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors .

E. Concealed mastics.

1. Joint Locations:
   a. Aluminum thresholds.
   b. Sill plates.
   c. Other joints as indicated on Drawings.
2. Joint Sealant: Butyl-rubber based .
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors .

F. Sound attenuation joints.

1. Joint Locations:
   a. STC rated assemblies.
   b. Floor slab perimeter joints.

c. Other joints as indicated on Drawings.

2. Joint Sealant: Acoustical joint sealant.
3. Joint Sealant Color: Architect to select color distinguishable from other sealants used on the project.

END OF SECTION

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SECTION 081113

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Hollow metal frames for wood doors.

C. Fire-rated hollow metal doors and frames.

D. Thermally insulated hollow metal doors with frames.

1.02 RELATED REQUIREMENTS

A. Section 087100 - Door Hardware.

B. Section 088000 - Glazing: Glass for doors and borrowed lites.

C. Section 099123 - Interior Painting: Field painting.

1.03 ABBREVIATIONS AND ACRONYMS

A. ANSI: American National Standards Institute.

B. ASCE: American Society of Civil Engineers.

C. HMMA: Hollow Metal Manufacturers Association.

D. NAAMM: National Association of Architectural Metal Manufacturers.

E. NFPA: National Fire Protection Association.

F. SDI: Steel Door Institute.

G. UL: Underwriters Laboratories.

1.04 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2024.

C. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames; 2020.

D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.

E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2020.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.
H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.
I. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.
J. ASTM C476 - Standard Specification for Grout for Masonry; 2023.
K. BHMA A156.115 - Hardware Preparation in Steel Doors and Frames; 2016.
L. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
M. ITS (DIR) - Directory of Listed Products; Current Edition.
N. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.
O. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.
P. NAAMM HMMA 840 - Guide Specifications for Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2024.
Q. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.
R. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.
S. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.
T. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2023.
U. UL (DIR) - Online Certifications Directory; Current Edition.
V. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.
B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.
C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

F. Manufacturer's Qualification Statement.

G. Installer's Qualification Statement.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide hollow metal doors and frames from SDI Certified manufacturer: https://steeldoor.org/sdi-certified/#sle.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

C. Maintain at project site copies of reference standards relating to installation of products specified.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames: Subject to compliance with requirements, provide one of the following or comparable product;

1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
2. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
3. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
4. Steelcraft, an Allegion brand: www.allegion.com/#sle.
5. Substitutions: See Section 016000 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:

1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
2. Accessibility: Comply with ICC A117.1 and ADA Standards.
3. Door Edge Profile: Manufacturers standard for application indicated.
4. Typical Door Face Sheets: Flush.

5. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturer's standard.
6. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
7. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
    a. Based on NAAMM HMMA Custom Guidelines: Provide at least A25/ZF75 (galvannealed) for interior applications, and at least A60/ZF180 (galvannealed) or G60/Z180 (galvanized) for corrosive locations.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

A. Door Finish: Factory primed and field finished.

B. Interior Doors, Non-Fire-Rated:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    a. Level 2 - Heavy-duty.
    b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
    c. Model 2 - Seamless.
    d. Door Face Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.
2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
3. Door Thickness: 1-3/4 inches (44.5 mm), nominal.

C. Fire-Rated Doors:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    a. Level 3 - Extra Heavy-duty.
    b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.

c. Model 2 - Seamless.
d. Door Face Metal Thickness: 16 gauge, 0.053 inch (1.3 mm), minimum.

2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
3. Provide units listed and labeled by UL (DIR) or ITS (DIR).
   a. Attach fire rating label to each fire rated unit.
4. Door Thickness: 1-3/4 inches (44.5 mm), nominal.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
B. Frame Finish: Factory primed and field finished.
C. Exterior Door Frames: Full profile/continuously welded type.
   1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
   2. Frame Metal Thickness: 14 gauge, 0.067 inch (1.7 mm), minimum.
   3. Weatherstripping: Separate, see Section 087100.
D. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
   1. Frame Metal Thickness: 16 gauge, 0.053 inch (1.3 mm), minimum.
E. Door Frames, Fire-Rated: Full profile/continuously welded type.
   1. Fire Rating: Same as door, labeled.
   2. Frame Metal Thickness: 16 gauge, 0.053 inch (1.3 mm), minimum.
F. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.
G. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
H. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches (102 mm) high to fill opening without cutting masonry units.
I. Frames Wider than 48 inches (1219 mm): Reinforce with steel channel fitted tightly into frame head, flush with top.

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.
B. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15 mil, 0.015 inch (0.4 mm) dry film thickness (DFT) per coat; provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

1. Fire-Rated Frames: Comply with fire rating requirements indicated.

2.06 ACCESSORIES

A. Astragals and Edges for Double Doors: Pairs of door astragals, and door edge sealing and protection devices.
   1. UL listed products in compliance with requirements of authorities having jurisdiction.
   2. Provide recessed astragal to cover or fill space for full door height between pair of doors or door and adjacent jamb.

B. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches (102 mm) as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.

C. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

D. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Install fire rated units in accordance with NFPA 80.

C. Coordinate frame anchor placement with wall construction.

D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

E. Install door hardware as specified in Section 087100.
   1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.

F. Touch up damaged factory finishes.

3.04 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch (1.6 mm) measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

B. Adjust sound control doors so that seals are fully engaged when door is closed.

C. Test sound control doors for force to close, latch, and unlatch; adjust as necessary in compliance with requirements.

END OF SECTION

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SECTION 081416
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush and flush glazed configuration; fire-rated and non-rated.

B. Door security shade(s).

1.02 RELATED REQUIREMENTS

A. Section 081113 - Hollow Metal Doors and Frames.

B. Section 087100 - Door Hardware.

C. Section 088000 - Glazing.

D. Section 097800: Interior Wall Paneling

E. Section 08 1116 - Aluminum Doors and Frames

F. Section 122400 - Window Shades: Blackout shade fabric.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

C. AWI (QCP) - Quality Certification Program; Current Edition.

D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

E. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

F. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.

1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
2. Include certification program label.

D. Samples: Submit two samples of door construction, 8 by 10 inches (203 by 254 mm) in size cut from top corner of door.

E. Samples: Submit two samples of door veneer, 8 by 10 inches (203 by 254 mm) in size illustrating wood grain, stain color, and sheen.
F. Samples for Selection: Submit color charts of manufacturer's full range of colors.
G. Samples for Verification: Submit two full unit samples demonstrating, shade assembly, mounting brackets, hembar and shade fabric.
    1. Approved sample may be incorporated into the work.
H. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
I. Manufacturer's Installation Instructions: Indicate special installation instructions.
J. Installer's qualification statement.
K. Specimen warranty.
L. Warranty, executed in Owner's name.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.
    1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.
C. Woodwork Quality Assurance Program:
    1. Comply with AWI (QCP) woodwork association quality assurance service/program in accordance with requirements for work specified in this section; www.awiqcp.org/#sle.
    2. Provide labels indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
    3. Provide designated labels on shop drawings as required by quality assurance program.
    4. Provide designated labels on installed products as required by quality assurance program.
    5. Submit documentation upon completion of installation that verifies this work is in compliance with specified requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.
B. Accept doors on site in manufacturer's packaging, and inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty - Doors: Provide manufacturer's warranty on interior doors for the life of the installation. Complete forms in Owner's name and register with manufacturer.

1. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

C. Manufacturer Warranty - Door Security Shade: Provide manufacturer's warranty for defects of materials and workmanship for a period of 15 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Product: Wood Veneer Faced Doors: subject to compliance with requirements provide doors by VT Industries, Inc, Heritage Series or comparable product by one of the following;

1. Haley Brothers: www.haleybros.com/#sle.
2. Marshfield-Algoma
3. Masonite Architectural; Aspiro Select Wood Veneer Doors: www.architectural.masonite.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

2.02 DOORS AND PANELS

A. Doors: See drawings for locations and additional requirements.

1. Quality Standard: Premium Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Interior Doors: 1-3/4 inches (44 mm) thick unless otherwise indicated; flush construction.

1. Provide solid core doors at each location.
2. Wood veneer facing with factory transparent finish as indicated on drawings.

2.03 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.

1. Core for doors with over 40% cut-out for lights or louvers: structural composite lumber core.

2.04 DOOR FACINGS

A. Veneer Facing for Transparent Finish: White birch, HPVA Grade A, rotary cut, with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
   1. Vertical Edges: Same species as face veneer.
   2. "Running Match" each pair of doors and doors in close proximity to each other.
   3. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet (3 m) of each other when doors are closed.
   4. Transoms: Continuous match to doors.
B. Facing Adhesive: Type I - waterproof.

2.05 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.
B. Cores Constructed with stiles and rails:
   1. Provide solid blocks at lock edge for hardware reinforcement.
   2. Provide solid blocking for other throughbolted hardware.
C. Where supplementary protective edge trim is required, install trim after veneer facing has been applied full-width.
D. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
E. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
F. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
G. Provide edge clearances in accordance with the quality standard specified.

2.06 FINISHES - WOOD VENEER DOORS

A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 1, Lacquer, Nitrocellulose.
      b. Stain: As selected by Architect.
      c. Sheen: Flat.

2.07 ACCESSORIES

A. Hollow Metal Door Frames: See Section 081113.

B. Glazed Openings:
   1. Heat-Strengthened and Fully Tempered Glass: ASTM C1048.
   2. Fire-Protection-Rated Glass: Safety Certification, 16 CFR 1201, Category II.
C. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.
D. Astragals for Fire-Rated Double Doors: Steel, T shaped, overlapping and recessed at face edge, specifically for double doors.
E. Door Security Shade (Type RS-7): Roller shade to block vision when deployed.
   1. Size: Roller shade to be 4 inches (100 mm) wider and taller than door lite. See door schedule for lite sizes.
   2. Fabric: Blackout shade fabric, see Section 122400 - Window Shades.
   3. Basis-of-Design Product: Subject to compliance with requirements provide The Specialty Group; The Security Roll or comparable product.
      a. Substitutions: See Section 016000-Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify that opening sizes and tolerances are acceptable.
C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.
   1. Install fire-rated doors in accordance with NFPA 80 requirements.
B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
C. Use machine tools to cut or drill for hardware.
D. Coordinate installation of doors with installation of frames and hardware.
E. Coordinate installation of glazing.
F. Mount door security shade to secure side, face of door, above door lite.

3.03 TOLERANCES

A. Comply with specified quality standard for fit and clearance tolerances.
B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

END OF SECTION

SECTION 083113
ACCESS DOORS AND FRAMES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Access doors and frames.
   2. Fire-rated access doors and frames.
   3. Access panels for items of mechanical, plumbing and electrical Work located behind or above finished walls or ceilings which require access, whether or not such panels are indicated on Drawings. All access panel locations shall be approved by Architect prior to installation.

B. Related Requirements:
   1. Section 017419 - Construction Waste Management and Disposal.
   2. Section 099123 - Interior Painting for field painting of access doors and frames where indicated.

C. Sustainable Design Requirements:
   1. The Owner requires the Contractor to implement practices and procedures to meet the Project's environmental performance goals, which include achieving LEED v4.1 certifications.
      a. Refer to Section 018113.14 - Sustainable Design Requirements for the Project's target certification level and specific third party certification requirements.
      b. The Contractor shall ensure that the requirements related to the Project's sustainability design goals are implemented to the fullest extent.
      c. Substitutions, or other changes to the work proposed by the Contractor or their Subcontractors, shall not be allowed if such changes compromise the Project's sustainability goals and third party certifications.

1.02 ACTION SUBMITTALS

A. Sustainable Design Submittals: For all permanently installed products and materials related to the work of this Section, submit product and material documentation to comply with and contribute to the Project's LEED requirements.

B. Product Data: For each type of product.

C. Samples: For each type of access door and frame and for each finish specified.

D. Product Schedule: For access doors and frames.

PART 2 PRODUCTS

2.01 SUSTAINABLE DESIGN PERFORMANCE REQUIREMENTS

A. For all permanently installed products and materials related to the work of this Section, provide products and materials that meet the Project's LEED performance criteria.

B. For all permanently installed low-emitting products and materials (paints & coatings, adhesives and sealants, flooring, wall panels, ceilings, insulation, and composite wood) related to the work of this Section, provide products and materials that meet the Project's LEED performance criteria.

2.02 ACCESS DOORS AND FRAMES

A. General: For all types of access doors indicated in this article, review with Architect prior to installation the size and location of any doors required by equipment manufacturer to be greater than 24 inches wide in any direction.

B. Flush Access Doors with Concealed Flanges :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    a. J. L. Industries, Inc.; Activar Construction Products Group, Inc.
    b. Milcor; Hart & Cooley, Inc.
    c. Nystrom, Inc.
2. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
3. Locations: Wall and Ceiling.
4. Door size(s) unless noted otherwise:
    a. Size : 18 inches wide by 18 inches high.
5. Metallic-Coated Steel Sheet for Door: Nominal 0.064 inch (1.63 mm), 16 gage factory primed.
6. Frame Material: Same material and thickness as door.
7. Latch and Lock: Manufacturer's standard key operated cam lock.

2.03 FIRE-RATED ACCESS DOORS AND FRAMES

A. General: For all types of access doors indicated in this article, review with Architect prior to installation the size and location of any doors required by equipment manufacturer to be greater than 24 inches wide in any direction.

B. Fire-Rated, Flush Access Doors with Concealed Flanges :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. J. L. Industries, Inc.; Activar Construction Products Group, Inc.
b. Milcor; Hart & Cooley, Inc.
c. Nystrom, Inc.

2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with concealed flange for gypsum board installation, self-closing door, and concealed hinge.
3. Optional Features: Gasketingand Masonry anchors.
4. Locations: Wall and ceiling.
5. Fire-Resistance Rating: Not less than that indicated.
6. Temperature-Rise Rating: 450 deg F (250 deg C) at the end of 30 minutes.
7. Metallic-Coated Steel Sheet for Door: Nominal 0.040 inch (1.02 mm), 20 gage, factory finished.
8. Frame Material: Same material, thickness, and finish as door.
9. Latch and Lock: Self-closing, self-latching door hardware, prepared for mortise cylinder.
10. Finish: Custom paint color to match adjacent finish.

C. Fire Rated, Flush Access Door with Exposed Flanges for CMU :
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. J.L. Industries, Inc.: Activar Construction Products Group, Inc.
b. Milcor: Hat & Cooley, Inc.
c. Nystrom, Inc.
2. Description: Door face flush with frame, with core of mineral-fiber insulation enclosed in sheet metal, with exposed flange for CMU installation, self-closing with concealed hinge.
3. Optional Features: Gasketing, and masonry anchors.
4. Location: Walls.
5. Fire-Resistance Rating: Not less than that indicated.
6. Temperature-Rise Rating: 450 deg F (250 deg C) at the end of 30 minutes.
7. Metallic-Coated Steel Sheet for Door: Nominal 0.040 inch (1.02mm) 20 gage, factory finished.
8. Frame Material: Same material, thickness and finish as door.
9. Latch and Lock: Self-closing, self-latching door hardware, prepared for mortise cylinder.
10. Door size: 24 inches x 24 inches unless noted otherwise.

11. Finish: Custom paint color to match adjacent finish.

D. Fire Rated, Recessed Access Doors with Concealed Flanges for Gypsum Board :
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. J. L. Industries, Inc.; Activar Construction Products Group, Inc.
      b. Milcor; Hart & Cooley, Inc.
      c. Nystrom, Inc.
   2. Description: Door face recessed with frame to receive gypsum board, with a core of mineral-fiber insulation enclosed in sheet metal; with concealed flange for gypsum board installation, self-closing door, and concealed hinge.
   3. Optional Features: Gasketing.
   4. Fire Resistance Rating: As indicated but not less than 90 minutes.
   5. Temperature-Rise Rating: 450 deg F (250 deg C) at the end of 30 minutes.
   6. Metallic-Coated Steel Sheet for Door: Nominal 0.040 inch (1.02 mm), 20 gage, factory finished.
   7. Frame Material: Same material, thickness, and finish as door.
   8. Latch and Lock: Self-closing, self-latching door hardware, prepared for mortise cylinder.
   9. Finish: Custom paint color to match adjacent finish.

E. Fire Rated, Tile Ready Access Door with Concealed Flanges AP- _____:
   1. Basis-of Design: Subject to compliance with requirements, provide Nystrom RUWK Series or comparable product from one of the following:
      a. J. L. Industries, Inc.; Activar Construction Products Group, Inc.
      b. Karp Associates, Inc.
      c. Milcor; Hart & Cooley, Inc.
      d. Nystrom, Inc.
   2. Description: Door face flush with frame with concealed flanges, self closing door and uninsulated, to receive tile by others.
   3. Fire Resistance Rating: As indicated, but not less than 90 minutes
   4. Temperature-Rise Rating: 450 deg F (250 deg C) at the end of 30 minutes.
   5. Metallic-Coated Steel Sheet for Door: Nominal 0.079 inch (2 mm) 14 gage, factory finished.
   6. Frame Material: Same material, and finish as door. Thickness 0.062 (1.6 mm), 16 gage, factory finished.

7. Latch and Lock: Self-closing, self-latching door hardware, prepared for mortise cylinder.
8. Finish: Manufacturer's standard finish and color.
9. Locations: All walls with Ceramic or Porcelain Tile Finishes.
10. Door size: 24 inches x 24 inches unless noted otherwise.

2.04 MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.
C. Frame Anchors: Same material as door face.
D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M.

2.05 FABRICATION

A. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
B. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
C. Latch and Lock Hardware:
    1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
    2. Keys: Furnish (2) two keys per lock and key all locks alike.

2.06 FINISHES

A. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
    1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
    2. Factory Finished: Apply manufacturer's standard baked-enamel or powder-coat finish immediately after cleaning and pretreating, with minimum dry-film thickness of 1 mil (0.025 mm) for topcoat.
        a. Color: As selected by Architect from full range of industry colors.

PART 3 EXECUTION

3.01 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Adjust doors and hardware, after installation, for proper operation.

3.02 FIELD QUALITY CONTROL

A. Inspections:

1. Fire-Rated Door Inspections: Inspect each fire-rated access door in accordance with NFPA 80, Section 5.2.

B. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

C. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

END OF SECTION

SECTION 083323
OVERHEAD COILING DOORS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Rolling Counter Doors.
   2. Exterior coiling doors.
   3. Interior non-fire-rated rolling service doors.
   4. Electric operators and control stations.
   5. Wiring from electric circuit disconnect to operators and control stations.

B. Related Sections include the following:
   1. Division 05 Section "Metal Fabrications" for miscellaneous steel supports.
   2. Section 260583 - Wiring Connections: Power to disconnect.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

D. ITS (DIR) - Directory of Listed Products; Current Edition.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

F. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).

G. UL (DIR) - Online Certifications Directory; Current Edition.

H. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.04 DEFINITIONS

A. Operation Cycle: One cycle of a door is complete when it is moved from the closed position to the fully open position and returned to the closed position.

1.05 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide door systems capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:
   1. Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft. (960 Pa)acting inward and outward.
   2. Impact Test for Flying Debris: Comply with ASTM E 1996, tested according to ASTM E 1886.
      a. Level of Protection: Basic Protection.
      b. Wind Zone: 110 mph(176 km/h), pressure test to 1/2 and 1-1/2 x design pressure (positive and negative).

B. Operation-Cycle Requirements: Provide components and operators capable of operating for not less than 20,000 cycles.

1.06 SUBMITTALS

A. Product Data: For each type and size of door and accessory. Include the following:
   1. Summary of forces and loads on walls and jambs.

B. Samples for Initial Selection: Manufacturer's color charts showing full range of colors available for units with factory-applied finishes.

C. Qualification Data: For Installer.

D. Closeout submittals: Operation and Maintenance manual.

E. See Section 013000 - Administrative Requirements for submittal procedures.

F. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.

G. Manufacturer's qualification statement.

H. Installer's qualification statement.

1.07 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by ITS (DIR), UL (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for purpose specified and indicated.

B. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

C. Source Limitations: Obtain all overhead doors through one source from a single manufacturer.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened labeled packaging until ready for installation.

B. Protect materials from exposure to moisture until ready for installation.

C. Store materials in a dry, ventilated weathertight location.

1.09 WARRANTY

A. Warranty: Manufacturer’s limited door and operators System warranty for 10 years against delamination of polystyrene foam from steel face and all other components for 1 year and covered under General Conditions of Contract.

PART 2 PRODUCTS

2.01 COUNTER DOOR - TYPE OH-4

A. Basis of Design: Cornell Rolling Counter Door ESC10.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Overhead Door Corp.
2. Cornell Iron Works Inc.
3. The Cookson Company.
4. Raynor.

C. Curtain Construction:

1. Fabricate coiling door curtain of interlocking slats in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows.

D. Slat Configuration: Aluminum interlocked flat-faced slats, 1 ½” by ½” deep, minimum 0.040-inch thickness, with extruded tubular aluminum bottom bar with continuous lift handle and vinyl astragal.

a. Finish: Custom color finish, powder coat.
b. Endlocks: Fabricate interlocking slat sections with high strength molded nylon endlocks riveted to ends of alternate slats.

E. Guides:

1. Fabrication: Heavy duty aluminum sections with snap-on cover to conceal fasteners. Provide polypropylene pile runners on both sides of curtain to eliminate metal to metal contact between guides and curtain.
2. Finish: Custom color finish, powder coat.

F. Counterbalancing Mechanism:

1. General: Counterbalance doors by means of adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to door curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
2. Counterbalance Barrel: Fabricate spring barrel of hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.
3. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast-steel barrel plugs to secure ends of springs to barrel and shaft.
4. Fabricate torsion rod for counterbalance shaft of cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

G. Brackets:
1. Fabricate from reinforced steel plate with bearings at rotating support points to support shaft assembly and form end closures.
2. Finish: As selected by Architect from Manufacturers standard colors.

H. Hood:
1. Min. 0.40-inch aluminum with reinforced top and bottom edges. Provide min. ½" steel intermediate support brackets. Clear anodized.

I. Operation:
1. Manual operation with crank hoist operator including crank gear box, steel crank drive shaft and geared reduction unit. Fabricate gear box to complete enclose operating mechanism and be oil-tight. Provide alloy steel hand chain with chain holder secured to operator guide.

J. Locking: Pad-lockable slide bolt on coil side of bottom bar at each jamb.

2.02 FINISHES, GENERAL

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.03 STEEL AND GALVANIZED STEEL FINISHES

A. Powder-Coat Finish: Manufacturer's standard powder-coat finish consisting of primer and topcoat according to coating manufacturer's written instructions for cleaning, pretreatment, application, thermosetting, and minimum dry film thickness.
   1. Color and Gloss: As selected by Architect from manufacturer's full range of up to 150 colors.

2.04 COILING DOORS

A. Exterior Coiling Doors; TYPE OH-1: Steel slat curtain.
   1. Basis-of-Design: Cornell Ironworks Rolling Service Door Model ESD20 or equal by one of the following:
      a. Overhead Door Corp.
      b. Raynor
      c. The Cookson Company
   2. Door Panel:
      a. Capable of withstanding positive and negative wind loads of 20 psf (940 Pa) without undue deflection or damage to components.
      b. Sandwich Slats: Manufacturer's standard, with core of foamed-in-place polyurethane insulation; minimum R-value of 4.88 (RSI-value of 0.86).
   3. Guide, Angles: Galvanized steel.
   4. Hood Enclosure: Manufacturer's standard; primed steel.
   5. Manual hand chain lift operation.
   6. Mounting: As indicated on drawings.
   7. Locking Devices: Slide bolt on inside.

B. Interior Non-Fire-Rated Rolling Service Doors; TYPE OH-3: Steel slat curtain.
   1. Basis-of-Design: Cornell Ironworks Rolling Service Door Model ESD10 or equal by one of the following:
      a. Overhead Door Corp.
      b. Raynor
      c. The Cookson Company
   2. Door Panel:
      a. Single Thickness Slats: Manufacturer's standard.
      b. Nominal Slat Size: 2 inches (50 mm) wide by required length.
   3. Guides, Angles: Galvanized steel.
   4. Electric operation.
   5. Mounting: As indicated on drawings.

2.05 MATERIALS

A. Metal Curtain Construction: Interlocking slats.
   1. Curtain Bottom for Slat Curtains: Fitted with angles to provide reinforcement and positive contact in closed position.
   2. Weatherstripping for Exterior Doors: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and where curtain enters hood enclosure of exterior doors.
   3. Steel Slats: Minimum thickness, ___ gauge, ___ inch (___ mm); ASTM A653/A653M galvanized steel sheet.

B. Guide Construction: Continuous, of profile to retain door in place with snap-on trim, mounting brackets of same metal.

C. Guides - Angle: ASTM A36/A36M metal angles, size as indicated.
   1. Hot-dip galvanized in compliance with ASTM A123/A123M.

D. Hood Enclosure and Trim: Internally reinforced to maintain rigidity and shape.

2.06 ELECTRIC OPERATION

A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.
   1. Provide interlock switches on motor operated units.

B. Electric Operators:
   1. Mounting: Side mounted.
   2. Motor Enclosure:
   3. Motor Rating: 1/3 HP (250 W); continuous duty.
   4. Motor Voltage: 120 volts, single phase, 60 Hz.
   5. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
   6. Controller Enclosure: NEMA 250, Type 4.
   7. Opening Speed: 12 inches per second (300 mm/sec).
   8. Brake: Manufacturer's standard type, activated by motor controller.
   9. Manual override in case of power failure.
   10. See Section 260583 for electrical connections.

C. Control Station: Provide standard three button, 'Open-Close-Stop' momentary-contact control device for each operator complying with UL 325.
   1. 24 volt circuit.
   2. Surface mounted, at interior door jamb.

3. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
    a. Primary Device: Provide electric sensing edge, wireless sensing, NEMA 1 photo eye sensors, or NEMA 4X photo eye sensors as required with momentary-contact control device.

D. Safety Edge: Located at bottom of coiling door, full width, electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object, hollow neoprene covered.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that adjacent construction is suitable for door installation.
B. Verify that electrical services have been installed and are accessible.
C. Verify that door opening is plumb, header is level, and dimensions are correct.
D. Notify Architect of any unacceptable conditions or varying dimensions.
E. Commencement of installation indicates acceptance of substrate and door opening conditions.

3.02 INSTALLATION

A. General: Install overhead doors and operating equipment complete with necessary hardware, jamb and head molding strips, anchors, inserts, hangers, and equipment supports.
B. Demolition: Remove existing construction. Prepare opening for installation of new door assembly.
C. Install units in accordance with manufacturer's instructions.
D. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
E. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
F. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
G. Coordinate installation of electrical service with Section 260583.
H. Complete wiring from disconnect to unit components.
I. Install enclosure and perimeter trim.

3.03 ADJUSTING

A. Lubricate bearings and sliding parts; adjust doors to operate easily, free of warp, twist, or distortion and with weathertight fit around entire perimeter.

B. Adjust operating assemblies for smooth and noiseless operation.

3.04 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors. Refer to Division 01 Section "Demonstration and Training."

3.05 CLEANING

A. Clean installed components.

B. Remove labels and visible markings.

END OF SECTION

SECTION 083613
SECTIONAL DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Overhead sectional doors, electrically operated.

B. Operating hardware and supports.

C. Electrical controls.

1.02 RELATED REQUIREMENTS

A. Section 055000 - Metal Fabrications: Steel channel opening frame.

B. Section 079200 - Joint Sealants: Sealing joints between frames and adjacent construction.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

B. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

C. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

D. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

E. DASMA 102 - American National Standard Specifications for Sectional Doors; 2018.

F. ITS (DIR) - Directory of Listed Products; Current Edition.

G. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).

H. NEMA MG 1 - Motors and Generators; 2021.

I. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. UL (DIR) - Online Certifications Directory; Current Edition.

L. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.
C. Product Data: Show component construction, anchorage method, and hardware.
D. Samples: Two panel finish samples, 4 by 4 inch (101 by 101 mm) in size, illustrating color and finish.
E. Manufacturer's Installation Instructions: Include any special procedures required by project conditions.
F. Manufacturer's qualification statement.
G. Installer's qualification statement.
H. Operation Data: Include normal operation, troubleshooting, and adjusting.
I. Maintenance Data: Include data for motor and transmission, shaft and gearing, lubrication frequency, spare part sources.
J. Specimen warranty.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years documented experience.
C. Comply with applicable code for motor and motor control requirements.
D. Products Requiring Electrical Connection: Listed and classified by ITS (DIR), UL (DIR), or testing firm acceptable to authorities having jurisdiction, as suitable for purpose specified.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals for warranty requirements.
B. Extended Correction Period: Correct defective work within a 2-year period commencing on Date of Substantial Completion.
C. Manufacturer Warranty: Provide 5-year manufacturer warranty for electric operating equipment. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Performance: Withstand positive and negative wind loads equal to 1.5 times design wind loads specified by local code without damage or permanent set, when tested in accordance with ASTM E330/E330M, using 10 second duration of maximum load.
B. Air Leakage Rate: Less than 0.40 cfm/sq ft (2.0 L/sec/sq m) when tested in accordance with ASTM E283/E283M at test pressure difference of 1.57 psf (75 Pa).

C. Thermal Transmittance: U-factor (Usi-factor) of 0.31 Btu/hr sq ft degrees F (1.76 W/sq m K), maximum, in accordance with DASMA 102.

2.02 ALUMINUM DOORS

A. Type OH-2 - Doors: Stile and rail aluminum with glazed panels; standard lift operating style with track and hardware; complying with DASMA 102, Commercial application.
   1. Door Panels: Paneled aluminum construction; extruded aluminum stiles and rails; panels glazed as indicated, stile and rail joints welded; rabbeted weather joints at meeting rails.
   2. Configuration: As indicated on Drawings.
   3. Door Nominal Thickness: 1-3/4 inches (45 mm) thick.
   4. Finish: Factory anodized; Dark bronze anodized.
   5. Glazed Lites: Four glazed panels per row, One row per panel, All panels glazed; set in place with resilient glazing channel.
      a. Glazing: Fully tempered glass; insulated glass units; clear; 1 inch (25.4 mm) overall thickness; Refer to Drawings and Specification Section 088000 - Glazing for glass type to be provided in Section Door.
   6. Electric Operation: Electric control station.

B. Products: Subject to compliance with requirements, provide Overhead Door Company, Model 511 or comparable product by one of the following;
   1. Clopay Building Products
   2. Raynor Garage Doors
   3. Wayne-Dalton, a Division of Overhead Door Corporation
   4. Substitutions: See Section 016000-Product Requirements.

2.03 COMPONENTS

A. Track: Rolled galvanized steel, 0.090 inch (2.3 mm) minimum thickness; 2 inch (50 mm) wide, continuous one piece per side; galvanized steel mounting brackets 1/4 inch (6 mm) thick.

B. Hinge and Roller Assemblies: Heavy duty hinges and adjustable roller holders of galvanized steel; floating hardened steel bearing rollers, located at top and bottom of each panel, each side.

C. Lift Mechanism: Torsion spring on cross head shaft, with braided galvanized steel lifting cables.
   1. For Manual Operation: Requiring maximum exertion of 25 lbs (110 N) force to open.

D. Sill Weatherstripping: Resilient hollow rubber strip, one piece; fitted to bottom of door panel, full length contact.
E. Jamb Weatherstripping: Roll formed steel section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.
F. Head Weatherstripping: EPDM rubber seal, one piece full length.
G. Panel Joint Weatherstripping: Neoprene foam seal, one piece full length.
H. Lock: Inside center mounted, adjustable keeper, spring activated latch bar with feature to retain in locked or retracted position; interior and exterior handle.
I. Lock Cylinders: Keyed alike.

2.04 MATERIALS

A. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G60/Z180 coating, plain surface.
B. Aluminum Extrusions: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
C. Float Glass: Provide glazing as specific in Section 088000 - Glazing.
    1. Heat-Strengthened and Fully Tempered Types: ASTM C1048.
D. Insulation: Foamed-in-place polyurethane, bonded to facing.
    1. Same thickness as core framing members.

2.05 ELECTRIC OPERATION

A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.
    1. Provide interlock switches on motor operated units.
    2. Provide tamperproof operation cycle counter.
B. Electric Operators:
    1. Mounting: Side mounted on cross head shaft.
    2. Motor Enclosure:
        a. Exterior Doors: NEMA MG 1, Type 4; open drip proof.
    3. Motor Rating: 1/2 hp (375 W); continuous duty.
    4. Motor Voltage: 120 volts, single phase, 60 Hz.
    5. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
    6. Controller Enclosure: NEMA 250, Type 1.
    7. Opening Speed: 12 inches per second (300 mm/s).
    8. Brake: Adjustable friction clutch type, activated by motor controller.
    9. Manual override in case of power failure.
    10. See Section 260583 for electrical connections.

C. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated; enclose terminal lugs in terminal box sized to comply with NFPA 70.

D. Control Station: Provide standard three button (Open-Close-Stop) momentary-contact control device for each operator complying with UL 325.

1. 24 volt circuit.
2. Surface mounted, at interior door jamb.
3. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
    a. Primary Device: Provide electric sensing edge, wireless sensing, NEMA 1 photo eye sensors, or NEMA 4X photo eye sensors as required with momentary-contact control device.

E. Safety Edge: Located at bottom of sectional door panel, full width; electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object; hollow neoprene covered to provide weatherstrip seal.

F. Provide interconnection to security system.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.

B. Verify that electric power is available and of the correct characteristics.

3.02 PREPARATION

A. Prepare opening to permit correct installation of door unit to perimeter air and vapor barrier seal.

B. Apply primer to wood frame.

3.03 INSTALLATION

A. Install door unit assembly in accordance with manufacturer's instructions.

B. Anchor assembly to wall construction and building framing without distortion or stress.

C. Securely brace door tracks suspended from structure. Secure tracks to structural members only.

D. Fit and align door assembly including hardware.

E. Coordinate installation of electrical service. Complete power and control wiring from disconnect to unit components.

3.04 TOLERANCES

A. Maximum Variation from Plumb: 1/16 inch (1.5 mm).

B. Maximum Variation from Level: 1/16 inch (1.5 mm).

C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch (3 mm) from 10 ft (3 m) straight edge.

D. Maintain dimensional tolerances and alignment with adjacent work.

3.05 ADJUSTING

A. Adjust door assembly for smooth operation and full contact with weatherstripping.

B. Have manufacturer's field representative present to confirm proper operation and identify adjustments to door assembly for specified operation.

3.06 CLEANING

A. Clean doors and frames and glazing.

B. Remove temporary labels and visible markings.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

B. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

END OF SECTION

SECTION 084313
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.
B. Aluminum-framed storefront, reinforced, sunshade brackets, with vision glass.
C. Operable glazed units set in storefront system.
D. Aluminum doors and frames.
E. Weatherstripping.

1.02 RELATED REQUIREMENTS

A. Section 087100 - Door Hardware: Hardware items other than specified in this section.
B. Section 088000 - Glazing: Glass and glazing accessories.
C. Section 107113.43 - Fixed Sun Screens: Sunshades attached to storefront where indicated.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.
B. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2015.
C. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.
D. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
E. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.
F. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

I. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

J. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

K. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Coordinate sunshade design and finish with storefront where indicated. See Section 107113.43 - Fixed Sun Screens.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.

C. Shop Drawings: Indicate system dimensions for each size storefront, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.

1. Indicate sunshade bracket locations and required framing reinforcement.

D. Design Data - System with Sun Shades: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.

E. Field Quality Control Submittals: Report of field testing for water penetration.

F. Designer's qualification statement.

G. Specimen warranty.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.07 MOCK-UPS

A. Provide window system complete with sunshade brackets and sun shades.

B. Locate where directed.

C. Mock-up may remain as part of work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.09 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.10 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING

A. Center-Set Style, Thermally-Broken: Reinforced, with sun shade brackets. Subject to compliance with requirements, provide the following:

1. Basis of Design, SF-2: Kawneer; Trifab VersaGlaze 451T Framing System.

B. Front-Set Style, Thermally-Broken: Subject to compliance with requirements, provide the following:

1. Basis of Design, SF-1: Kawneer; Trifab VersaGlaze 451T Framing System.
2. Basis of Design, SF-3: Kawneer; Trifab VersaGlaze 601T Framing System.
3. Basis of Design, SF-4: Kawneer; Trifab VersaGlaze 451T Framing System configured to create butt-glazed corners integrated into standard framing system as indicated in Drawings.

C. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:

1. EFCO LLC
2. YKK AP

2.02 BASIS OF DESIGN -- SWINGING DOORS

A. Wide Stile, Monolithic Glazing (Interior): Subject to compliance with requirements, provide the following:

1. Basis of Design: Kawneer.

2. Thickness: 1-3/4 inches (43 mm).

B. Wide Stile, Insulating Glazing, Thermally-Broken: Subject to compliance with requirements, provide the following:
   1. Basis of Design: Kawneer; Insulpour 500T Thermal Entrance
   2. Thickness: 1-3/4 inches (43 mm).

C. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
   1. EFCO LLC
   2. YKK AP America

2.03 ALUMINUM-FRAMED STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Glazing Position: Varies as indicated in Drawings and Basis-of-Design article.
   2. Vertical Mullion Dimensions; SF-1: 2 inches wide by 4-1/2 inches deep (50 mm wide by 114 mm deep).
   3. Vertical Mullion Dimensions; SF-2: 2-1/4 inches wide (verticals only for reinforcing) by 4-1/2 inches deep (56 mm wide by 114 mm deep).
   4. Vertical Mullion Dimensions; SF-3: 2 inches wide by 6 inches deep (50 mm wide by 152 mm deep).
   5. Finish: Superior performing organic coatings.
      a. Factory finish all surfaces that will be exposed in completed assemblies.
      b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
   6. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
   7. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
   8. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
   9. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.

10. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
11. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
12. Maintain continuous air barrier and/or vapor retarder seal throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel, and heel bead of glazing compound.

B. Performance Requirements
1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
   a. Design Wind Loads: Comply with requirements of ASCE 7 for wind pressures indicated.
   b. Member Deflection: Limit member deflection to 1/175 in any direction, with full recovery of glazing materials.
2. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf (390 Pa).
3. Air Leakage: 0.03 cfm/sq ft maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 6.27 psf (300 Pa) pressure difference.

2.04 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
1. Framing members for interior applications need not be thermally broken.
2. Glazing Stops: Flush.
3. Subsill: Manufacturer's standard aluminum extrusion.
   a. End Dams: Provide aluminum end dams for each length of subsill.

B. Glazing: See Section 088000.

C. Swing Doors: Glazed aluminum.
1. Thickness: 1-3/4 inches (43 mm).
2. Top Rail: 8-1/2 inches (215 mm) wide.
3. Vertical Stiles: 7 inches (178 mm) wide.
4. Intermediate Rail: Match height of top rail.

5. Bottom Rail: 12 inches (305 mm) wide.
6. Glazing Stops: Square.
7. Finish: Same as storefront.

D. Sunshades: See Section 107113.43 - Fixed Sun Screens for sunhsades and extension plates.

E. Sunshade Outrigger Brackets:
1. Manufacturer's standard brackets designed to attach to face of storefront system and support sunshade element.
2. Basis-of-Design Sun Shade Brackets: Subject to compliance with requirements, provide Kawneer Outrigger Bracket, 494200, or an approved comparable bracket compatible with and designed for specified system.
3. Color and Coating: Match storefront finish and color.

F. Operable Sash: Aluminum project-out awning and casement style; finished to match storefront; turn handle latch with manufacturer's standard insect screen.
1. Size: As indicated on Drawings
2. Glazing: 1" IGU, Type as indicated on Drawings
3. Basis of Design: Kawneer Glassvent Windows or equal as determined by Architect
4. System Dimensions: 2 3/4" Overall System Depth
5. Hardware: Stainless Steel 4-bar hinges; Cast White Bronze Cam Lock

G. Transaction Window: Vertical Sliding Service Window
1. Size: 24" x 36", or as indicated on Drawings
2. Material: Anodized Aluminum, color to be selecte
3. Orientation: Vertical Sliding
4. Glazing: 1/4" tempered
5. Basis of Design Product: CR Laurence Vertical Sliding Service Window Model # V2436NS

2.05 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Fasteners: Stainless steel.

C. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

D. Reinforcement: Manufacturer's standard reinforcing required to accommodate sunshade attachment and structural loads.

2.06 FINISHES

A. High Performance Organic Coating - Interior: AAMA 2604; multiple coats, thermally cured fluoropolymer system.

B. Superior Performing Organic Coatings System - Exterior: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch (0.030 mm).

C. Color: As selected by Architect from manufacturer's full range.

2.07 HARDWARE

A. Other Door Hardware: See Section 087100.

B. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.

C. Sill Sweep Strips: Resilient seal type, of neoprene; provide on all doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install subsill with sill and perimeter flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate subsill and sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Install operating sash.

J. Set thresholds in bed of sealant and secure.

K. Install glass and infill panels using glazing method required to achieve performance criteria; see Section 088000.

L. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet (1.5 mm per m) non-cumulative or 0.06 inch per 10 feet (1.5 mm per 3 m), whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for general testing and inspection requirements.

B. Water-Spray Test: Provide water spray quality test of installed storefront components in accordance with AAMA 501.2 during construction process and before installation of interior finishes.

1. Perform a minimum of two tests in each designated area as directed by Architect.
2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.

C. Repair or replace storefront components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.05 ADJUSTING

A. Adjust operating hardware and sash for smooth operation.

3.06 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.

C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 084413
GLAZED ALUMINUM CURTAIN WALLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed curtain wall, with vision glazing and infill panels.

1.02 RELATED REQUIREMENTS

A. Section 051200 - Structural Steel Framing: Steel attachment members.

B. Section 084229 - Automatic Entrances.

C. Section 088000 - Glazing.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.

B. AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems; 2015.

C. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems; 2014.

D. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.

E. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

F. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

G. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

H. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

I. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

J. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

K. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

L. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015 (Reapproved 2022).

M. ASTM C793 - Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants; 2023.
N. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
O. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2023.
P. ASTM C1135 - Standard Test Method for Determining Tensile Adhesion Properties of Structural Sealants; 2019.
Q. ASTM C1184 - Standard Specification for Structural Silicone Sealants; 2023.
R. ASTM C1249 - Standard Guide for Secondary Seal for Sealed Insulating Glass Units for Structural Sealant Glazing Applications; 2018 (Reapproved 2023).
S. ASTM C1401 - Standard Guide for Structural Sealant Glazing; 2023.
T. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.
U. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.
V. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2023).
W. ASTM E413 - Classification for Rating Sound Insulation; 2022.
X. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015 (Reapproved 2023).
Y. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.
B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.
B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, internal drainage details, glazing, and infill.
C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.

1. Provide details of proposed structural sealant glazing (SSG) at indicated locations and weather sealant joints indicating dimensions, materials, bite, thicknesses, profile, and support framing.

D. Samples: Submit two samples 12 by 12 inches (305 by 305 mm) in size illustrating finished aluminum surface, glazing, and glazing materials.

E. Design Data: Provide framing member structural and physical characteristics and engineering calculations, and identify dimensional limitations; include load calculations at points of attachment to building structure.

F. Test Reports: Submit results of full-size mock-up testing. Reports of tests previously performed on the same design are acceptable.

G. Field Quality Control Submittals: Report of field testing for water penetration.

H. Designer's Qualification Statement.

I. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Design curtain wall and its structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the State in which the Project is located.

B. Verify that each component is appropriate for use in structural sealant glazing (SSG) application in regards to at least the following properties: size, shape, dimensions, material, durability, storage conditions, and color.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than three years of documented experience.

1. Provide certified glass products through ANSI accredited certifications that include plant audits and independent laboratory performance testing.
    a. Insulating Glass Certification Council (IGCC).
    b. Safety Glazing Certification Council (SGCC).

D. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.07 MOCK-UPS

A. See Section 014000 - Quality Requirements for additional requirements.

B. Construct mock-up, 6 feet (2 m) long by 4 feet (1.25 m) wide, indicating each component being used on the project. Assemble to illustrate component assembly including glazing materials, weep drainage system, attachments, anchors, and perimeter sealant.

C. Mock-up may not remain as part of work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.09 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.10 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Assembly Warranty: The manufacturer agrees to repair or replace any components of the glazed aluminum curtain wall that fail to meet the requirements or exhibit defects in materials or workmanship within the warranty period. Failures include, but are not limited to:

1. Structural failures such as excessive deflection or related failures.
2. Deterioration of metals and other materials beyond normal weathering.
3. Water penetration through curtain wall system.
4. Warranty Period: Two years from date of Substantial Completion of the project.

C. Finish Warranty: Provide 20-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN - CURTAIN WALL SYSTEMS

A. Basis-of-Design Curtain Wall System: Subject to compliance with requirements, provide Kawneer 1600 System Curtain Wall System. System to consist of a combination of standard glazed system with SSG system in select locations.

B. Other Manufacturers: Provide either product identified as "Basis-of-Design" or an approved comparable product of one of the manufacturers listed below.

1. Pittco Architectural Metals Inc: www.pittcometals.com/#sle.

2. YKK..

C. Substitutions: See Section 016000 - Product Requirements.
   1. For any product not identified as "Basis of Design", submit information as specified for substitutions.

2.02 CURTAIN WALL

A. Aluminum-Framed Curtain Wall: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Structural sealant glazing (SSG) adhesive on two (2)-sides, with temporary glazing stops, and pressure plate and mullion cover on 2-sides, where indicated on drawings.
      a. SSG Glazing locations indicated on Drawings.
   2. Glazing Method: Field glazed system.
   3. Vertical Mullion Face Width: 2-1/2 inches (63.5 mm).
   4. Vertical Mullion Depth From Face of Glazing to Back of Frame: 6-1/2 inches.
   5. Finish: Superior performing organic coatings.
      a. Factory finish surfaces that will be exposed in completed assemblies.
      b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
      c. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
   6. Provide flush joints and corners, weathersealed, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads.
   7. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
   8. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
   9. Maintain continuous air barrier and/or vapor retarder seal throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.

B. Structural Performance Requirements: Design and size components to withstand the following load requirements without damage or permanent set.

1. Design Wind Loads: Comply with the requirements of ASCE 7 and loads indicated on Drawings.
    a. Member Deflection: For spans less than 13 feet 6 inches (4115 mm), limit member deflection to flexure limit of glass in any direction, and maximum of 1/175 of span or 3/4 inch (19 mm), whichever is less and with full recovery of glazing materials.
    b. Member Deflection: For spans over 13 feet 6 inches (4115 mm) and less than 40 feet (12.2 m), limit member deflection to flexure limit of glass in any direction, and maximum of 1/240 of span plus 1/4 inch (1/240 of span plus 6.4 mm), with full recovery of glazing materials.
2. Movement: Accommodate the following movement without damage to components or deterioration of seals:
    a. Expansion and contraction caused by 180 degrees F (82 degrees C) surface temperature.
    b. Expansion and contraction caused by cycling temperature range of 170 degrees F (77 degrees C) over a 12 hour period.
    c. Movement of curtain wall relative to perimeter framing.
    d. Deflection of structural support framing, under permanent and dynamic loads.
3. Structural Sealant Glazing (SSG) System: For individual glass lites, design framing members to not exceed a deflection normal to the wall of L/175 between supports with 3/4 inch (19 mm) maximum, and a deflection parallel to the wall of L/360 with 1/8 inch (3.2 mm) maximum, whichever is less.

C. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on indoor face when tested as follows:
1. Test Pressure Differential: 10 psf (480 Pa).
2. Test Method: ASTM E331.

D. Air Leakage: 0.06 cfm/sq ft (0.3 L/sec sq m) maximum leakage of wall area when tested in accordance with ASTM E283/E283M at 6.24 psf (300 Pa) pressure difference across assembly.

E. Thermal Performance Requirements:
1. Condensation Resistance Factor of Framing: 70, minimum, measured in accordance with AAMA 1503.
2. Overall U-value Including Glazing: 0.37 Btu/(hr sq ft deg F) (_____ W/(sq m K)), maximum.

F. Acoustical Performance Requirements:
   1. Sound Attenuation: STC of 34, minimum, from exterior to interior.
   2. Test Method: ASTM E90, with calculation in accordance with ASTM E413.

2.03 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
   1. Cross-Section: As indicated on drawings.
B. Glazing: See Section 088000.

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).
B. Structural Steel Sections: ASTM A36/A36M; galvanized in accordance with requirements of ASTM A123/A123M.
C. Structural Supporting Anchors: See Section 051200.
D. Structural Supporting Anchors Attached to Structural Steel: Design for bolted attachment.
E. Exposed Flashings: Aluminum sheet, 20-gauge, 0.032-inch (0.81 mm) minimum thickness; finish to match framing members.
F. Concealed Flashings: Stainless steel, 26-gauge, 0.0187-inch (0.48 mm) minimum thickness.
G. Structural Sealant Glazing (SSG) Adhesive: Neutral curing, silicone sealant formulated for SSG applications in compliance with ASTM C1184 and structural glazing industry guidelines, ASTM C1401.
   1. SSG adhesive in compliance with ASTM C920; Type S - Single-component, Grade NS, Class 50, Use NT, G, and A.
   2. Ultimate Tensile Strength: Minimum of 50 psi (345 kPa) as determined by test method ASTM C1135 under the following conditions.
      a. Exposure to air temperatures of 190 degrees F (88 degrees C) and minus 20 degrees F (minus 29 degrees C).
      b. Water immersion for seven (7) days, minimum.
      c. Exposure to weathering for 5,000 hours, minimum.
   3. Sealant Design Tensile Strength: 20 psi (139 kPa), maximum.
   4. Hardness: 20 to 60 with Type A-2 durometer in compliance with test method ASTM C661.
   5. Color: Black.

6. SSG sealant tested for compatibility with glazing accessories in compliance with ASTM C1087, tested for accelerated weathering in compliance with ASTM C793, and in compliance with insulating glass secondary sealant design standards of ASTM C1249.

H. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

I. Glazing Accessories: See Section 088000.

J. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

2.05 FINISHES

A. Superior Performing Organic Coatings System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of aluminum extrusion and panels surfaces having minimum total dry film thickness (DFT) of 1.2 mils, 0.0012 inch (0.030 mm).

B. Color: To be selected by Architect from manufacturer's custom range.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install curtain wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

H. Pressure Plate Framing: Install glazing using glazing method required to achieve performance criteria; see Section 088000.

I. Structural Sealant Glazing (SSG) Adhesive: Install structural sealant glazing adhesive and weatherseal sealant in accordance with manufacturer's instructions.

J. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.02 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet (1.5 mm/m) noncumulative or 0.5 inches per 100 feet (12 mm/30 m), whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

C. Sealant Space Between Curtain Wall Mullions and Adjacent Construction: Maximum of 3/4 inch (19 mm) and minimum of 1/4 inch (6 mm).

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.

B. Water-Spray Test: Provide water spray quality test of installed curtain wall components in accordance with AAMA 501.2 during construction process and before installation of interior finishes.

1. Perform a minimum of two tests in each designated area as indicated on drawings.
2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.

C. Provide field testing of installed curtain wall system by independent laboratory in accordance with AAMA 503 during construction process and before installation of interior finishes.

1. Perform a minimum of two tests in each designated area as indicated on drawings.
2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.
3. Field test for water penetration in accordance with ASTM E1105 with uniform static air pressure difference (Procedure A) not less than 4.18 psf (200 Pa).
    a. Maximum allowable rate of water penetration in 15-minute test is 0.5 ounce (14 gram) that is not contained in an area with provisions to drain to exterior, or collected on surface of interior horizontal framing member.

D. Repair or replace curtain wall components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.04 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, take care to remove dirt from corners, and wipe surfaces clean.

C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

END OF SECTION

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Sliding doors.
3. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 06 Section “Rough Carpentry”.
2. Division 06 Section “Finish Carpentry”.
3. Division 08 Section “Hollow Metal Doors and Frames”.
4. Division 08 Section “Flush Wood Doors”.
5. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.
5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
3. Content: Include the following information:

    a. Type, style, function, size, label, hand, and finish of each door hardware item.
    b. Manufacturer of each item.
    c. Fastenings and other pertinent information.
    d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    e. Explanation of abbreviations, symbols, and codes contained in schedule.
    f. Mounting locations for door hardware.
    g. Door and frame sizes and materials.
    h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of

the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
b. Complete (risers, point-to-point) access control system block wiring diagrams.
c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

1.4 CLOSEOUT SUBMITTALS

A. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

B. Project Record Documents: Provide record documentation of as-built door hardware sets in digital format (.pdf, .docx, .xlsx, .csv) and as required in Division 01, Project Record Documents.

1.5 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that

indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

F. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.

G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.

4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

I. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.6 DELIVERY, STORAGE AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.7 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.8 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 BUTT HINGES

A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:

    a. Two Hinges: For doors with heights up to 60 inches.
    b. Three Hinges: For doors with heights 61 to 90 inches.
    c. Four Hinges: For doors with heights 91 to 120 inches.
    d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

    a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
    b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:

    a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
    b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:

    a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for all out-swinging lockable doors.

5. Manufacturers:

    a. McKinney (MK) - TA/T4A Series, 5-knuckle.

2.2 CONTINUOUS HINGES

A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Where specified, provide modular continuous geared hinges that ship in two or three pieces and form a single continuous hinge upon installation.
2. Manufacturers:.

    a. Pemko (PE).

2.3 POWER TRANSFER DEVICES

A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets with a 1-year warranty. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

    a. McKinney (MK) - QC (# wires) Option.

B. Electrified Quick Connect Continuous Geared Transfer Hinges: Provide electrified transfer continuous geared hinges with a removable service panel cutout accessible without de-mounting door from the frame. Furnish with Molex™ standardized plug connectors with sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

    a. Pemko (PE) - SER-QC (# wires) Option.

C. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

    a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
    b. McKinney (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

    a. McKinney (MK) - QC-C Series.

2.4 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
5. Manufacturers:

    a. Rockwood (RO).

B. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Pulls, where applicable, shall be provided with a 10” clearance from the finished floor on the push side to accommodate wheelchair accessibility.
5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets. When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.
6. Manufacturers:

    a. Rockwood (RO).

2.5 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.
2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
6. Keyway: Manufacturer’s Standard.

C. Small Format Interchangeable Cores: Provide small format interchangeable cores (SFIC) as specified, core insert, removable by use of a special key; usable with other manufacturers' cylinders.

D. Permanent Cores: Match standard. Reference Division 01 for material required under project. Installation to be included under Division 08 "Door Hardware" base bid package.

1. Small Format Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.
2. Large Format Interchangeable Cores: Core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware. Provide removable core (small or large format) as specified in Hardware Sets.

E. High Security Cylinders: ANSI/BHMA A156.5, Grade 1 Certified Products Directory (CPD) listed cylinders certified to UL437, including pick and drill resistance. Pick resistance to incorporate two or more independent locking mechanisms including a pin tumbler device with five or six pin chambers, mushroom-shaped driver pins, and sidebar locking mechanism operated independently from the six top pin tumbler device. Drill resistance to incorporate cylinder housing with fixed case-hardened inserts protecting the pin tumbler shear line, cylinder plugs with case-hardened inserts protecting both the pin tumbler shear line and the side bar, mushroom-shaped stainless steel driver pins, and stainless steel side pins. Cylinders to be factory keyed.

1. New high security key systems shall not be established with products that have an expired patent. Expired systems shall only be specified and supplied to support existing systems.

2. Manufacturers:

   a. Best 7 pin IC core
   b. No Substitution.

F. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. New System: Key locks to a new key system as directed by the Owner.

G. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).
4. Construction Control Keys (where required): Two (2).
5. Permanent Control Keys (where required): Two (2).

H. Construction Keying: Provide construction master keyed cylinders.

I. Construction Keying: Provide temporary keyed construction cores.

J. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

2.6 KEY CONTROL

2.7 MORTISE LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Manufacturers:

a. dormakaba BEST (BE) - 45H Series.
b. Sargent Manufacturing (SA) - 8200 Series.

2.8 CYLINDRICAL LOCKS AND LATCHING DEVICES

A. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed cylindrical locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide locksets with functions and features as follows:

a. Meets ANSI/BHMA A156.41 for single motion egress.

b. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.
c. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
d. Exceeds ANSI/BHMA A156.2 requirements by 2.6 times for 3,100 in-lb. abusive locked lever torque with no entry while maintaining egress.
e. Exceeds ANSI/BHMA A156.2 requirements by 8 times for 1,600 lbs. offset lever pull with no entry for protection against attacks.
f. Exceeds ANSI/BHMA A156.3 requirements by 2 times for latch retraction with 100 lb. preload while maintaining operation in warped doors.
g. Exceeds ANSI/BHMA A156.3 requirements by 20 times for no access with minimum 100 vertical impacts for protection against vandalism attempts.
h. Independent return springs allow lock to exceed ANSI/BHMA A156.2 Grade 1 cycle requirements without lever sag.
i. Ten-year limited warranty for mechanical functions.

2. Manufacturers:

a. Corbin Russwin Hardware (RU) - CLX3300 Series.
b. dormakaba BEST (BE) - 9K Series.
c. Sargent Manufacturing (SA) - 10X Line.

2.9 RESIDENTIAL LOCKING DEVICES

A. Residential Locking Devices: Provide ANSI A156.2, Series 4000, Grade 2 products (knobs, levers, deadbolts, interconnected, handlesets) as specified.

1. Provide residential locking devices with functions and features as follows:

a. Locksets, deadbolts, and handle sets designed to fit ANSI standard door preps.
b. Meets UL and ULC Standard 10C Positive Pressure, Fire Test of Door Assemblies.
c. Non-handed levers.
d. Single motion for retraction of latchbolt and deadbolt.
e. Provide levers of like design and style as specified.

2. Manufacturers:

a. ASSA ABLOY ACCENTRA - Heritage Series.
b. Kwikset (KW) - Light Commercial Series.
c. No Substitution.

B. Residential Pivot Devices: Provide ANSI A156.36, Grade 2 push/pull paddle devices as specified.

1. Provide residential locking devices with functions and features as follows:

a. ADA compliant.

b. Two-year limited warranty.

2. Manufacturers:

a. ASSA ABLOY ACCENTRA - Navis Paddle Series.
b. No Substitution.

C. Residential Locking Devices: Provide ANSI A156.2, Series 4000, Grade 3 products (knobs, levers, deadbolts, interconnected, handlesets) as specified.

1. Provide residential locking devices with functions and features as follows:

a. Locksets, deadbolts, and handle sets designed to fit ANSI standard door preps.
b. Meets UL and ULC Standard 10C Positive Pressure, Fire Test of Door Assemblies.
c. Non-handed levers.
d. Single motion for retraction of latchbolt and deadbolt.
e. Provide levers of like design and style as specified.

2. Manufacturers:

a. ASSA ABLOY ACCENTRA - Heritage Series.
b. Kwikset (KW) - Residential Series.
c. Weiser (WE) - Residential Series.
d. No Substitution.

2.10 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.11 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. Exit devices shall have a five-year warranty.
2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.
4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.

    a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
    b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.
9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.

1. Manufacturers:

    a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
    b. Sargent Manufacturing (SA) - 80 Series.
    c. Von Duprin (VD) - 35A/98 XP Series.

2.12 SURFACE DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Heavy duty surface mounted door closers shall have a 30-year warranty.

2. Manufacturers:

   a. Corbin Russwin Hardware (RU) - DC6000 Series.
   b. Norton Rixson (NO) - 7500 Series.
   c. Sargent Manufacturing (SA) - 351 Series.

C. Door Closers, Surface Mounted (Cam Action): ANSI/BHMA 156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, high efficiency door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be of the cam and roller design, one piece cast aluminum silicon alloy body with adjustable backcheck and independently controlled valves for closing sweep and latch speed.

1. Manufacturers:

   a. Corbin Russwin (RU) - DC5000 Series.
   b. Norton Rixson (NO) - 2800ST Series.

c. Sargent Manufacturing (SA) - 422 Series.

2.13 OVERHEAD CONCEALED DOOR CLOSERS

A. Door Closers, Overhead Concealed (Narrow Profile): ANSI/BHMA 156.4 Grade 1 Certified Products Directory (CPD) listed door closers designed for narrow profile frames and doors. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide overhead concealed doors closers with functions and features as follows:

   a. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies and A117.1 Accessibility Code.
   b. Single acting, offset hung with a cast iron body.
   c. Fully concealed body in the frame head and track assembly in the door.
   d. Separate and independent valves for closing speed and backcheck adjustments.
   e. Five-year limited warranty.

2. Manufacturers:

   a. dormakaba (DO) - RTS88 Series.
   b. LCN Closers (LC) - 2030 Series.
   c. Norton Rixson (RF) - 91DCP Series.
   d. No Substitution.

2.14 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:

   a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

6. Manufacturers:

a. Rockwood (RO).

2.15 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

a. Rockwood (RO).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:

a. Norton Rixson (RF).
b. Rockwood (RO).
c. Sargent Manufacturing (SA).

2.16 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. Pemko (PE).

2.17 ELECTRONIC ACCESSORIES

A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Manufacturers:

a. Securitron (SU) - DPS Series.

B. Intelligent Switching Power Supplies: Provide power supplies with single, dual or multi-voltage configurations at 12 and/or 24VDC. Power Supply shall have battery backup function with an integrated battery charging circuit. The power supply shall have a standard, integrated Fire Alarm Interface (FAI). The power supply shall provide capability for secondary voltage, power distribution, direct lock control and network monitoring through add on modules. The power supply shall be expandable up to 16 individually protected outputs. Output modules shall provide individually protected, continuous outputs and/or individually protected, relay controlled outputs. Network modules shall provide remote monitoring functions such as status reporting, fault reporting and information logging.

1. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.
2. Manufacturers:

a. Securitron (SU) - AQL Series.

2.18 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.19 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Push Plates and Door Pulls: When through-bolt fasteners are in the same location as a push plate, countersink the fasteners flush with the door face allowing the push plate to sit flat against the door.

E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.5 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.6 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.7 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Manufacturer’s Abbreviations:

1. MK - McKinney
2. OT - Other
3. PE - Pemko
4. RO - Rockwood
5. SA - SARGENT
6. AD - Adams Rite
7. BE - BEST Locks & Closers
8. RF - Rixson
9. NO - Norton
10. SU - Securitron
11. HG - HID Global

Hardware Sets

Set: 1.0
Doors: 100.1, 100.3, 101A.1, 101A.2
Description: EXT PR - ALUM - EAC

2 Continuous Hinge (Elec)	CFMXXHD1 SER		PE
2 Concealed Vert Rod Exit, Nightlatch		55 56 737P AD8410	
106 x 862	US32D	SA	
1 SFIC Core	Best IC Core as Required	US26D	BE
2 Door Pull [Offset}	RM3310-24	US32D	RO

1	Automatic Opener	6000 Series - Mtg as required	689	NO	⚡
2	Door Stop	480	US26D	RO	
1	Gasketing	by door / frame mfg			
1	Threshold	271A MSES25SS		PE	
1	ElectroLynx Harness	QC-C1500 [PS to hinge / Strike]		MK	⚡
1	ElectroLynx Harness	QC-CXXP [Lock / exit to hinge]		MK	⚡
1	Card Reader	By security vendor- Div 28		OT	
1	Door Position Switch	DPS-XXXX - WH (as required)		SU	⚡
1	Wall actuator (Touchless)	700		NO	⚡
1	Power Supply	AQLXX - R8E1 size as required		SU	⚡
1	Wikk Bollard	B-6SQ-FT-32D-MS-SQ32	US32D	OT	

Notes: Operational Narrative:
1. Doors normally closed and secure.
2. Authorized access by card reader retracting exit device latches for predetermined time limit. Exit device latches can be electrically held retracted for open access.
3. ADA access by actuator switch. In locked condition, actuator energized only upon valid card reader presentation.
4. Egress free for immediate exit. ADA egress by actuator switch.
5. REX switch in push rail allows authorized exit without alarm condition.
6. Door position switches monitor open/closed status.
7. Exit device latches release (fail secure) in event of power loss. Keyed cylinder override for emergency access.

Set: 2.0
Description: HEADING NOT USED

Set: 3.0
Doors: 100.2
Description: EXT- PR - ALUM

2	Continuous Hinge - Pemkonnect	CFMXXHD1-M		PE	
1	Concealed Vert Rod Exit, Nightlatch Less Pull	US32D	737P AD8410 106 SA		
1	Concealed Vert Rod Exit, Exit Only SA		AD8410 EO	US32D	
1	SFIC Core	Best IC Core as Required	US26D	BE	
2	Door Pull [Offset}	RM3310-24	US32D	RO	
2	Concealed Closer	91NDCP 90N	626	RF	
2	Door Stop	480	US26D	RO	
1	Gasketing	by door / frame mfg			
1	Threshold	271A MSES25SS		PE	

Set: 4.0
Doors: 100.4
Description: PR - ALUM

2	Continuous Hinge - Pemkonnect	CFMXXHD1-M		PE
1	Concealed Vert Rod Exit, Nightlatch		737P AD8410 106	
Less Pull		US32D	SA	
1	Concealed Vert Rod Exit, Exit Only		AD8410 EO	US32D
SA				
1	SFIC Core	Best IC Core as Required	US26D	BE
2	Door Pull [Offset}	RM3310-24	US32D	RO
2	Concealed Closer	91NDCP 90N	626	RF
2	Door Stop	480	US26D	RO
1	Gasketing	by door / frame mfg		

Set: 5.0
Doors: 125.2, 127.2, 128.2, 129.2
Description: EXT SGL - ALUM - PANIC

1	Continuous Hinge - Pemkonnect	CFMXXHD1-M		PE
1	Rim Exit Device, Storeroom	737P AD8504 Less Pull	US32D	SA
2	SFIC Core	Best IC Core as Required	US26D	BE
1	Door Pull [Offset}	RM3310-24	US32D	RO
1	Concealed Closer	91NDCP 90N	626	RF
1	Door Stop	480	US26D	RO
1	Gasketing	by door / frame mfg		
1	Threshold	271A MSES25SS		PE

Set: 5.01
Doors: 117
Description: EXT SGL - ALUM - PANIC W/ DELAY EGRESS

1	Continuous Hinge (Elec)	CFMXXHD1 SER		PE
1	Rim Exit Device, Storeroom	59 737P AD8504 Less Pull	US32D	SA
2	SFIC Core	Best IC Core as Required	US26D	BE
1	Door Pull [Offset}	RM3310-24	US32D	RO
1	Concealed Closer	91NDCP 90N	626	RF
1	Door Stop	480	US26D	RO
1	Gasketing	by door / frame mfg		
1	Threshold	271A MSES25SS		PE
1	ElectroLynx Harness	QC-C1500 [PS to hinge / Strike]		MK
1	ElectroLynx Harness	QC-CXXP [Lock / exit to hinge]		MK
1	Power Supply	AQLXX - R8E1 size as required		SU

Notes: Operational Narrative:
1. Doors normally closed and secure.
2. When the exit device push pad is depressed, the exit device delays egress and sounds an

alarm from the rail to alert personnel that someone is attempting egress.
3. The exit device stays secure for fifteen seconds. Allowing tome for personnel to respond.
4. Momentary release for egress is provided by a cylinder on the rail or from a remote location.
5. When the fire alarm system is activated (if connected), the exit device disarms and allows immediate egress.

Set: 5.02
Doors: 121.2, 122.2, 123.2, 124.2, 130.2
Description: EXT SGL - ALUM - PANIC EAC

1	Continuous Hinge (Elec)	CFMXXHD1 SER		PE	⚡
1	Rim Exit Device, Storeroom	55 56 737P AD8504 Less Pull	US32D	SA	⚡
2	SFIC Core	Best IC Core as Required	US26D	BE	
1	Door Pull [Offset}	RM3310-24	US32D	RO	
1	Concealed Closer	91NDCP 90N	626	RF	
1	Door Stop	480	US26D	RO	
1	Gasketing	by door / frame mfg			
1	Threshold	271A MSES25SS		PE	
1	ElectroLynx Harness	QC-C1500 [PS to hinge / Strike]		MK	⚡
1	ElectroLynx Harness	QC-CXXP [Lock / exit to hinge]		MK	⚡
1	Card Reader	By security vendor- Div 28		OT	
1	Power Supply	AQLXX - R8E1 size as required		SU	⚡

Notes: Operational Narrative:
1. Doors normally closed and secure.
2. Authorized access by card reader retracting exit device latch for predetermined time limit. Exit device latch can be electrically held retracted for open access.
3. Egress free for immediate exit.
4. REX switch in push rail allows authorized exit without alarm condition.
5. Door position switch monitor open/closed status.
6. Exit device latch releases (fail secure) in event of power loss. Keyed cylinder override for emergency access.

Set: 6.0
Doors: S001.2, S002.2
Description: EXT SGL - ALUM - PANIC - FIRE RATED

1	Continuous Hinge - Pemkonnect	CFMXXHD1-M		PE
1	Rim Exit Device, Storeroom	12 737P AD8504 Less Pull	US32D	SA
1	SFIC Core	Best IC Core as Required	US26D	BE
1	Door Pull [Offset}	RM3310-24	US32D	RO
1	Concealed Closer	91NDCP 90N	626	RF
1	Door Stop	480	US26D	RO
1	Gasketing	by door / frame mfg		
1	Threshold	271A MSES25SS		PE

Set: 7.0
Doors: 223.2, 224.2, 235.2
Description: EXT SGL - ALUM - LOCK

1	Continuous Hinge - Pemkonnect	CFMXXHD1-M		PE	
1	Deadlatch	4900 X 4591	628	AD	
1	Cylinder	as required	US32D	SA	
1	SFIC Core	Best IC Core as Required	US26D	BE	
1	Door Pull [Straight}	RM3300-24	US32D	RO	
1	Concealed Closer	91NDCP 90N	626	RF	
1	Door Stop	480	US26D	RO	
1	Gasketing	by door / frame mfg			
1	Threshold	158A		PE	

Notes: Free egress in to building from terrace at all times to meet life safety requirements.

Set: 8.0
Doors: 118.1
Description: EXT PR - HM - EAC

5	Hinge, Full Mortise, Hvy Wt	T4A3386 X NRP 4-1/2" x 4-1/2"	US32D	MK	
1	Electric Hinge, Hvy Wt	T4A3386-QCXX 4-1/2" x 4-1/2"	US32D	MK	⚡
1	Surface Vert Rod Exit	55 56 737P 8706 ETL	US32D	SA	⚡
1	Surface Vert Rod Exit, Exit Only	8710 EO	US32D	SA	
1	SFIC Core	Best IC Core as Required	US26D	BE	
2	Surface Closer	351 CPS	EN	SA	
2	Kick Plate	K1050 10" X 2" LDW	US32D	RO	
2	Latch Cover Kick Plate	BFLG1050 10" high	US32D	RO	
1	Astragal set	18061CNB		PE	
1	Gasketing	303AS		PE	
1	Rain Guard	346C x LAR		PE	
2	Sweep	3452AV		PE	
1	Threshold	271A MSES25SS		PE	
1	ElectroLynx Harness	QC-C1500 [PS to hinge / Strike]		MK	⚡
1	ElectroLynx Harness	QC-CXXP [Lock / exit to hinge]		MK	⚡
1	Card Reader	By security vendor- Div 28		OT	
1	Door Position Switch	DPS-XXXX - WH (as required)		SU	⚡
1	Power Supply	AQLXX - R8E1 size as required		SU	⚡

Notes: Operational Narrative:
1. Doors normally closed and secure.
2. Authorized access by card reader retracting exit device latches for predetermined time limit. Exit device latches can be electrically held retracted for open access.
3. Egress free for immediate exit.
4. REX switch in push rail allows authorized exit without alarm condition.
5. Door position switches monitor open/closed status.
6. Exit device latches release (fail secure) in event of power loss. Keyed cylinder override for

emergency access.

Set: 9.0
Doors: 124.4
Description: EXT PR - HM - SVR EXIT EAC

6	Hinge, Full Mortise, Hvy Wt	T4A3386 X NRP 4-1/2" x 4-1/2"	US32D	MK	
6	Electric Hinge, Hvy Wt	T4A3386-QCXX 4-1/2" x 4-1/2"	US32D	MK	⚡
1	Surface Vert Rod Exit	55 56 737P 8706 ETL	US32D	SA	⚡
1	Surface Vert Rod Exit, Exit Only	8710 EO	US32D	SA	
1	SFIC Core	Best IC Core as Required	US26D	BE	
2	Surface Closer	351 CPS	EN	SA	
2	Kick Plate	K1050 10" X 2" LDW	US32D	RO	
1	Astragal set	18061CNB		PE	
1	Gasketing	303AS		PE	
1	Rain Guard	346C x LAR		PE	
2	Sweep	3452AV		PE	
1	Threshold	271A MSES25SS		PE	
1	ElectroLynx Harness	QC-C1500 [PS to hinge / Strike]		MK	⚡
1	ElectroLynx Harness	QC-CXXP [Lock / exit to hinge]		MK	⚡
1	Card Reader	By security vendor- Div 28		OT	
1	Power Supply	AQLXX - R8E1 size as required		SU	⚡

Notes: Operational Narrative:
1. Doors normally closed and secure.
2. Authorized access by card reader retracting exit device latch for predetermined time limit. Exit device latch can be electrically held retracted for open access.
3. Egress free for immediate exit.
4. REX switch in push rail allows authorized exit without alarm condition.
5. Door position switch monitor open/closed status.
6. Exit device latch releases (fail secure) in event of power loss. Keyed cylinder override for emergency access.

Set: 10.0
Doors: 001.1, 002.1
Description: EXT - HM - LOCK- EAC

2	Hinge, Full Mortise, Hvy Wt	T4A3386 X NRP 4-1/2" x 4-1/2"	US32D	MK	
1	Electric Hinge, Hvy Wt	T4A3386-QCXX 4-1/2" x 4-1/2"	US32D	MK	⚡
1	Fail Secure Lock	10XG71 LP	US26D	SA	⚡
1	Surface Closer	351 CPS	EN	SA	
1	Kick Plate	K1050 10" X 2" LDW	US32D	RO	
1	Gasketing	303AS		PE	
1	Rain Guard	346C x LAR		PE	
1	Sweep	3452AV		PE	
1	Threshold	271A MSES25SS		PE	
1	ElectroLynx Harness	QC-C1500 [PS to hinge / Strike]		MK	⚡
1	ElectroLynx Harness	QC-CXXP [Lock / exit to hinge]		MK	⚡
1	Card Reader	By security vendor- Div 28		OT	
1	Door Position Switch	DPS-XXXX - WH (as required)		SU	⚡
1	Power Supply	AQLXX - R8E1 size as required		SU	⚡

Notes: Operational Narrative:
1. Door normally closed and secure.
2. Authorized access by card reader unlocking lever trim for a predetermined time limit. Trim can remain unlocked for open access.
3. Egress free for immediate exit.
4. Mortise lock REX switch allows authorized exit without alarm condition.
5. Door position switch monitors open/closed/latched status.
6. Lever remains locked (fail secure) in event of power loss. Keyed cylinder override for emergency access.

Set: 11.0
Doors: 102.1
Description: SGL - WD - LOCK- EAC

2	Hinge, Full Mortise, Hvy Wt	T4A3386 X NRP 4-1/2" x 4-1/2"	US32D	MK	
1	Electric Hinge, Hvy Wt	T4A3386-QCXX 4-1/2" x 4-1/2"	US32D	MK	⚡
1	Fail Secure Lock	10XG71 LP	US26D	SA	⚡
1	Surface Closer	351 Reg/PA	EN	SA	
1	Kick Plate	K1050 10" X 2" LDW	US32D	RO	
1	ElectroLynx Harness	QC-C1500 [PS to hinge / Strike]		MK	⚡
1	ElectroLynx Harness	QC-CXXP [Lock / exit to hinge]		MK	⚡
1	Card Reader	By security vendor- Div 28		OT	
1	Door Position Switch	DPS-XXXX - WH (as required)		SU	⚡
1	Power Supply	AQLXX - R8E1 size as required		SU	⚡

Notes: Operational Narrative:
1. Door normally closed and secure.
2. Authorized access by card reader unlocking lever trim for a predetermined time limit. Trim can remain unlocked for open access.
3. Egress free for immediate exit.
4. Mortise lock REX switch allows authorized exit without alarm condition.
5. Door position switch monitors open/closed/latched status.
6. Lever remains locked (fail secure) in event of power loss. Keyed cylinder override for emergency access.

Set: 12.0
Description: HEADING NOT USED

Set: 13.0
Doors: S001a
Description: SGL - RATED - STAIRS

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Rim Exit Device, Storeroom	12 737P 8804 ETL	US32D	SA
1	SFIC Core	Best IC Core as Required	US26D	BE
1	Surface Closer	422 CTHB2	EN	SA
1	Kick Plate	K1050 10" X 2" LDW	US32D	RO
1	Door Stop	409 / 446 as required	US26D	RO
1	Gasketing	S88BL X LAR		PE

Set: 14.0
Doors: S001.1, S001.3, S001.4, S002.1, S002.3
Description: STAIR - RATED - PANIC

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Rim Exit Device, Passage	12 8815 ETL	US32D	SA
1	Surface Closer	422 CTHB2	EN	SA
1	Kick Plate	K1050 10" X 2" LDW	US32D	RO
1	Door Stop	409 / 446 as required	US26D	RO
1	Gasketing	S88BL X LAR		PE

Set: 15.0
Doors: 120, 220
Description: PR - PANIC - PASSAGE

6	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Flush Bolt	555 [12" / 72" AFF]	US26D	RO
1	Dust Proof Strike	570	US26D	RO
1	Storeroom/Closet Lock	737P 10XG04 LP	US26D	SA
2	Surface Closer	351 PH9	EN	SA
2	Kick Plate	K1050 10" X 2" LDW	US32D	RO
2	Door Stop	409 / 446 as required	US26D	RO
2	Silencer	608		RO

Set: 16.0
Doors: 110A, 115B, 131, 134.2, 136, 231, 235A, 238
Description: SGL - LOCK - STOR./AV / IDF / ELEC. / JAN.

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Storeroom/Closet Lock	737P 10XG04 LP	US26D	SA
1	SFIC Core	Best IC Core as Required	US26D	BE
1	Surface Closer	351 Reg/PA	EN	SA
1	Kick Plate	K1050 10" X 2" LDW	US32D	RO
1	Door Stop	409 / 446 as required	US26D	RO
3	Silencer	608		RO

Set: 17.0
Doors: 115a, 117B
Description: SGL - LOCK - STOR. - OHS

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Storeroom/Closet Lock	737P 10XG04 LP	US26D	SA
1	SFIC Core	Best IC Core as Required	US26D	BE
1	Surface Closer	351 PS	EN	SA
1	Kick Plate	K1050 10" X 2" LDW	US32D	RO
1	Door Stop	409 / 446 as required	US26D	RO
3	Silencer	608		RO

Set: 18.0
Doors: 134.1
Description: PR - LOCK - STOR. - OHS

6	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
2	Flush Bolt	555 [12" / 72" AFF]	US26D	RO
1	Dust Proof Strike	570	US26D	RO
1	Storeroom/Closet Lock	737P 10XG04 LP	US26D	SA
1	SFIC Core	Best IC Core as Required	US26D	BE
1	Surf Overhead Stop	10-X36	689	RF
1	Surface Closer	351 PS	EN	SA
1	Kick Plate	K1050 10" X 2" LDW	US32D	RO
1	Door Stop	409 / 446 as required	US26D	RO
3	Silencer	608		RO

Set: 19.0
Doors: R001
Description: EXT-SGL - LOCK - ROOF. - OHS

3	Hinge, Full Mortise, Hvy Wt	T4A3386 X NRP 4-1/2" x 4-1/2"	US32D	MK
1	Storeroom/Closet Lock	737P 10XG04 LP	US26D	SA
1	SFIC Core	Best IC Core as Required	US26D	BE
1	Surface Closer	351 CPS	EN	SA
1	Kick Plate	K1050 10" X 2" LDW	US32D	RO
1	Door Stop	409 / 446 as required	US26D	RO
1	Gasketing	S88BL X LAR		PE
1	Rain Guard [Head]	347A X 68AR		PE
1	Sweep	3452AV		PE
1	Threshold	271A MSES25SS		PE

Set: 20.0
Doors: 002.2, 005, 103, 104, 105, 109, 111, 112, 113, 117A, 213, 216
Description: SGL - LOCK - OFFICE

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Entry/Office Lock	737P 10XG05 LP	US26D	SA
1	SFIC Core	Best IC Core as Required	US26D	BE
1	Surface Closer	351 Reg/PA	EN	SA
1	Kick Plate	K1050 10" X 2" LDW	US32D	RO
1	Door Stop	409 / 446 as required	US26D	RO
3	Silencer	608		RO

Set: 21.0
Doors: 102A, 108, 110, 114, 117C, 117D, 118.2, 123A, 126.1, 126.2, 137.1, 137.2, 140.1, 140.2, 211, 221A.1, 221A.2, 226.1, 226.2, 230, 235.1, 239.1, 239.2, 242.1, 242.2
Description: SGL - LOCK - CLASS

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Classroom Lock	737P 10XG37 LP	US26D	SA
1	SFIC Core	Best IC Core as Required	US26D	BE
1	Surface Closer	351 Reg/PA	EN	SA
1	Kick Plate	K1050 10" X 2" LDW	US32D	RO
1	Door Stop	409 / 446 as required	US26D	RO
3	Silencer	608		RO

Set: 21.01
Doors: 106.2, 107, 121.1, 122.1, 123.1, 124.1, 125.1, 127.1, 128.1, 129.1, 130.1, 132, 133, 219, 221, 222, 223.1, 224.1, 225, 227, 228, 229, 232, 233
Description: SGL - LOCK - CLASS W/ INDC.

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Classroom Lock	V11 737P 8237 LNP	US26D	SA
1	SFIC Core	Best IC Core as Required	US26D	BE
1	Surface Closer	351 Reg/PA	EN	SA
1	Kick Plate	K1050 10" X 2" LDW	US32D	RO
1	Door Stop	409 / 446 as required	US26D	RO
3	Silencer	608		RO

Set: 22.0
Doors: 102.2, 123.4
Description: SGL - LOCK - CLASS - OHS

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Classroom Lock	737P 10XG37 LP	US26D	SA
1	SFIC Core	Best IC Core as Required	US26D	BE
1	Surface Closer	351 PS	EN	SA
1	Kick Plate	K1050 10" X 2" LDW	US32D	RO
1	Door Stop	409 / 446 as required	US26D	RO
3	Silencer	608		RO

Set: 23.0
Doors: 116.2
Description: SGL - LOCK - CLASS [OHS]

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Classroom Lock	737P 10XG37 LP	US26D	SA
1	SFIC Core	Best IC Core as Required	US26D	BE
1	Surface Closer	351 PS	EN	SA
1	Kick Plate	K1050 10" X 2" LDW	US32D	RO
1	Gasketing	S88BL X LAR		PE

Set: 24.0
Doors: 121.3
Description: PR - PASSAGE

6	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
2	Flush Bolt	555 [12" / 72" AFF]	US26D	RO
1	Dust Proof Strike	570	US26D	RO
1	Passage Latch	8215 LNP	US26D	SA
2	Door Stop	409 / 446 as required	US26D	RO
2	Silencer	608		RO

Set: 25.0
Doors: 003, 107A, 108A, 117E, 119A, 119B, 119C, 119D, 119E, 119F, 119G, 119H, 130A, 130B, 138, 139, 217, 218, 230A, 230B, 236, 237, 240, 241
Description: SGL - TOILET

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Indicator Lockset	10XU65 VSLL V33	US26D	SA
1	Surface Closer	422 CTHB2	EN	SA
1	Mop Plate	K1050 4" X 1" LDW	US32D	RO
1	Door Stop	409 / 446 as required	US26D	RO
1	Gasketing	S88BL X LAR		PE

Set: 26.0
Doors: 106.1, 212, 214, 215
Description: SGL - PASS - CLOSET / WELLNESS

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Passage Latch	10XU15 LP	US26D	SA
1	Door Stop	409 / 446 as required	US26D	RO
3	Silencer	608		RO

Set: 27.0
Description: HEADING NOT USED

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Passage Latch	10XU15 LP	US26D	SA
1	Surface Closer	351 PS	EN	SA
1	Door Stop	409 / 446 as required	US26D	RO
3	Silencer	608		RO

Set: 28.0
Doors: 135, 234
Description: SGL - Elec. Room

3	Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Rim Exit Device, Storeroom	12 737P 8804 ETL	US32D	SA
1	SFIC Core	Best IC Core as Required	US26D	BE
1	Surface Closer	351 PS	EN	SA
1	Kick Plate	K1050 10" X 2" LDW	US32D	RO
1	Gasketing	S88BL X LAR		PE

Set: 29.0
Doors: G001, G002, G003, G004
Description: GATE

1	Gate hinges & closer	By Gate Mfg		OT
1	Cylinder	as required	US32D	SA
1	SFIC Core	Best IC Core as Required	US26D	BE

Notes: Balance of hardware by gate manufacturer.

Set: 30.0
Doors: 001.2, 116.1, 117F, 123.3, 124.3
Description: OH DOOR

1	Cylinder	as required	US32D	SA
1	SFIC Core	Best IC Core as Required	US26D	BE
1	HBO-Balance	Balance of hardware by door mfg		

END OF SECTION 087100

SECTION 088000

GLAZING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
   1. Doors and frames.
   2. Glazed curtain walls.
   3. Storefront Entrances and Framing.
   4. Glass products.
   5. Insulating glass.
   6. Glazing sealants.
   7. Glazing tapes.
   8. Miscellaneous glazing materials.
   9. Decorative Glass Film.
   10. Insulating glass units.

B. Related Requirements:
   1. Division 08 Section "Hollow Metal Doors and Frames".
   2. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
   3. Division 08 Section "Glazed Aluminum Curtain Walls."
   4. Section 064100 - Architectural Wood Casework: Cabinets with requirements for glass shelves.

1.03 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

C. IBC: International Building Code.

D. Interspace: Space between lites of an insulating-glass unit.

1.04 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Data: For sealants, indicating VOC content.
2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
3. Provide the following supporting LEEDv4.1 documentation for permanently installed products:
    a. Sourcing of Raw Materials:
        1) Recycled Content - Provide manufacturer supporting documentation indicating post-consumer and pre-consumer recycled content.
        2) Regional - Provide the location and distance to the project site. For products with recycled content, biobased content, or FSC certified wood.
    b. Environmental Product Declaration (EPD): Provide the published manufacturer EPD.
    c. Material Ingredients: Provide the published manufacturer material ingredient report according to 018113.
    d. Low Emitting Materials:
        1) For wet applied products installed on the interior indicate the VOC content and provide certificates indicating compliance.
        2) For all other products installed on the interior, including wet applied products and subject to section ‘018113 Sustainable Design Requirements’, provide certificates indicating compliance with the VOC Emissions Evaluation.
        3) For composite wood products installed on the interior, subject to section ‘018113 Sustainable Design Requirements’, provide certificates indicating compliance with Formaldehyde Emissions Evaluation.
4. Include a completed LEEDv4 Submittal form when submitting sustainable design product information.

C. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.

1. Coated glass.
2. Insulating glass.

3. Insulating glass with Acid Etched glass lite.
4. Insulating glass with colored PVB interlayer.
5. Colored gel film applied to insulating glass - one sample per selected color.

D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

E. Decorative Glass Film Samples: 4 inch by 4 inch samples of texture, color and/or pattern for verification.

1.06 QUALITY ASSURANCE

A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved by primary glass manufacturer.

B. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors and who employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program.

C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

D. Field measurements shall be taken prior to completion of manufacturing and cutting of glazed-in metal panels.

E. Maximum deviation from vertical and horizontal alignment of installed panels is 1/8" (3mm) in 20' (6m) non-commutative.

F. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

G. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

H. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

I. Decorative Glass Film Qualifications: Installation shall be performed by a trained and qualified installer, specialized and experienced in work required for this project.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.08 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.09 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations for Glass: Obtain glass from single source from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:

1. Design Wind Pressures: As indicated on Drawings .
    a. Wind Design Data: As indicated on Drawings.
2. Design Snow Loads: As indicated on Drawings.
3. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
4. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.

C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6 mm thick .
2. For laminated-glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.
5. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
6. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.03 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
   1. NGA Publications: "Glazing Manual."
   2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction . Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.
   1. Minimum Glass Thickness for Exterior Lites: 1/4-inch 6 mm .

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.04 GLASS PRODUCTS

A. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

B. Reflective- and Low-E-Coated Vision Glass: ASTM C1376.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Viracon; VNE1-63 on clear or comparable product by one of the following:
      a. Guardian Industries Corp.
      b. Saint-Gobain Glass Corp.
      c. Vitro Architectural Glass.
      d. Pilkington North America.

2.05 LAMINATED GLASS

A. Laminated Glass: ASTM C 1172 and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation. Fabricate laminated glass to produce glass free of foreign substances and air or glass pockets.
   1. Construction: Laminate glass with specified interlayer to comply with interlayer manufacturer's written instructions.
   2. Security Interlayer: Ionoplast structural material.
      a. Trosifol “SentryGlas,” as manufactured by Trosifol, a division of Kuraray America, Inc.; or equal.
      b. Thickness: 0.060-inch.
      c. Color: Clear.
      d. Interlayer Physical Properties:
         1) Young’s Modulus: 43 kpsi, when tested in accordance with ASTM D5026.
         2) Tensile Strength: 5.0 kpsi, when tested in accordance with ASTM D638.
         3) Elongation: 400%, when tested in accordance with ASTM D638.
         4) Flex Modulus: 50 kpsi, when tested in accordance with ASTM D790.
         5) Heat Deflection Temperature at 0.46 MPa: 110 deg F, when tested in accordance with ASTM D648.
   3. Acoustic Interlayer: Polyvinvyl Butyl (PVB)
      a. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
      b. Interlayer Color: Clear unless otherwise indicated.

B. Laminated, Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass with one layer of security film laminated to the inner layer surface, separated by a dehydrated interspace, qualified in accordance with ASTM E2190.
   1. Manufacturer: Armoured One; or approved equal product.
   2. Security window film laminated as an inner layer on the interior glass pane.
      a. Film Thickness: 23 mil.

2.06 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.
   1. Sealing System: Dual seal, with polyisobutylene and silicone primary and secondary sealants.

2. Perimeter Spacer: Manufacturer's standard spacer material and construction Aluminum with mill or clear anodic finish.
3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.07 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
   1. EPDM complying with ASTM C 864.
   2. Neoprene, complying with ASTM C 864.
   3. Silicone complying with ASTM C 1115.
   4. Thermoplastic polyolefin rubber complying with ASTM C 1115.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned EPDM, neoprene, silicone or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.

2.08 GLAZING SEALANTS

A. General:
   1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
   2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
   3. Verify sealant complies with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
   4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.

B. Neutral-Curing Silicone Glazing Sealant, Class 100/50: Complying with ASTM C920, Type S, Grade NS, Use NT.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. GE Construction Sealants; Momentive Performance Materials Inc.

b. Pecora Corporation.
c. Sika Corporation.
d. The Dow Chemical Company.
e. Tremco Incorporated.

2. Applications: Exterior glazing unless otherwise indicated .

2.09 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:
   1. AAMA 804.3 tape, where indicated.
   2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
   3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

2.10 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
C. Setting Blocks:
   1. Elastomeric material with Shore A durometer hardness of 85, plus or minus 5.
   2. Type recommended in writing by sealant or glass manufacturer.
D. Spacers:
   1. Elastomeric material blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
   2. Type recommended in writing by sealant or glass manufacturer.
E. Edge Blocks:
   1. Elastomeric material with Shore A durometer hardness per manufacturer's written instructions.
   2. Type recommended in writing by sealant or glass manufacturer.
F. Glass Finishes:

1. Color Gel Film: Basis of Design: Vanceva, North America. Colors shall be selected from manufacturer's full range of colors which may include a combination of more than one color film to make a specific color.

2.11 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

2.12 DECORATIVE GLASS FILM

A. Provide decorative glass and window film that can be used to control privacy through a building’s interior glass.

1. Manufacturer: Subject to compliance with requirements, provide 3M FASARA Finishes series Film or comparable.
    a. Substitutions: See Section 016000 - Product Requirements.
2. Film Type: Vinyl or Polyester.
3. Usage: Interior.
4. Adhesive Type: Pressure-sensative.
5. Certification: Class A – ASTM E84 Fire Classification.
6. Pattern/Graphic: (3) Three distinct patterns, as indicated on Drawings, shall be selected by Architect form manufacturer's full range.
7. Color and Texture: As selected by Architect from manufacturer's full range.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.03 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch- minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.04 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.05 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

3.06 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
   1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

E. Remove nonpermanent labels immediately after glazing installation is complete.

F. Clean glass and adjacent surfaces after sealants are fully cured.

G. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.07 MONOLITIHIC GLASS SCHEDULE

A. Clear Glass Type **GL-3**: Fully tempered clear float glass.
   1. Minimum Thickness: 6 mm.
   2. Safety glazing required.
   3. Location: All interior glass unless indicated otherwise, ref. Drawings.

3.08 LAMINATED GLASS TYPES

A. Glass Type **GL-4**: Interior laminated acoustic glass, clear, with two plies of float glass.
   1. Minimum Thickness of Each Glass Ply: 3 mm.
   2. Interlayer Thickness: 0.030 inch.
   3. Provide safety glazing labeling.
   4. Location: As indicated on Drawings.

B. Glass Type **GL-5**: Laminated Security Glass, Clear
   1. Interlayer Basis-of-Design: Trosifol “SentryGlas,” as manufactured by Trosifol, a division of Kuraray America, Inc.; or equal as determined by Architect
   2. Minimum Thickness of Each Glass Ply: 3 mm
   3. Interlayer Thickness: 0.060 inch.
   4. Location: As indicated on Drawings.

3.09 INSULATING GLASS SCHEDULE

A. Glass Type **GL-1**: Low-E-Coated, Low Iron Clear Insulating Glass:
   1. Basis-of-Design Product: Viracon VNE1-63.
   2. Overall Unit Thickness: 1 inch.
   3. Minimum Thickness of Each Glass Lite: 6 mm.
   4. Outdoor Lite: Fully tempered float glass.
   5. Interspace Content: Argon.
   6. Indoor Lite: Fully tempered float glass.
   7. Low-E Coating: Sputtered on second surface.
   8. System: 1/4 inch clear with VNE-63 #2, + 1/2 inch space, air filled + 1/4 inch clear glass.
   9. Winter Nighttime U-Factor: 0.25 maximum.
   10. Summer Daytime U-Factor: 0.21 maximum.
   11. Visible Light Transmittance: 62 percent minimum.
   12. SGHC: 0.28 maximum.
   13. Safety glazing required.
   14. Location: Typical Exterior Insulated Glazing Unit.

B. Glass Type **GL-1a**: Low-E-Coated, Low Iron Clear Insulating Glass, with applied frit pattern:
   1. Type **GL-1** with applied frit pattern on Surface #2.
   2. Frit Pattern No. 2 Basis-of-Design: Viracon Standard Pattern "51767" on Surface #2.
      a. 1% coverage.
      b. 1/4" dots
      c. Staggered Pattern.
      d. Color: "V952 Warm Gray", no border.
      e. Location: As indicated on Drawings.

C. Glass Type **GL-1b**: Low-E-Coated, Low Iron Clear Insulating Glass with 3/8" outer glass:
   1. Match Type **GL-1** with 3/8" glass substrate at exterior lite.

D. Glass Type **GL-1c:** Low-E-Coated, Low Iron Clear Insulating Glass with applied frit pattern, with 3/8" outer glass:
   1. Match Type **GL-1a** with 3/8" glass substrate at exterior lite

E. Insulated Spandrel Unit: **GL-2**
   1. Basis-of-Design: "Mapespan" 1-inch Insulated Spandrel Glass Panels.

2. Overall Unit Thickness: 1 inch.
3. Exterior Color: Subdued Gray.
4. Core: 2.5# Density IsoCyanurate.
5. Substrate: 1/8" Tempered Hardboard.
6. Interior Finish: Colorlume (Baked Enamel) .016in thick.
7. Location: As indicated on the drawings.

3.10 INSULATED-LAMINATED GLASS TYPES

A. Glass Type **GL-7**: Acoustic Insulating Glass, Interior
   1. Double Glazed, 1" overall thickness.
   2. STC: 42.
   3. Outer Lite (Corridor Side): Type **GL-4** Laminated Acoustic Glass.
   4. Indoor Lite (Room Side: Type **GL-3** float glass
   5. Acoustic seals for glazing shall be vibration-isolating resilient gaskets, U-shaped and continuous santoprene UV grade 65-75 durometer black. Desiccant material shall be incorporated into multiple glazed units.
   6. Stops: Provide stops that are 1” high (min) and readily removable, fabricated from not less than 16 gauge rolled steel sections predrilled and aligned with frame to form tight square acoustical joints. Stop fasteners shall be concealed.

B. Glass Type **GL-8**: Security Insulating Glass, with Low-E Coating, Exterior
   1. Insulated Glazing Unit with Low-E coated exterior lite and security laminated interior lite
   2. Overall Thickness: 1"
   3. System: 1/4" clear low-iron glass w/ Low-E + 1/2" air space + security laminated glass, clear low iron
   4. Exterior Lite:
      a. Basis-of-Design Product: Viracon VNE 1-63
      b. Minimum Thickness: 6 mm
      c. Low E Coating: Sputtered on Surface #2
   5. Interior Lite
      a. Type **GL-5** Security Laminated glass, fabricated with clear low iron glass

C. Glass Type **GL-8a**: Security Insulating Glass, with Low E Coating and Applied Frit Pattern
   1. Match Type **GL-8** with applied frit pattern on Surface #2
   2. Frit Pattern Basis of Design: Viracon Standard Pattern "51767" on Surface #2
      a. Coverage: 1% coverage

b. Image: 1/4" diameter circular dots
c. Pattern: Staggered pattern
d. Color: "V952 Warm Grey", no border
e. Location: As indicated on Drawings

D. Glass Type **GL-8b:** Security Insulating Glass, with Low E Coating and Applied Frit Pattern, 3/8" outer glass
1. Match Type **GL-8a**, with 3/8" thick glass substrate at exterior lite

END OF SECTION

SECTION 092116
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.
B. Metal stud wall framing.
C. Metal channel ceiling framing.
D. Acoustic insulation.
E. Gypsum wallboard.
F. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Division 01 Sections - Sustainability Design Requirements
B. Section 054000 - Cold-Formed Metal Framing: Structural steel stud framing and non-load bearing exterior framing.
C. Section 061053 - Miscellaneous Rough Carpentry: Wood blocking product and execution requirements.
D. Section 079200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.
E. Section 093000 - Tiling: Tile backing board.

1.03 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).
B. AISI S201 - North American Standard for Cold-Formed Steel Framing - Product Data; 2017.
C. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.
D. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).
E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
G. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.
H. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020.

I. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).
J. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2017).
K. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2023.
L. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
M. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2023.
N. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.
O. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.
P. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.
Q. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.
R. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2023.
S. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.
T. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.
U. ASTM E413 - Classification for Rating Sound Insulation; 2022.
V. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.
W. GA-600 - Fire Resistance and Sound Control Design Manual; 2024.
X. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
Y. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of gypsum board assemblies with size, location, and installation of service utilities.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

C. Sequencing: Install service utilities in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data:

1. Provide data on metal framing, gypsum board, accessories, and joint finishing system.
2. Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

C. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.

D. Steel Framing Industry Association (SFIA) Certification:

1. Submit documentation that metal studs and connectors used on project meet or exceed requirements of International Building Code.
2. Submit current documentation of contractor and fabricator accreditation. Keep copies of each on-site during and after installation, and present upon request.

E. Delegated Design Submittal: As indicated in this section by a professional structural engineer.

1. Framing shop drawings signed and sealed by a professional structural engineer.
2. Design calculations sufficient to demonstrate compliance with design criteria; signed and sealed by a professional structural engineer.
3. Details and calculations for factory-made connectors, signed and sealed by a professional structural engineer.

F. Test Reports: For stud framing products that do not comply with AISI S220 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

G. Qualification Statements:

1. Delegated Designer's Qualification Statement.
2. Installer's Qualification Statement.

1.06 SUSTAINABLE DESIGN SUBMITTALS

A. Comply with Division 01 Sustainability Requirements.

B. Provide documentation for the following;

1. MR Credit 2: Environmental Product Declarations.
    a. Steel framing

b. Gypsum board.

2. MR Credit 3: Sourcing of Raw Materials.
   a. Recycled content: Steel.
   b. Recycled content: Gypsum board.
   c. Regionally sourced recycled content: Gypsum board.
   d. Manufacturers with extended producer responsibility programs: Gypsum board.
3. MR Credit 4: Material Ingredients.
   a. Report: Gypsum board, sound attenuation blanket, joint compound, if available.
4. EQ Credit 2: Low-Emitting Materials.
   a. Products installed in building interior: Certificate stating compliance with California Department of Public Health (CDPH) Standard Method including TVOC range.
      1) Ceilings: gypsum board, joint compound.
      2) Insulation: thermal, acoustic.

1.07 QUALITY ASSURANCE

A. See Section 014000 - Quality Requirements for additional requirements.
B. Delegated Designer Qualifications: Perform framing design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
C. SFIA Code Compliance Certification Program: www.CFSteel.org/#sle: Use metal studs and connectors certified for compliance with International Building Code.
D. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
E. Documents at Project Site: Maintain at the project site a copy of manufacturer's instructions, erection drawings, and shop drawings.

1.08 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.
B. Store gypsum products and accessories indoors and keep above freezing. Elevate boards above floor, on nonwicking supports, in accordance with manufacturer's recommendations.
C. Store metal products to prevent corrosion.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Comply with requirements for Contractor's design-related professional design services indicated in Section 014000-Quality Requirements.

B. Design Requirements: Design metal framing systems, components and connectors to withstand specified design loads in compliance with ICC (IBC), ASCE 7, AISI S100, and AISI S240.

C. Design framing systems in accordance with AISI S220, "North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members," unless otherwise indicated.

D. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

E. Regulatory Requirements: Comply with applicable building code criteria for loads, including seismic loads.

F. Design Criteria: In accordance with applicable codes.

1. Able to tolerate movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
2. Seismic Criteria: Comply with ASCE 7 and with local authorities having jurisdiction:
3. Able to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

2.02 PERFORMANCE REQUIREMENTS - SUSTAINABILITY

A. Recycled Content:

1. Provide regular gypsum board with minimum 80 percent recycled content, including recycled content face paper.
2. Regional Materials: If necessary to meet required LEED threshold, provide gypsum board manufactured and containing recycled raw materials recovered within 100 mile radius of Project Site.
3. Celling-applied gypsum board, joint compound, thermal and acoustic insulation: Comply with emissions requirements of CDPH Standard Test Method in Section 01 8113.

2.03 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.
   1. See PART 3 for finishing requirements.
B. Interior Partitions, Indicated as Sound-Rated: Provide completed assemblies with the following characteristics:
   1. Acoustic Attenuation: STC as indicated calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
C. Shaft Walls at HVAC Shafts: Provide completed assemblies with the following characteristics:
   1. Air Pressure Within Shaft: Sustained loads of 5 lbf/sq ft (0.24 kPa) with maximum mid-span deflection of L/240.
   2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
D. Fire-Resistance-Rated Assemblies: Provide completed assemblies as indicated on drawings.
   1. ICC IBC Item Numbers: Comply with applicable requirements of ICC IBC for the particular assembly.
   2. Gypsum Association File Numbers: Comply with requirements of GA-600 for the particular assembly.
   3. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.04 METAL FRAMING MATERIALS

A. Material and Product Requirements Criteria: AISI S201.
B. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.
   1. Structural Grade: As required to meet design criteria.
   2. Corrosion Protection Coating Designation: G40, or equivalent in accordance with AISI S220.
C. Manufacturers - Metal Framing, Connectors, and Accessories: Subject to compliance with requirements, provide products from one of the following;
   1. ClarkDietrich: www.clarkdietrich.com/#sle.
   2. Jaimes Industries: www.jaimesind.com/#sle.
   3. MarinoWARE: www.marinoware.com/#sle.
   4. SCAFCO Corporation: www.scafco.com/#sle.
   5. Substitutions: See Section 016000 - Product Requirements.

D. Nonstructural Framing System Components: AISI S220; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf (L/120 at 240 Pa).
   1. Studs: C-shaped with knurled or embossed faces.
      a. Products: Subject to compliance with requirements, provide one of the following products;
         1) MBA Building Supplies; ProSTUD: www.mbastuds.com/#sle.
         2) Super Stud Building Products, Inc; The EDGE: www.buysuperstud.com/#sle.
         3) Substitutions: See Section 016000 - Product Requirements.
   2. Thickness and Depth: Depth as indicated on the drawings; thickness and structural grade as required to meet design criteria.
   3. Runners: U shaped, sized to match studs.
   4. Ceiling Channels: C-shaped.
      a. Products: Subject to compliance with requirements, provide one of the following products;
         1) Same manufacturer as other framing materials.
         2) Substitutions: See Section 016000-Product Requirements.
   5. Furring Members: Hat-shaped sections, minimum depth of 7/8 inch (22 mm).
      a. Products: Subject to compliance with requirements, provide one of the following products;
         1) Same manufacturer as other framing materials.
         2) Substitutions: See Section 016000 - Product Requirements.
   6. Furring Members: Zee-shaped sections, minimum depth of 1 inch (25 mm).
      a. Products: Subject to compliance with requirements, provide one of the following products;
         1) Same manufacturer as other framing materials.
         2) MBA Building Supplies; MBA Z-Furring: www.mbastuds.com/#sle.
         3) Substitutions: See Section 016000 - Product Requirements.

E. Shaft Wall Studs and Accessories: AISI S220; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.
   1. Products: Subject to compliance with requirements, provide one of the following products;
      a. Same manufacturer as other framing materials.
      b. Substitutions: See Section 016000 - Product Requirements.

F. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection and prevent rotation of studs while maintaining structural performance of partition.
   1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100.
   2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot-dipped galvanized coating.
   3. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.
   4. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-resistance rating of the wall assembly.
      a. Products: Subject to compliance with requirements, provide one of the following products;
         1) ClarkDietrich; BlazeFrame RipTrak: www.clarkdietrich.com/#sle.
         2) FireTrak Corporation; Posi Klip: www.fire-trak.com/#sle.
         3) MBA Building Supplies; Slotted Slip Track: www.mbastuds.com/#sle.
         4) Metal-Lite, Inc; The System: www.metal-lite.net/#sle.
         5) Super Stud Building Products, Inc; Slotted Deflection Track: www.buysuperstud.com/#sle.
         6) Substitutions: See Section 016000 - Product Requirements.

G. Non-structural Framing Accessories:
   1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
   2. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.
      a. Materials: ASTM A36/A36M formed sheet steel support member with factory-welded ASTM A1003/A1003M steel plate base.
      b. Height: 35-3/4 inches (908 mm).
      c. Products: Subject to compliance with requirements, provide one of the following products;
         1) ClarkDietrich; Pony Wall (PW): www.clarkdietrich.com/#sle.
         2) Substitutions: See Section 016000 - Product Requirements.
   3. Framing Connectors: ASTM A653/A653M G90 galvanized steel clips; secures cold rolled channel to wall studs for lateral bracing.
      a. Products: Subject to compliance with requirements, provide one of the following products;
         1) ClarkDietrich; FastBridge Clip (FB33): www.clarkdietrich.com/#sle.

2) Substitutions: See Section 016000 - Product Requirements.

H. Grid Suspension Systems: Steel grid system of main tees and support bars connected to structure using hanging wire.

1. Products: Subject to compliance with requirements, provide one of the following products;
   a. USG Corporation; Drywall Suspension System: www.usg.com/#sle.
   b. Substitutions: See Section 016000 - Product Requirements.

2.05 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board: Subject to compliance with requirements, provide products by one of the following;
   1. American Gypsum Company: www.americangypsum.com/#sle.
   2. CertainTeed Corporation: www.certainteed.com/#sle.
   3. Gold Bond Building Products, LLC provided by National Gypsum Company: www.goldbondbuilding.com/#sle.
   4. PABCO Gypsum: www.pabcogypsum.com/#sle.
   5. USG Corporation: www.usg.com/#sle.
   6. Substitutions: See Section 016000 - Product Requirements.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273, unless indicated otherwise.
      a. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned..
      b. Mold resistant board is required as indicated..
   3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
   4. Thickness:
      a. Vertical Surfaces: 5/8 inch (16 mm).
      b. Ceilings: 1/2 inch (13 mm).
      c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.

C. Impact Resistant Wallboard:
   1. Application: At corridors and as indicated.

2. Surface Abrasion: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
3. Indentation: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
4. Soft Body Impact: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
5. Hard Body Impact: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
6. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
7. Paper-Faced Type: Gypsum wallboard, as defined in ASTM C1396/C1396M.
8. Type: Fire-resistance-rated Type X, UL or WH listed.
9. Thickness: 5/8 inch (16 mm).
10. Edges: Tapered.
11. Paper-Faced Products: Subject to compliance with requirements, provide one of the following products;
    a. American Gypsum Company; M-Bloc IR Type X: www.americangypsum.com/#sle.
    b. CertainTeed Corporation; Extreme Impact Resistant Drywall with M2Tech: www.certainteed.com/#sle.
    c. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond XP Hi-Impact Gypsum Board: www.goldbondbuilding.com/#sle.
    d. USG Corporation; Sheetrock Brand Mold Tough VHI Firecode X Panels 5/8 in. (15.9 mm): www.usg.com/#sle.
    e. Substitutions: See Section 016000 - Product Requirements.

D. Backing Board For Wet Areas: See Section 093000 - Tiling for backing board material.

E. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
1. Application: Vertical surfaces behind thinset tile, except in wet areas.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. Type: Regular, in locations indicated.
4. Regular Board Thickness: 5/8 inch (16 mm).
5. Edges: Tapered.

6. Products: Subject to compliance with requirements, provide one of the following products;
    a. American Gypsum Company; M-Bloc: www.americangypsum.com/#sle.
    b. Georgia-Pacific Gypsum; ToughRock Mold-Guard Gypsum Board: www.gpgypsum.com/#sle.
    c. Georgia-Pacific Gypsum; DensArmor Plus: www.gpgypsum.com/#sle.
    d. Substitutions: See Section 016000 - Product Requirements.

F. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Ceilings, unless otherwise indicated.
2. Thickness: 1/2 inch (13 mm).
3. Edges: Tapered.
4. Products: Subject to compliance with requirements, provide one of the following products;
    a. CertainTeed Corporation; Interior Ceiling Drywall: www.certainteed.com/#sle.
    b. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond High Strength LITE Gypsum Board: www.goldbondbuilding.com/#sle.
    c. USG Corporation; Sheetrock Brand UltraLight Panels 1/2 in. (12.7 mm): www.usg.com/#sle.
    d. Substitutions: See Section 016000 - Product Requirements.

G. Shaftwall and Coreboard: Type X; 1 inch (25 mm) thick by 24 inches (600 mm) wide, beveled long edges, ends square cut. Liner panels attach to
1. Paper-Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM C1396/C1396M; water-resistant faces.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. Paper-Faced Products: Subject to compliance with requirements, provide one of the following products;
    a. American Gypsum Company; M-Bloc Shaft Liner: www.americangypsum.com/#sle.
    b. CertainTeed Corporation; M2Tech Type X Shaftliner: www.certainteed.com/#sle.
    c. Georgia-Pacific Gypsum; ToughRock Shaftliner: www.gpgypsum.com/#sle.

d. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond Shaftliner XP: www.goldbondbuilding.com/#sle.
e. Substitutions: See Section 016000 - Product Requirements.

2.06 GYPSUM BOARD ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed mineral-fiber, friction fit type, unfaced; thickness as required for STC.
B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
1. Products: Subject to compliance with requirements, provide one of the following products;
a. Franklin International, Inc; Titebond Acoustical Smoke & Sound Sealant: www.titebond.com/#sle.
b. Liquid Nails, a brand of PPG Architectural Coatings: www.liquidnails.com/#sle.
c. Specified Technologies Inc; Smoke N Sound Acoustical Sealant: www.stifirestop.com/#sle.
d. Substitutions: See Section 016000 - Product Requirements.
C. Beads, Joint Accessories, and Other Trim: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
1. Heavy Duty Corner Trim: Extruded aluminum trim with painted exposed metal corner used at all corners in high-traffic areas and where indicated.
a. Basis-of-Design Product: Subject to compliance with requirements, provide Fry Reglet Corner Trim, DMCT-1250, or a comparable approved trim.
1) Exposed Metal Width: 1 1/4 inch.
2) Finish: Field painted.
3) Substitutions: See Section 016000 - Product Requirements.
2. Corner Beads: Low profile, for 90 degree outside corners.
a. Products:
1) CertainTeed Corporation; No-Coat Drywall Corner: www.certainteed.com/#sle.
2) ClarkDietrich; Strait-Flex OS-300: www.clarkdietrich.com/#sle.
3) Phillips Manufacturing Co; Everlast Corner Bead: www.phillipsmfg.com/#sle.
4) Substitutions: See Section 016000 - Product Requirements.
3. Expansion Joints:
a. Type: V-shaped metal with factory-installed protective tape.
b. Type: Off-angle inside corner expansion.

c. Products: Subject to compliance with requirements, provide one of the following products;

1) Phillips Manufacturing Co; 093 Expansion Control Joint: www.phillipsmfg.com/#sle.
2) Trim-Tex, Inc; Fire Rated 093V Expansion Bead: www.trim-tex.com/#sle.
3) Substitutions: See Section 016000 - Product Requirements.

D. Decorative Metal Trim:

1. Material: Extruded aluminum alloy 6063-T5 temper.
2. Finish: Anodized, clear.
3. Type: As indicated on drawings.
   a. Products:
      1) Gordon Inc: www.gordon-inc.com/#sle.
      2) Pittcon Industries: www.pittconindustries.com/#sle.
      3) Tamlyn: www.tamlyn.com/#sle.
      4) Substitutions: See Section 016000 - Product Requirements.

E. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.

1. Paper Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners, except as otherwise indicated.
2. Joint Compound: Drying type, vinyl-based, ready-mixed.
3. Joint Compound: Setting type, field-mixed.

F. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

G. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

H. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

I. Adhesive for Attachment to Wood, ASTM C557 and Metal:

1. Products: Subject to compliance with requirements, provide one of the following products;
   a. Franklin International, Inc; Titebond Drywall Construction Adhesive: www.titebond.com/#sle.
   b. Liquid Nails, a brand of PPG Architectural Coatings: www.liquidnails.com/#sle.

c. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 SHAFT WALL INSTALLATION

A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.
   1. Fasten runners to structure with short leg to finished side, using appropriate power-driven fasteners at not more than 24 inches (600 mm) on center.
   2. Install studs at spacing required to meet performance requirements.

B. Shaft Wall Liner: Cut panels to accurate dimensions and install sequentially between special friction studs.
   1. On walls over sixteen feet high, screw-attach studs to runners top and bottom.
   2. Seal perimeter of shaft wall and penetrations with acoustical sealant.

3.03 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C1007AISI S220 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
   1. Level ceiling system to a tolerance of 1/1200.

C. Studs: Space studs at 16 inches on center (at 406 mm on center).
   1. Extend partition framing to structure in all locations.
   2. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Standard Wall Furring: Install at masonry walls scheduled to receive gypsum board, not more than 4 inches (100 mm) from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches (600 mm) on center.
   1. Orientation: Vertical.
   2. Spacing: At 16 inches on center (At 400 mm on center).

F. Blocking: Install wood blocking for support of:

1. Framed openings.
2. Wall-mounted cabinets.
3. Plumbing fixtures.
4. Toilet partitions.
5. Toilet accessories.
6. Wall-mounted door hardware.
7. Wall-mounted equipment

3.04 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
   1. Place one bead continuously on substrate before installation of perimeter framing members.
   2. Place continuous bead at perimeter of each layer of gypsum board.
   3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.05 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
   1. Exception: Tapered edges to receive joint treatment at right angles to framing.

C. Double-Layer, Nonrated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.

D. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

E. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.

F. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.

3.06 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as follows:
   1. Not more than 30 feet (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.
B. Corner Beads: Install at external corners, using longest practical lengths.
C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.
D. Decorative Trim: Install at locations shown on drawings and in accordance with manufacturer's instructions.

3.07 JOINT TREATMENT

A. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.
B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
   2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   3. Level 3: Walls to receive textured wall finish.
   4. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
   5. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.
C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).
   2. Taping, filling, and sanding are not required at base layer of double-layer applications.
D. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.08 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

3.09 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Clean wall cavities before close-in and all exposed surfaces.

3.10 PROTECTION

A. Protect installed gypsum board assemblies from subsequent construction operations.

END OF SECTION

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SECTION 093000
TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for wall applications.
B. Cementitious backer board as tile substrate.
C. Stone thresholds.
D. Ceramic trim.
E. Non-ceramic trim.

1.02 RELATED REQUIREMENTS

A. Section 079200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.

1.03 REFERENCE STANDARDS

A. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2023.
B. ANSI A108.1b - Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set, Modified Dry-Set, or Improved Modified Dry-Set Cement Mortar; 2023.
C. ANSI A108.1c - Contractor's Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set, Modified Dry-Set, or Improved Modified Dry-Set Cement Mortar; 2023.
D. ANSI A108.2 - American National Standard General Requirements: Materials, Environmental and Workmanship; 2019.
E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesive or Water Cleanable Tile-Setting Epoxy Adhesive; 2023.
F. ANSI A108.5 - Setting of Ceramic Tile with Dry-Set Cement Mortar, Modified Dry-Set Cement Mortar, EGP (Exterior Glue Plywood) Modified Dry-Set Cement Mortar, or Improved Modified Dry-Set Cement Mortar; 2023.
G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grout Epoxy; 2023.
H. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (Reaffirmed 2019).
I. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 2023.

J. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 2017 (Reaffirmed 2022).
K. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2023.
L. ANSI A108.12 - Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Modified Dry-Set Mortar; 2023.
M. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2021).
N. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar; 2020.
O. ANSI A108.20 - American National Standard Specifications for Exterior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs; 2020.
P. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive; 2021.
Q. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 2023.
R. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2023.
S. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2014 (Reaffirmed 2019).
T. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar; 2023.
U. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2022.
V. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products; 2018 (Reapproved 2023).
W. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

X. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.

Y. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

Z. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2024.

AA. TCNA (HB-GP) - Handbook for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs Installation; 2023.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by affected installers.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Master Grade Certificate: Submit for each type of tile, signed by the tile manufacturer and tile installer.

F. Installer's Qualification Statement:

1. Submit documentation of National Tile Contractors Association (NTCA) or Tile Contractors' Association of America (TCAA) accreditation.
2. Submit documentation of completion of apprenticeship and certification programs.

G. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Tile: 10 square feet (1 square meters) of each size, color, and surface finish combination.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

B. Installer Qualifications: Natural Stone Institute (NSI) Accredited Commercial B Contractor (light commercial): www.naturalstoneinstitute.org/#sle.

C. Installer Qualifications:

1. Company specializing in performing tile installation, with minimum of five years of documented experience.

a. Accredited Five-Star member of the National Tile Contractors Association (NTCA) or Trowel of Excellence member of the Tile Contractors' Association of America (TCAA).

2. Installer Certification:

a. Ceramic Tile Education Foundation (CTEF): Certified Tile Installer (CTI).

1.07 MOCK-UPS

A. See Section 014000 - Quality Requirements for general requirements for mock-up.

B. Construct tile mock-up where indicated on drawings, incorporating all components specified for the location.

1. Minimum size of mock-up is indicated on drawings.
2. Approved mock-up may remain as part of work.
3. Demolish mock-up when directed by Architect, and remove debris from the site.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.09 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

B. Maintain ambient and substrate temperature above 50 degrees F (10 degrees C) and below 100 degrees F (38 degrees C) during installation and curing of setting materials.

PART 2 PRODUCTS

2.01 TILE

A. Glazed Wall Tile, Types CWT-1, CWT-2 and CWT-3: ANSI A137.1 standard grade.

1. Moisture Absorption: 7.0 to 20.0 percent as tested in accordance with ASTM C373.
2. Size: 2 by 8 inches (51 by 202 mm), nominal.
3. Edges: Cushioned.

4. Surface Finish: High gloss, unless otherwise indicated.
5. Style/Color(s):
    a. Type CWT-1a: American Olean, Conrad Brick, Polar.
    b. Type CWT-1b: American Olean, Conrad Brick, Color to be selected.
    c. Type CWT-1c: American Olean, Conrad Brick, Color to be selected.
    d. Type CWT-2: American Olean, Color Story Wall, Restore.
6. Products: Subject to compliance with requirements, provide American Olean or comparable product from one of the following;
    a. Dal-Tile Corporation: www.daltile.com/#sle.
    b. Substitutions: See Section 016000 - Product Requirements.

2.02 TRIM AND ACCESSORIES

A. Ceramic Trim: Matching ceramic shapes as indicated.
    1. Applications:
        a. Inside Corners: Jointed.
        b. Floor to Wall Joints: Cove base, 4 by 6 inches at tile Type CWT-2.
    2. Manufacturers: Same as for tile.
B. Non-Ceramic Trim: Brushed stainless steel, style and dimensions to suit application, set with tile mortar or adhesive, exposed edge flush with face of tile.
    1. Applications:
        a. Open edges of wall and floor tile, Schulter-Systems, JOLLY trim.
        b. Outside wall corners, Schulter-Systems, FINEC trim.
        c. Floor-to-wall joints, Schulter-Systems, DILEX-AHK base at tile Type CWT-1a, CWT-1b and CWT-1c.
    2. Products: Subject to compliance with requirements, provide Schluter-Systems trim or comparable products.
        a. Substitutions: See Section 016000 - Product Requirements.
C. Thresholds: 2 inches (51 mm) wide by full width of wall or frame opening; beveled edge on both long edges; without holes, cracks, or open seams.
    1. Thickness: 1/2 inch (12.7 mm).
    2. Material: Marble, honed finish.
    3. Applications:
        a. At doorways where tile terminates.
        b. At open edges of floor tile where adjacent finish is a different height.

2.03 SETTING MATERIALS

A. Provide setting and grout materials from same manufacturer.

B. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.
   1. Applications: Use this type of bond coat where indicated, and where no other type of bond coat is indicated.
   2. Products:
      a. ARDEX Engineered Cements; S 28: www.ardexamericas.com/#sle.
      b. Custom Building Products; Complete Contact-LFT Premium Rapid Setting Large Format Tile Mortar, with Multi-Surface Bonding Primer: www.custombuildingproducts.com/#sle.
      c. H.B. Fuller Construction Products, Inc; TEC TotalFlex 150 Universal Mortar: www.tecspecialty.com/#sle.
      d. LATICRETE International, Inc; MULTIMAX LITE: www.laticrete.com/#sle.
      e. Mapei Corporation; Granirapid System: www.mapei.com/#sle.
      f. Substitutions: See Section 016000 - Product Requirements.

2.04 GROUTS

A. Provide setting and grout materials from same manufacturer.
B. Epoxy Grout: ANSI A118.3 chemical resistant and water-cleanable epoxy grout.
   1. Applications: Typical unless otherwise indicated..
   2. Color(s): As selected by Architect from manufacturer's full line.
   3. Products: Subject to compliance with requirements, provide one of the following or comparable;
      a. ARDEX Engineered Cements; ARDEX WA: www.ardexamericas.com/#sle.
      b. Custom Building Products; CEG-IG 100% Solids Industrial Grade Epoxy Grout: www.custombuildingproducts.com/#sle.
      c. H.B. Fuller Construction Products, Inc; TEC AccuColor EFX Epoxy Special Effects Grout: www.tecspecialty.com/#sle.
      d. LATICRETE International, Inc; LATICRETE SPECTRALOCK PRO Premium Grout: www.laticrete.com/#sle.
      e. Mapei Corporation; Kerapoxy CQ: www.mapei.com/#sle.
      f. Substitutions: See Section 016000 - Product Requirements.

2.05 ACCESSORY MATERIALS

A. Waterproofing Membrane at Floors: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.

1. Crack Resistance: No failure at 1/16 inch (1.6 mm) gap, minimum; comply with ANSI A118.12.
2. Fluid or Trowel Applied Type:
    a. Material: Synthetic rubber or Acrylic.
    b. Thickness: 25 mils (0.6 mm), minimum, dry film thickness.
    c. Products:
        1) ARDEX Engineered Cements; ARDEX 8+9: www.ardexamericas.com/#sle.
        2) Custom Building Products; RedGard Crack Prevention and Waterproofing Membrane: www.custombuildingproducts.com/#sle.
        3) H.B. Fuller Construction Products, Inc; TEC HydraFlex Waterproofing Crack Isolation Membrane: www.tecspecialty.com/#sle.
        4) LATICRETE International, Inc; LATICRETE HYDRO BAN: www.laticrete.com/#sle.
        5) Mapei Corporation; Mapelastic AquaDefense: www.mapei.com/#sle.
        6) Substitutions: See Section 016000 - Product Requirements.

B. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 7/16 inch (11 mm) thick; 2 inch (51 mm) wide coated glass fiber tape for joints and corners.
1. Products:
    a. Custom Building Products; WonderBoard Lite Backerboard: www.custombuildingproducts.com/#sle.
    b. Substitutions: See Section 016000 - Product Requirements.

C. Mesh Tape: 2 inch (50 mm) wide self-adhesive fiberglass mesh tape.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

B. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).
1. Test as Follows:
    a. Alkalinity (pH): ASTM F710.
    b. Internal Relative Humidity: ASTM F2170.
    c. Moisture Vapor Emission: ASTM F1869.
2. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer.

C. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

3.03 INSTALLATION - GENERAL

A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.20, manufacturer's instructions, and TCNA (HB) or TCNA (HB-GP) recommendations, as applicable.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align base and wall joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install non-ceramic trim in accordance with manufacturer's instructions.

G. Install thresholds where indicated.

H. Sound tile after setting. Replace hollow sounding units.

I. Keep control and expansion joints free of mortar, grout, and adhesive.

J. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

K. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

L. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.04 INSTALLATION - WALL TILE

A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.

3.05 CLEANING

A. Clean tile and grout surfaces.

3.06 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

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SECTION 095100
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.02 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

C. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

E. CHPS (HPPD) - High Performance Products Database; Current Edition.

F. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning.

C. Product Data: Provide data on suspension system components and acoustical units.

D. Sustainable Design Requirements:

1. The Owner requires the Contractor to implement practices and procedures to meet the Project’s environmental performance goals, which include achieving LEED Silver.
    a. Refer to Section 013329.02 - Sustainable Design Reporting - LEED v4 and v4.1 for the Project’s target certification level and specific third-party certification requirements.

b. The Contractor shall ensure that the requirements related to the Project's sustainability design goals are fully implemented.
c. Substitutions, or other changes to the work proposed by the Contractor or their Subcontractors, shall not be allowed if such changes compromise the Project's sustainability goals and third-party certifications.

E. Samples: Submit two samples minimum 4 inches square in size illustrating material and finish of acoustical units.

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Acoustical Units: 1 sealed case of each size and color of panel provided..

1.06 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.
1. VOC Content: Certified as Low Emission by one of the following:
a. Product listing in UL (GGG).
b. Product listing in CHPS (HPPD).

B. Acoustical Panels Type SACP-1: Painted mineral fiber, with the following characteristics:
1. Application(s): Typical, unless otherwise indicated..
2. Classification: ASTM E1264 Type III.
a. Form: 2, water felted.
b. Pattern: "C" - perforated, small holes.
3. Size: 24 by 24 inches (610 by 610 mm).
4. Thickness: 5/8 inch (16 mm).
5. Light Reflectance: 80 percent, determined in accordance with ASTM E1264.
6. NRC Range: 0.55 to 0.60, determined in accordance with ASTM E1264.
7. Ceiling Attenuation Class (CAC): 33, determined in accordance with ASTM E1264.
8. Panel Edge: Square.

9. Color: White.
10. Suspension System: Exposed grid.
11. Products: Subject to compliance with requirements, provide Armstrong World Industries, Inc, Cortega panels or comparable by one of the following;
    a. Certainteed Architectural: www.certainteed.com/ceilings-and-walls/#sle.
    b. USG Corporation: www.usg.com/ceilings/#sle.
    c. Substitutions: See Section 016000 - Product Requirements.

C. Acoustical Panels, Type SACP-2: Mineral fiber with colored membrane-faced overlay, with the following characteristics:
1. Application(s): As indicated.
2. Classification: ASTM E1264 Type IV.
    a. Form: 2, water felted.
    b. Pattern: "G" - smooth.
3. Size: 24 by 24 inches (610 by 610 mm).
4. Thickness: 1 inch (25 mm).
5. Light Reflectance: 85 percent, determined in accordance with ASTM E1264.
6. NRC Range: 84 to 86, determined in accordance with ASTM E1264.
7. Articulation Class (AC): 170, determined in accordance with ASTM E1264.
8. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
9. Panel Edge: Square.
10. Color: Match Architect's sample.
11. Suspension System: Exposed grid.
12. Products: Basis-of-Design; subject tocompliance with requirements, provide Armstrong World Industries, Inc., CALLA panels or comparable product.
    a. Substitutions: See Section 016000 - Product Requirements.

D. Acoustical Panels Type SACP-3: Mineral fiber with scrubbable finish, with the following characteristics:
1. Application(s): Kitchen.
2. Classification: ASTM E1264 Type IX.
    a. Form: 2, water felted.
    b. Pattern: "G" - smooth.
3. Size: 24 by 24 inches (610 by 610 mm).
4. Thickness: 5/8 inch (16 mm).
5. Light Reflectance: 89 percent, determined in accordance with ASTM E1264.

6. Ceiling Attenuation Class (CAC): 33, determined in accordance with ASTM E1264.
7. Panel Edge: Square.
8. Color: White.
9. Suspension System: Exposed grid.
10. Products: Subject to compliance with requirements, provide Armstrong World Industries, Inc., KITCHEN ZONE panels or comparable by one of the following;
    a. USG Corporation; Kitchen Lay-In Panels: www.usg.com/ceilings/#sle.
    b. Substitutions: See Section 016000 - Product Requirements.

2.02 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings as required.
B. Provided by Acoustic panel manufacturer.
    1. Materials:
        a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.
        b. Aluminum Grid: Aluminum sheet, ASTM B209/B209M.
C. Exposed Suspension System: Hot-dipped galvanized steel grid with aluminum cap.
    1. Structural Classification: Intermediate-duty, when tested in accordance with ASTM C635/C635M.
    2. Profile: Tee; 15/16 inch (24 mm) face width.
    3. Finish: Baked enamel.
    4. Color: Match Architect's sample.
    5. Products: Subject to compliance with requirements, provide Armstrong World Industries, Inc., Prelude XL or comparable product by one of the following;
        a. Certainteed Architectural; 15/16" EZ Stab Classic System: www.certainteed.com/ceilings-and-walls/#sle.
        b. USG Corporation; Donn Brand ZXLA 15/16 inch Acoustical Suspension System: www.usg.com/ceilings/#sle.
        c. Substitutions: See Section 016000 - Product Requirements.

2.03 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
B. Hanger Wire: 12 gauge, 0.08 inch (2 mm) galvanized steel wire.
C. Perimeter Moldings: Same metal and finish as grid.
    1. Size: As required for installation conditions.

2. Angle Molding: L-shaped, for mounting at same elevation as face of grid.
3. Acoustical Sealant For Perimeter Moldings: Non-hardening, non-skinning, for use in conjunction with suspended ceiling system.

D. Metal Edge Trim for Suspension Systems: Steel or extruded aluminum; provide attachment clips, splice plates, and preformed corner pieces for complete trim system.
1. Trim Height: As indicated on drawings.
2. Finish: Baked enamel.
3. Color: To match ceiling grid.
4. Products: Basis-of-Design; Subject to compliance with requirements, provide Armstrong World Industries, Inc., Axiom Trim or comparable product from one of the following;
a. Flannery, Inc; Strata Ceiling Trims: www.flannerytrim.com/#sle.
b. Tamlyn; PACT Acoustical Trim: www.xtremeias.com/#sle.
c. USG Corporation; Compasso Suspension Trim: www.usg.com/ceilings/#sle.
d. Substitutions: See Section 016000 - Product Requirements.

E. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify that layout of hangers will not interfere with other work.

3.02 PREPARATION

A. Install after major above-ceiling work is complete.
B. Coordinate the location of hangers with other work.
C. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

3.03 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with manufacturer's instructions and as supplemented in this section.
B. Configure suspension system so that its concealed from view within 24 inches of any open side.
C. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
D. Locate system on room axis according to reflected plan.

E. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Install in bed of acoustical sealant.
   2. Use longest practical lengths.

F. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

I. Support fixture loads using supplementary hangers located within 6 inches (152 mm) of each corner, or support components independently.

J. Do not eccentrically load system or induce rotation of runners.

3.04 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

E. Cutting Acoustical Units:
   1. Make field cut edges of same profile as factory edges.

3.05 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.06 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Clean surfaces.

C. Replace damaged or abraded components.

END OF SECTION

SECTION 095423
LINEAR METAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Linear metal ceilings.

B. Suspended metal support system and perimeter trim.

1.02 RELATED REQUIREMENTS

A. Section 072100 - Thermal Insulation: Sound attenuation insulation.

B. Section 265100 - Interior Lighting: Integrated light fixtures.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

E. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2022.

1.04 DESIGN REQUIREMENTS

A. Design components to ensure light fixtures will not induce eccentric loads. Where components may induce rotation of ceiling system components, provide stabilizing reinforcement.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate work of this section with installation of mechanical and electrical components and with other construction activities affected by work of this section.

B. Preinstallation Meeting: Convene one week before starting work of this section.

C. Sequencing: Supply hanger clips during steel deck erection. Supply additional hangers and inserts as required.

1.06 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Furnish for component profiles.

C. Shop Drawings: Indicate reflected ceiling plan.
D. Samples: Submit two samples 6 by 12 inch (152 by 305 mm) in size illustrating color and finish of components exposed to view.
E. Manufacturer's qualification statement.
F. Installer's qualification statement.
G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    1. See Section 016000 - Product Requirements for additional provisions.
    2. Extra Linear Panels: Ten, standard length.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
B. Installer Qualifications: Company specializing in performing the work of this section.
    1. Minimum five years documented experience.
    2. Approved by metal ceiling manufacturer.
C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc.

1.08 MOCK-UPS

A. See Section 014000 - Quality Requirements for additional requirements.
B. Construct ceiling mock-up, 8 feet (2.44 m) long by 8 feet (2.44 m) wide; include suspension system, panels, closures in mock-up.
C. Locate mock-up where directed.
D. Mock-up may remain as part of the work.

1.09 DELIVERY, STORAGE, AND HANDLING

A. See Section 017419 - Construction Waste Management and Disposal for packaging waste requirements.
B. Accept factory-finished products on site in manufacturer's unopened factory packaging only; reject opened packages.
C. Protect factory-finished products from damage to appearance by storing products in manufacturer's unopened factory packaging in dry storage area.

1.10 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.
B. Manufacturer Warranty: Provide 5-year manufacturer warranty; include coverage for corrosion resistance and discoloration of surface finish.

PART 2 PRODUCTS

2.01 LINEAR METAL CEILINGS

A. Linear Metal Ceiling System: Panels, suspension members, trim, and accessories as required to provide a complete system.

B. Performance Requirements:

1. Design to support imposed loads of indicated items without eccentric loading of supports.
2. Design for maximum deflection of 1/360 of span.
3. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
4. Systems Located Outside Building Envelope:
    a. Accommodate wind and suction loads and wind uplift without damage in accordance with applicable code.

2.02 COMPONENTS

A. Linear Metal Panels:

1. Type: Linear panel, butt jointed; snap-in installation.
    a. Size and Configuration: 9 inches wide by 96 inches long by 1 inch deep.
    b. Panel Profile: Plank shaped with square edges.
    c. Perforations:
        1) Interior Locations: M2 - Microperforated.
        2) Exterior Locations: M1 - Unperforated.
2. Material: Aluminum sheet, ASTM B209/B209M.
    a. Finish: Powder coated; Color and "wood-look" pattern as selected by Architect from manufacturer's full range.
3. Products: Subject to compliance with requirements, provide Armstrong World Industries, Inc., MetalWorks Synchro or comparable product by one of the following;
    a. Certainteed Architectural, www.certainteed.com/ceilings-and-walls/#sle.
    b. USG Corporation, www.usg.com/ceilings/#sle.
    c. Substitutions: See Section 016000-Product Requirements.

B. Edge Molding, Expansion Joints, and Splices: Same material, thickness, and finish as linear panels.

C. End Caps: Formed metal; same color and finish as sight-exposed surfaces of linear panels.

D. Suspension Members: Formed steel sections, with integral attachment points; galvanized finish; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
E. Suspension Wire: Steel, annealed, galvanized finish, 9 gauge, 0.1144 inch (2.91 mm) diameter.
F. Subgirt Members: Hot-dip galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating; formed to resist imposed loads and to provide attachment for linear ceiling and accessories.
G. Sound Attenuation Insulation: See Section 072100.
H. Touch-up Paint For Concealed Items: Zinc rich type.

2.03 FABRICATION

A. Shop cut linear panels to accommodate mechanical and electrical items.
B. Factory-form internal and external corners of same material, thickness, finish, and profile to match exposed linear panels ; back brace internal corners.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify that layout of hangers will not interfere with other work.
C. Verify that required utilities are available, in proper location, and ready for use.
D. Verify that field measurements are as indicated.

3.02 INSTALLATION

A. Suspension Components:
    1. Install after above-ceiling work is complete in accordance with manufacturer's instructions, ASTM C636/C636M, and ASTM E580/E580M.
    2. Hang carrying members independent of walls, columns, ducts, light fixtures, pipe, and conduit; where carrying members are spliced, avoid visible displacement of face panels with adjacent panels.
    3. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest adjacent hangers to span the required distance.
    4. Locate suspension system for linear panel layout on room axis according to reflected plan.
B. Linear Metal Ceiling:
    1. Install linear panels and other system components in accordance with manufacturer's instructions.
    2. Stagger end joints minimum 12 inches (300 mm).

3. Butt interior end joints tight.
4. Set exterior end joints with 1/16 inch (2 mm) gap for expansion and contraction.
5. Provide expansion joints to accommodate plus or minus 1 inch (25 mm) movement and maintain visual closure.
6. Field miter corners at changes in panel direction.
7. Install edge moldings at junctions with other finishes and at vertical surfaces; use maximum piece lengths.
8. Install end caps at sight-exposed ends of linear panels.
9. Exercise care when site cutting sight-exposed finished components to ensure surface finish is not defaced.

C. Sound Attenuation Insulation: Install above panel members; fit tight between grid members ; place insulation with facing side down, where indicated on interior units.

3.03 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).
B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.
C. Maximum Variation From Dimensioned Position: 1/4 inch (6 mm).

3.04 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.
B. Clean surfaces.
C. Replace damaged or abraded components.

END OF SECTION

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SECTION 095426
SUSPENDED WOOD CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wood veneer panels.

B. Wood grilles.

C. Metal suspension system.

1.02 REFERENCE STANDARDS

A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

B. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

E. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2022.

F. CISCA (WC) - Wood Ceilings Technical Guidelines; 2009.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure ceilings are not installed until building is enclosed, dust generating activities have terminated, and overhead work is completed.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning, attachment of wood ceiling components to grid, accessory attachments, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.

C. Product Data: Provide data on wood ceiling components and suspension system components.

D. Samples: Submit two samples each, 12 inches (305 mm) long, of suspension system main runner, cross runner, and perimeter molding.

E. Test Reports: Certified test data from an independent test agency verifying that panels meet specified requirements for fire, acoustical, and seismic performance.

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
G. Manufacturer's qualification statement.
H. Installer's qualification statement.
I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements for additional provisions.
2. Wood Ceiling Components: Provide a quantity equal to 2 percent of total product installed.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with at least three years documented experience.
B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.06 MOCK-UPS

A. See Section 014000 - Quality Requirements for additional requirements.
B. Construct 8 feet (2.44 m) by 8 feet (2.44 m) mock-up including suspension members, trim, and wood ceiling components.
C. Locate where directed.
D. Mock-up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver wood ceiling components to project site in original, unopened packages.
B. Store in fully enclosed space, flat, level and off the floor.

1.08 FIELD CONDITIONS

A. Do not install suspended wood ceiling system until wet construction work is complete and permanent heat and air conditioning is installed and operating.

PART 2 PRODUCTS

2.01 SOURCE LIMITATIONS:

A. Obtain wood ceiling system, panels, trim, suspension system and accessories from single source and from a single manufacturer.

2.02 SUSPENDED WOOD CEILING SYSTEM

A. Performance Requirements:
1. Design for maximum deflection of 1/360 of span.
2. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

B. Wood-Based Materials:
   1. Certified as sustainably harvested as specified in Section 016000.
C. Wood Veneer Panels Type LWC-1: Composite wood core with wood veneer finish.
D. Wood Grilles: Pre-assembled module of wood veneer grilles with battens.
   1. Module Size: 12 by 72 inches (305 by 1829 mm), nominal.
   2. Slat Width: 3/4 inch (19 mm).
   3. Slat Height: 2-1/2 inch (63 mm).
   4. Slats Per Panel: Four.
   5. Acoustical Backer: Fiberglass, 1 inch (25 mm) thick, where indicated on drawings.
      a. Color: Black.
   6. Veneer Species: As selected by Architect from manufacturer's full range.
      a. Veneer Cut: As selected.
      b. Veneer Matching: As selected.
      c. End Matching: Manufacturer's recommended matching.
      d. Factory Finish: Clear sealer.
   7. Attachment to Suspension Grid: Manufacturer's recommended method according to panel product selected.
   8. Suspension System: Type specified below.
   9. Products: Subject to compliance with requirements, provide Armstrong Woodworks Grille - Forte Veneer or comparable product by one of the following;
      a. 9Wood: www.9wood.com/products/grilles/#sle.
      b. Certainteed Architectural: www.certainteed.com/ceilings-and-walls/#sle.
      c. ulon International.
      d. USG Corporation: www.usg.com/ceilings/#sle.
      e. Substitutions: See Section 016000 - Product Requirements.
E. End Trim: WoodWorks Veneered FRPB trim to match panels, 4 inches high unless otherwise indicated, or comparable product.
   1. Substitutions: See Section 016000-Product Requirements.
F. Metal Suspension System:
   1. General: Comply with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.
      a. Materials:
         1) Aluminum Grid: Aluminum sheet, ASTM B209/B209M.

2. Concealed Ceiling Suspension System: Aluminum grid.
    a. Description: Engineered grid, with slotted faces in main tees, cross tees, hangers, trim molding, load resisting struts, hinge assemblies, and other suspension components required to support ceiling and other ceiling supported construction. Panels installed from below by inserting torsion springs into slots in faces of main tees of ceiling grid.
    b. Application(s): Downward access.
    c. Structural Classification: Heavy-duty, when tested in accordance with ASTM C635/C635M.
    d. Profile: Flat.
    e. Finish: Powder coat.
    f. Color: Black.
    g. Products: Provide metal suspension system by ceiling panel manufacturer.
3. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement.

G. Accessories: Manufacturer's standard accessories for installation method indicated, above-ceiling accessibility.

2.03 FABRICATION

A. Shop fabricate wood ceiling components to the greatest extent possible.

B. Fabricate components to allow access to ceiling plenum as required.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Do not install ceiling until after interior wet work is dry.

3.02 PREPARATION

A. Coordinate the location of hangers with other work.

B. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

C. Layout wood ceiling components in pattern according to reflected ceiling plan and as shown on shop drawings.

D. Acclimate wood ceiling materials by removing from packaging in installation area a minimum of 48 hours prior to installation.

3.03 INSTALLATION

A. General: Install suspended wood ceiling system in accordance with CISCA (WC).

B. Configure suspension system so that its concealed from view within 24 inches of any open side.

C. Suspension System:
   1. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
   2. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
   3. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
   4. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
   5. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
   6. Support fixture loads using supplementary hangers located within 6 inches (152 mm) of each corner, or support components independently.
   7. Do not eccentrically load system or induce rotation of runners.

D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Provide 4 inch high, Veneered FRPB end trim to match ceiling panels, by ceiling manufacturer.

E. Wood Ceiling:
   1. Install wood ceilings in accordance with manufacturer's instructions.
   2. Fit wood components in place, free from damaged edges or other defects detrimental to appearance and function.
   3. Install components in uniform plane, and free from twist, warp, and dents.
   4. Cut to fit irregular grid and perimeter edge trim.
   5. Make field cut edges of same profile as factory edges, seal and finish according to manufacturer.
   6. Install clips, stabilizer bars, and other attachments as indicated to secure wood ceiling components tight to the grid system.
   7. Install acoustical backer above wood ceiling components; fit tight between grid members.

3.04 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

3.05 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Clean and touch up minor finish damage. Remove and replace components that cannot be successfully cleaned and repaired.

END OF SECTION

SECTION 096500
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient sheet flooring.
B. Static control resilient tile flooring.
C. Resilient base.
D. Resilient stair accessories.
E. Installation accessories.

1.02 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.
B. Section 033000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied resilient flooring.
C. Section 260526 - Grounding and Bonding for Electrical Systems: Grounding and bonding of static control flooring to building grounding system.

1.03 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2023.
B. ASTM F150 - Standard Test Method for Electrical Resistance of Conductive and Static Dissipative Resilient Flooring; 2006 (Reapproved 2018).
C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.
D. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.
E. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.
F. ASTM F2034 - Standard Specification for Sheet Linoleum Floor Covering; 2018.
G. ASTM F2169 - Standard Specification for Resilient Stair Treads; 2015 (Reapproved 2020).
H. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.
I. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
C. Shop Drawings: Indicate seaming plans and floor patterns.
D. Verification Samples: Submit two samples, 24 by 24 inch (609 by 609 mm) in size illustrating color and pattern for each resilient flooring product specified.
E. Sustainable Design Submittal: Submit VOC content documentation for flooring and adhesives.
F. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
G. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.
H. Installer's Qualification Statement.
I. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
    1. See Section 016000 - Product Requirements, for additional provisions.
    2. Extra Flooring Material: Quantiy equivalent to 5 percent of each type and color.
    3. Extra Wall Base: One full length roll of each type and color.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.
B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.
C. Testing Agency Qualifications: Independent firm specializing in performing concrete slab moisture testing and inspections of the type specified in this section.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
B. Store all materials off of the floor in an acclimatized, weather-tight space.
C. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).
D. Protect roll materials from damage by storing on end.
E. Do not double stack pallets.

1.07 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

PART 2 PRODUCTS

2.01 SHEET FLOORING

A. Linoleum Sheet Flooring - Type LIN-1, LIN-2 and LIN-3: Homogeneous wear layer bonded to backing, with color and pattern through wear layer thickness.
   1. Manufacturers: Subject to compliance with requirements, provide Forbo Flooring, Inc., Marmoleum or comparable product by one of the following;
      a. Gerflor USA, Inc: www.gerflorusa.com/#sle.
      b. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.
      c. Substitutions: See Section 016000 - Product Requirements.
   2. Minimum Requirements: Comply with ASTM F2034, Type corresponding to type specified.
   3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
   4. VOC Content Limits: As specified in Section 016116.
   5. Backing: Jute fabric.
   6. Thickness: 0.100 inch (2.5 mm), minimum, excluding backing.
   7. Sheet Width: 79 inch (2000 mm), minimum.
   8. Seams: Heat welded.
   9. Pattern: Marbleized.
   10. Color: Forbo Marbled Collection, As selected by Architect from manufacturer's full range..

B. Welding Rod: Solid bead in material compatible with flooring, produced by flooring manufacturer for heat welding seams, and in color matching field color.

2.02 TILE FLOORING

A. Static Control Tile - Type SDT-1: Homogeneous; color and pattern throughout thickness.
   1. Product: Subject to compliance with requirements, provide Forbo Flooring, Inc, Colorex SD or comparable product.
      a. Substitutions: See Section 016000 - Product Requirements.
   2. Electrical Resistance:

a. Conductive Tile: Resistance between 25 kiloohms and 1.0 megohms as tested in accordance with ASTM F150.
b. Dissipative Tile: Resistance between 1.0 megohms and 1000 megohms as tested in accordance with ASTM F150.

3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
4. VOC Content Limits: As specified in Section 016116.
5. Tile Size: 24 by 24 inch (610 by 610 mm).
6. Total Thickness: 0.125 inch (3 mm).
7. Color: Forbo Colorex SD. As selected by Architect from manufacturer's full range.

2.03 STAIR COVERING

A. Stair Treads with Integral Risers: Rubber; full height of riser, full width and depth of tread in one piece; tapered thickness.
1. Manufacturers: Basis-of-Design; Subject to compliance with requirements provide Johnsonite a Tarkett Company one piece tread and riser or comparable product by one of the following;
a. Flexco Corporation: www.flexcofloors.com/#sle.
b. Mannington Commercial: www.manningtoncommercial.com#sle.
c. Roppe Corporation: www.roppe.com/#sle.
d. Substitutions: See Section 016000 - Product Requirements.
2. Minimum Requirements: Comply with ASTM F2169, Type TS, rubber, vulcanized thermoset.
3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
4. Nominal Thickness: 0.1875 inch (4.75 mm).
5. Nosing: Square.
6. Striping: 2 inch (24 mm) wide contrasting color abrasive strips.
7. Tread Texture: Hammered.
8. Color: To be selected by Architect from manufacturer's full range.

2.04 LANDING COVERING

A. Resilient Tile: Rubber to match stair treads.
1. Size: 24 by 24 inches.

2.05 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS, rubber, vulcanized thermoset; Style B, Cove, unless indicated otherwise.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following;
      a. Flexco Corporation: www.flexcofloors.com/#sle.
      b. Johnsonite, a Tarkett Company: www.johnsonite.com/#sle.
      c. Mannington Commercial: www.manningtoncommercial.com#sle.
      d. Roppe Corporation: www.roppe.com/#sle.
      e. Substitutions: See Section 016000 - Product Requirements.
   2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
   3. Height: 4 inches (100 mm).
   4. Thickness: 0.125 inch (3.2 mm).
   5. Finish: Satin.
   6. Length: Roll.
   7. Color: To be selected by Architect from manufacturer's full range.
   8. Accessories: Premolded external corners.

2.06 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
   1. VOC Content Limits: As specified in Section 016116.
C. Adhesive for Linoleum Flooring and Resilient Base: As recommended by flooring and base manufacturers and meeting VOC content limits in Section 016116.
D. Resilient Moldings, Transition and Edge Strips: As scheduled on Drawings.
   1. Manufacturers: Basis-of-Design; Subject to compliance with requiements, provide Johnsonite a Tarkett Company, Slimline series or comparable product by one of the following;
      a. Mannington Commercial: www.manningtoncommercial.com#sle.
      b. Schluter-Systems: www.schluter.com/#sle.
      c. Substitutions: See Section 016000 - Product Requirements.
E. Extruded Moldings, Transition and Edge Strips: As scheduled on Drawings.

1. Manufacturers: Basis-of-Design; Subject to compliance with requirements, provide Schluter-Systems; Stainless steel - satin finish in configuration indicated, or comparable product;
    a. Substitutions: See Section 016000 - Product Requirements.

F. Copper Grounding Strips: Type and size as recommended by static control flooring manufacturer.

G. Floor Polish for Static Control Flooring: Fluid-applied polish, intended to protect electrical properties of flooring, as recommended by static control flooring manufacturer.

H. Sealer and Wax: Types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
    1. Test as Follows:
        a. Alkalinity (pH): ASTM F710.
        b. Internal Relative Humidity: ASTM F2170.
        c. Moisture Vapor Emission: ASTM F1869.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.

C. Prohibit traffic until filler is fully cured.

D. Clean substrate.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Adhesive-Applied Installation:

1. Spread only enough adhesive to permit installation of materials before initial set.
2. Place copper grounding strip in conductive adhesive and apply additional adhesive to top side of strip before installing static control flooring. Allow strip to extend beyond flooring in accordance with static control flooring manufacturer's instructions. Refer to Section 260526 for grounding and bonding to building grounding system.
3. Fit joints and butt seams tightly.
4. Set flooring in place, press with heavy roller to attain full adhesion.

D. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

E. Install flooring in recessed floor access covers, maintaining floor pattern.

F. At movable partitions, install flooring under partitions without interrupting floor pattern.

3.04 INSTALLATION - SHEET FLOORING

A. Lay flooring with joints and seams parallel to longer room dimensions, to produce minimum number of seams. Lay out seams to avoid widths less than 1/3 of roll width; match patterns at seams.

B. Seams are prohibited in bathrooms, kitchens, toilet rooms, and custodial closets.

C. Cut sheet at seams in accordance with manufacturer's instructions.

D. Seal seams by heat welding where indicated.

3.05 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.

C. Install square tile to ashlar pattern. Allow minimum 1/2 full size tile width at room or area perimeter.

3.06 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.

B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

D. Scribe and fit to door frames and other interruptions.

3.07 INSTALLATION - STAIR COVERINGS

A. Install stair coverings in one piece for full width and depth of tread.

B. Adhere over entire surface. Fit accurately and securely.

3.08 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean and wax in accordance with manufacturer's written instructions.

3.09 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 096623

RESINOUS MATRIX TERRAZZO FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Divider strips.

B. Precast epoxy terrazzo stair units.

1.02 REFERENCE STANDARDS

A. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive; 2021.

B. NTMA (GRAD) - Aggregate Gradation Standards; Current Edition.

C. NTMA (EPOXY) - Epoxy Terrazzo Specifications; Current Edition.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for divider strips and precast units; include printed copy of current NTMA recommendations for type of terrazzo specified.

C. Shop Drawings: Indicate divider strip and precast tread layout, and details of adjacent components. For precast units, detail profile and anchorage requirements.

D. Samples: Submit two tread samples, 8 inch (___ mm) by 8 inch (___ mm) in size illustrating color, chip size and variation, chip gradation, matrix color, non-slip inserts, and nosing profile and finish.

E. Manufacturer's Qualification Statement.

F. Installer's Qualification Statement.

G. Cleaning and Maintenance Data: Include procedures for stain removal, stripping, and sealing.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with NTMA recommendations as posted at their web site at www.ntma.com.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section.

1. Contractor member of the National Terrazzo and Mosaic Association, Inc.

1.05 MOCK-UP

A. Construct mock-up of terrazzo treads as follows:

1. One complete tread mounted on steel pan showing fit and finish of tread, metal riser, and termination at stringer.

2. One complete tread mounted on concrete plinth showing fit and finish of tread, riser, and edge termination.

B. Mock-up may remain as part of the work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store terrazzo materials in a dry, secure area.

B. Maintain minimum temperature of 60 degrees F (16 degrees C).

C. Keep products away from fire or open flame.

1.07 FIELD CONDITIONS

A. Do not install terrazzo when temperature is below 50 degrees F (10 degrees C) or above 90 degrees F (32 degrees C).

B. Maintain temperature within specified range 24 hours before, during, and 72 hours after installation of flooring.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design - Resinous Matrix Terrazzo Flooring: Subject to compliance with requirements, provide Terrazzo & Marble Supply Companies; Terroxy Resin Systems: www.tmsupply.com/#sle.

B. Other Acceptable Manufacturers - Resinous Matrix Terrazzo Flooring:

1. Key Resin Company: www.keyresin.com/#sle.
2. Terrazzco, a Brand of Concord Terrazzo Company, Inc: www.terrazzco.com/#sle.
3. Substitutions: See Section 016000 - Product Requirements.

2.02 EPOXY MATRIX TERRAZZO APPLICATIONS

A. Stairs - Treads and Landings: Precast epoxy terrazzo.

1. Thickness: 1-1/2 inch (38 mm), minimum.
2. Color(s): Match Architect's sample.
3. Aggregate Type and Size: Match Architect's sample.

2.03 MATERIALS

A. Aggregate: Type as indicated; sized in accordance with NTMA aggregate gradation standards; color(s) as indicated, uniform in color.

B. Finishing Grout: Epoxy, color to match terrazzo matrix.

C. Precast Epoxy Terrazzo Units: Fabricate to sizes and profiles indicated on drawings.

1. Setting Material: Epoxy adhesive, ANSI A118.3.

2.04 ACCESSORIES

A. Non-Slip Inserts: Provide channel-shaped inserts filled with a mixture of resin and fine, abrasive aggregate.

B. Anchors and Reinforcement for Precast Units: As recommended by manufacturer for type of installation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive terrazzo.

3.02 PREPARATION

A. Clean substrate of foreign matter.

3.03 INSTALLATION

A. Install non-slip inserts in stair treads where indicated.

B. Anchor precast units as recommended by precast manufacturer.

C. Install precast units using specified setting material.

3.04 FINISHING

A. Finish terrazzo to NTMA requirements.

B. Remove grout coat by grinding, using a fine grit abrasive.

3.05 TOLERANCES

A. Maximum Variation from Flat Surface: 1/4 inch in 10 feet (6 mm in one m).

B. Maximum Variation from Level (Except Surfaces Sloping to Drain): 1/8 inch (3 mm).

3.06 CLEANING

A. Scrub and clean terrazzo surfaces with neutral pH cleaner in accordance with manufacturer's instructions. Let dry.

B. Polish surfaces in accordance with manufacturer's instructions.

3.07 PROTECTION

A. Protect finished terrazzo from damage due to subsequent construction until Date of Substantial Completion.

END OF SECTION

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SECTION 096700
FLUID-APPLIED FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fluid-applied flooring and base.

1.02 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 079200 - Joint Sealants: Sealing joints between fluid-applied flooring and adjacent construction and fixtures.

C. Section 221006 - Plumbing Piping Specialties: Recessed plumbing access cover frames.

D. Section 260539 - Underfloor Raceways for Electrical Systems: Recessed electrical access cover frames.

1.03 REFERENCE STANDARDS

A. ANSI/ESD STM7.1 - The Protection of Electrostatic Discharge Susceptible Items Flooring Systems Resistive Characterization; 2021.

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.

D. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

E. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair; 2013.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colors available.

C. Samples: Submit two samples, 4 by 4 inch (101 by 101 mm) in size illustrating color and pattern for each floor material for each color specified.

D. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and application rate for each coat.

F. Applicator's Qualification Statement.

G. Maintenance Data: Include maintenance procedures, recommended maintenance materials, procedures for stain removal, repairing surface, and suggested schedule for cleaning.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Top Coat Materials: 2 gallons (8 liters).

1.05 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the work of this section.

1. Minimum five years of documented experience.
2. Approved by manufacturer.

B. Supervisor Qualifications: Trained by product manufacturer , under direct full time supervision of manufacturer's own foreman.

1.06 MOCK-UPS

A. See Section 014000 - Quality Requirements for additional requirements.

B. Construct mock-up(s) of fluid applied flooring to serve as basis for evaluation of texture and workmanship.

1. Number of Mock-Ups to be Prepared: One.
2. Use same materials and methods for use in the work.
3. Use approved design samples as basis for mock-ups.
4. Locate where directed.
5. Minimum Size: 48 inches by 48 inches (1220 mm by 1220 mm).

C. See Section 014000 - Quality Requirements for additional requirements.

D. Obtain approval of mock-up by Architect before proceeding with work.

E. Approved mock-up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store resin materials in a dry, secure area.

B. Store materials for three days prior to installation in area of installation to achieve temperature stability.

1.08 FIELD CONDITIONS

A. Maintain minimum temperature in storage area of 55 degrees F (13 degrees C).

B. Store materials in area of installation for minimum period of 24 hours prior to installation.

C. Maintain ambient temperature required by manufacturer 72 hours prior to, during, and 24 hours after installation of materials.

PART 2 PRODUCTS

2.01 FLUID-APPLIED FLOORING SYSTEMS

A. Fluid-Applied Flooring Type EPX-1 and EPX-2: Polyurethane cement slurry base coat(s) with broadcast aggregate.
   1. Aggregate: Quartz granules.
   2. System Thickness: 1/4 inch (6.4 mm), nominal, dry film thickness (DFT).
   3. Texture: Slip resistant.
   4. Sheen: Semi-gloss.
   5. Color: As selected by Architect.
   6. Basis of Design Product: Subject to compliance with requirements, provide Duraflex, Polycrete MDB or comparable product by one of the following;
   7. Products:
      a. Elite Crete Systems; Hermetic 4.8S Urethane Cement Slurry: www.elitecrete.com/#sle.
      b. Flowcrete Americas; Flowfresh SR System: www.flowcreteamericas.com/#sle.
      c. Neogard; Neocrete SL: www.neogard.com/#sle.
      d. PPG Flooring; 700HB SL Urethane Cement with 610 SL Self-Leveling Epoxy, High Gloss: www.ppgpaints.com/#sle and www.ppgmc.com.aspx/#sle.
      e. Resinwerks; BioCem SF: www.resinwerks.com/#sle.
      f. Sika Corporation; Sikafloor PurCem Self-Leveling Broadcast System: www.sikafloorusa.com/#sle.
      g. LATICRETE International, Inc; SPARTACOTE Urethane Cement: www.laticrete.com/#sle.
      h. Substitutions: See Section 016000 - Product Requirements.

2.02 ACCESSORIES

A. Transition Strips: Brushed stainless steel transistion strips as indicated, by Schulter-Systems.
B. Base Caps: Zinc with projecting base of 1/8 inch (3 mm); color as selected.
C. Cant Strips: Molded of flooring resin material.
D. Subfloor Filler: Type recommended by fluid-applied flooring manufacturer.
E. Primer: Type recommended by fluid-applied flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive flooring.

B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of materials to subfloor surfaces.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for fluid-applied flooring installation by testing for moisture and alkalinity (pH).

1. Test as Follows:
   a. Alkalinity (pH): ASTM F710.
   b. Internal Relative Humidity: ASTM F2170.
   c. Moisture Vapor Emission: ASTM F1869.
2. Obtain instructions if test results are not within limits recommended by fluid-applied flooring manufacturer.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes, and other defects with subfloor filler.

B. Prepare concrete surfaces according to ICRI 310.2R.

C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Grind irregularities above the surface level. Prohibit traffic until filler is cured.

D. Vacuum clean substrate.

E. Apply primer to surfaces required by flooring manufacturer.

3.03 INSTALLATION - ACCESSORIES

A. Install cant strips at base of walls where flooring is to be extended up wall as base.

B. Install terminating cap strip at top of base; attach securely to wall substrate.

3.04 INSTALLATION - FLOORING

A. Apply in accordance with manufacturer's instructions.

B. Apply each coat to minimum thickness required by manufacturer.

C. Finish to smooth level surface.

D. Install flooring in recessed type floor access covers.

E. At movable partitions install flooring under partitions without interrupting floor pattern.

F. Cove at vertical surfaces.

3.05 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Test installed floor surface in accordance with ANSI/ESD STM7.1 .

3.06 PROTECTION

A. Prohibit traffic on floor finish for 48 hours after installation.

B. Barricade area to protect flooring until fully cured.

END OF SECTION

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SECTION 096813
TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, fully adhered.

1.02 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 017419 - Construction Waste Management and Disposal: Reclamation/Recycling of new carpet tile scrap.

C. Section 033000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied flooring.

1.03 REFERENCE STANDARDS

A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016 (Reapproved 2021).

B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2023.

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2023.

E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

F. CRI (GLP) - Green Label Plus Testing Program - Certified Products; Current Edition.

G. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2023.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Shop Drawings: Indicate layout of joints, direction of carpet pile, location of edge moldings, and carpet tile types.

D. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

E. Sustainable Design Submittal: Submit VOC content documentation for adhesives.

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

G. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

H. Installer's Qualification Statement.

I. Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

B. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.06 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Tile Carpeting, Types TXCP-1, TXCP-2, TXCP-3 and TXCP-4: Textile Composite, manufactured in one color dye lot for each type.

1. Product: Subject to compliance with requirements, provide J&J Flooring Kinetex carpet tile or comparable product .
    a. Substitutions: See Section 016000-Product Requirements.
2. Tile Size: 24 by 24 inch (609 by 609 mm), nominal.
3. Overall Thickness: 0.205 inch (5.2 mm).
4. Color:
    a. Type TXCP-1: J&J Flooring Kinetex, "Put A Cork In It #1830".
    b. Type TXCP-2: J&J Flooring Kinetex, "Network Modular - Encryption".
    c. Type TXCP-3: J&J Flooring Kinetex, "Network Modular - Directory".
    d. Type TXCP-4: J&J Flooring Kinetex, "Network Modular - Fiber".
5. Installation Pattern:

a. Type TXCP-1: Brick.
b. Types TXCP-2, TXCP-3 and TXCP-4: Quarter turn.

6. Pile: 100 percent solution dyed polyester.
7. Face Weight: 12 oz per square yard (407 grams per square meter).
8. Critical Radiant Flux: Minimum of 0.22 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
9. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
10. VOC Content: Comply with Section 016116.
11. VOC Content: Provide CRI (GLP) certified product; in lieu of labeling, independent test report showing compliance is acceptable.
12. Primary Backing Material: Polyester Felt Cushion.
13. Total Weight: 40.5 to 46.8 oz/sq yd (1373 to 1587 g/sq m).
14. Abrasion and Wear Resistance: 4.0 or greater appearance retention per ASTM D5252.

2.02 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.
B. Edge Strips: Type as indicated, color as selected by Architect.
   1. Stainless steel, brushed, Schulter-Systems SCHIENE.
   2. Rubber
C. Adhesives:
   1. Compatible with materials being adhered; maximum VOC content as specified in Section 016116.
D. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.
C. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).
   1. Test as Follows:
      a. Alkalinity (pH): ASTM F710.
      b. Internal Relative Humidity: ASTM F2170.

c. Moisture Vapor Emission: ASTM F1869.

2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

D. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.

C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

D. Vacuum clean substrate.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet tile in accordance with manufacturer's instructions.

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in pattern indicated, with pile direction alternating to next unit, set parallel to building lines.

F. Locate change of color or pattern between rooms under door centerline.

G. Fully adhere carpet tile to substrate.

H. Trim carpet tile neatly at walls and around interruptions.

I. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Remove excess adhesive without damage, from floor, base, and wall surfaces.

C. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 096900
ACCESS FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Adjustable height access flooring systems.

B. Fabricated welded steel panels with cementitious core.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Requirements for floor flatness and levelness.

B. Section 096500 - Resilient Flooring: Finish for access flooring panels and resilient wall base.

C. Section 260526 - Grounding and Bonding for Electrical Systems: Grounding and bonding of access floor system to building grounding system.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASTM E2322 - Standard Test Method for Conducting Transverse and Concentrated Load Tests on Panels used in Floor and Roof Construction; 2022.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

D. CISCA (AF) - Recommended Test Procedures for Access Floors; 2016.

E. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

G. ICC-ES AC300 - Acceptance Criteria for Access Floors; 2010, with Editorial Revision (2022).

H. NFPA 75 - Standard for the Fire Protection of Information Technology Equipment; 2024.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data sheets including loading capacities, materials, finishes, dimensions of components, profiles, and accessories.

C. Shop Drawings: Indicate floor layout, appurtenances or interruptions, edge details, grilles and registers.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
E. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention .
F. Designer's Qualification Statement.
G. Installer's Qualification Statement.
H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Materials: Supply an additional 5 (five) percent of access flooring system components.
3. Panel Lifting Devices: One, of manufacturer's standard type.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Design floor system structure layout for this project under direct supervision of a Professional Structural Engineer experienced in design of floors of the type required and licensed in the State in which the Project is located.
B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum three years of documented experience.
C. Installer Qualifications: Company specializing in performing the type of work required in this section and approved by access flooring manufacturer.

1.07 MOCK-UP

A. Construct access flooring system mock-up, 10 feet (3.3 m) long by 10 feet (3.3 m) wide, showing specified components and accessories.
B. Locate where directed.
C. Mock-up may remain as part of the Work.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. General: Comply with the following system requirements and as indicated for specified components.
1. Test in accordance with CISCA (AF).
2. Comply with requirements of NFPA 75.
3. Comply with requirements of ICC-ES AC300.
4. Accessibility: Comply with ICC A117.1 and ADA Standards.
5. Structural Design Live Loads: Comply with requirements of ICC (IBC).

a. Uniformly Distributed Loads: In compliance with ICC (IBC) Table 1607.1, for access floor systems.
   1) Computer Use: 100 pounds per sq ft (4.79 kPa).
b. Concentrated Loads: Over an area of 2.5 feet by 2.5 feet (762 mm by 762 mm), 2000 pounds (907 kg) minimum, in compliance with ICC (IBC) Table 1607.1, for access floor systems.

6. Lateral Stability: Design system for lateral stability in all directions, with or without panels in place.

B. Uniform Load: 200 pounds per square foot (976 kg/sq m), when tested in accordance with CISCA (AF) and ASTM E2322.
   1. Maximum Deflection: 0.04 inch (1 mm).
C. Concentrated Load: Over an area of 1 inch by 1 inch (25 mm by 25 mm), 900 pounds (408 kg) at any location, when tested in accordance with CISCA (AF).
   1. Maximum Deflection: 0.04 inch (1 mm).
   2. Permanent Deformation: 0.02 inch (0.5 mm) maximum at design load.
D. Design Load: 1250 pounds (568 kg).
E. Ultimate Load: Over an area of 1 inch by 1 inch (25 mm by 25 mm): Not less than twice design load or 2500 pounds (1134 kg), when tested in accordance with CISCA (AF).
F. Rolling Loads: Permanent deformation not to exceed 0.04 inch (1 mm), when tested in accordance with CISCA (AF).
   1. Wheel A: 10 passes, with loading of 400 pounds (81 kg).
   2. Wheel B: 10,000 passes, with loading of 400 pounds (81 kg).
   3. Wheel C: 10,000 passes, with loading of 1500 pounds (680 kg).
G. Drop Impact Load: 150 pounds (68.0 kg), when tested in accordance with CISCA (AF).
H. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 75, maximum; when tested in accordance with ASTM E84.
I. Electrical Grounding Connection: Listed and classified by Underwriters Laboratories as suitable for the purpose specified and indicated.

2.02 ACCESS FLOORING - ADJUSTABLE HEIGHT

A. Factory-fabricated system consisting of removable floor panels and supporting understructure that allows access to space below floor without requiring removal of panels other than the one directly above the space to which access is needed; provide components and accessories required for complete installation.

B. Products: Subject to compliance with requirements, provide product by Tate Access Floors, Inc., ConCore 1250 or comparable product by one of the following;
   1. ASM Modular Systems, Inc..
   2. Global IFS.
   3. Substitutions: See Section 016000 - Product Requirements.

C. Finished Floor Elevation: Refer to drawings for dimension from top of access floor to above building structural floor.

D. Configuration:
   1. Bolted panels on bolted stringer understructure.

E. Components:
   1. Pedestal Assembly:
      a. Material: Steel.
      b. Finish: Manufacturer's standard.
      c. Base: Manufacturer's standard shape and size in accordance with system performance requirements.
      d. Column: Threaded supporting rod to permit 1-1/2 inch (38 mm) adjustment.
      e. Head: Manufacturer's standard shape and size to accept specified configuration.
      f. Maximum Pedestal Axial Load: 5000 pounds (2268 kg) without permanent deformation, when tested in accordance with CISCA (AF).
   2. Stringers: Steel channels, box, or tee sections.
      a. Stringer Load: 75 pounds (34 kg), with a permanent set not to exceed 0.010 inch (0.254 mm), when tested in accordance with CISCA (AF).
   3. Floor Panels:
      a. Construction:
         1) Fabricated welded sheet steel top and bottom plates with cementitious core.
      b. Factory-Applied Epoxy Finish: As selected from manufacturer's standard finishes for panel type specified.
      c. Panel size: 24 by 24 inches (609 by 609 mm).
   4. Resilient Tile Floor Covering: Field applied, as indicated.
      a. Static control resilient tile flooring: As specified in Section 096500.

2.03 ACCESSORIES - ADJUSTABLE HEIGHT

A. Electrostatic Grounding Connectors: Solid copper.

B. Cable Cutout Protection: Manufacturer's standard type, self-extinguishing.
C. Gaskets: Closed cell sponge rubber, preformed to suit.
D. Sealant: Any water-based, moisture-curing, or chemically-curing joint sealant suitable for purpose and compatible with materials being sealed; except acrylic latex emulsion.

2.04 FABRICATION

A. Fabrication Tolerances:
1. Floor Panel Flatness: Plus or minus 0.02 inch (0.5 mm) in any direction.
2. Floor Panel Width or Length From Specified Size: Plus or minus 0.02 inch (0.5 mm).
3. Floor Panel Squareness: Plus or minus 0.03 inch (0.8 mm) difference between opposite diagonal dimensions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify field measurements are as indicated on shop drawings.
B. Verify that substrates comply with tolerances, dimensioned clearances, and other requirements specified in other sections, and that substrates are clean, dry, and free of conditions and deleterious substances that might interfere with system installation.
C. Verify substrates comply with minimum subfloor flatness (FF) and subfloor levelness (FL) as specified in Section 033000.
D. Verify that required utilities are available, in proper location, and are ready for use.
E. Start of installation constitutes acceptance of project conditions.

3.02 PREPARATION

A. Vacuum clean substrate surfaces.

3.03 INSTALLATION - ADJUSTABLE HEIGHT ACCESS FLOORING

A. Install components in accordance with manufacturer's instructions.
B. Secure pedestal base plate to subfloor with adhesive.
C. Install stringers and floor panels on pedestals with full bearing.
D. Close field cut floor panels with edge trim.
E. Cut holes in floor panels to accommodate Owner equipment as indicated on drawings. Provide cable cut-out protection.
F. Provide gaskets and sealant to ensure airtight seal where holes are cut in elevated floor for penetration of cable.
G. Provide positive electrical earth grounding of entire floor assembly in accordance with NFPA 75.

3.04 TOLERANCES

A. Maximum Out of Level Floor Panel Tolerance: 1/16 inch in 10 ft (1.6 mm in 3 m), non-cumulative.

B. Gap Between Panels: 1/16 inch (1.6 mm).

3.05 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

3.06 ADJUSTING

A. Adjust pedestals to achieve a level floor and to assure adjacent floor panel surfaces are flush.

3.07 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. Demonstration and Training:

1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain access flooring system.
2. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
3. Provide minimum of two hours of training.
4. Instructor: Manufacturer's training personnel.
5. Location: At project site.

3.08 PROTECTION

A. Do not permit traffic over unprotected floor surface.

END OF SECTION

SECTION 097200
WALL COVERINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall covering.

1.02 RELATED REQUIREMENTS

A. Section 099123 - Interior Painting: Preparation and priming of substrate surfaces.

1.03 REFERENCE STANDARDS

A. ASTM D1308 - Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Coating Systems; 2020.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

C. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics; 2020.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on wall covering and adhesive.

C. Shop Drawings: Indicate wall elevations with seaming layout.

D. Samples: Submit two samples of wall covering, 24 by 24 inch (610 by 610 mm) in size illustrating color, finish, and texture.

E. Test Reports: Indicate verification of flame and smoke ratings, when tested by UL.

F. Manufacturer's Installation Instructions: Indicate special procedures.

G. Maintenance Data: Submit data on cleaning, touch-up, and repair of covered surfaces.

H. Manufacturer's Qualification Statement.

I. Installer's Qualification Statement.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 MOCK-UPS

A. See Section 014000 - Quality Requirements for additional requirements.

B. Provide panel, 12 feet (3.6 m) wide, full height, illustrating installed wall covering and joint seaming technique.

C. Locate where directed.

D. Mock-up may remain as part of the Work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Inspect roll materials at arrival on site, to verify acceptability.

B. Protect packaged adhesive from temperature cycling and cold temperatures.

C. Do not store roll goods on end.

1.08 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the adhesive or wall covering product manufacturer.

B. Maintain these conditions 24 hours before, during, and after installation of adhesive and wall covering.

C. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surfaces.

PART 2 PRODUCTS

2.01 WALL COVERINGS

A. General Requirements:

1. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.
2. Chemical and Stain Resistance: No visible staining or discoloration and no damage to surface texture when tested in accordance with ASTM D1308.

B. Wall Covering - Type WC-1, WC-2, WC-3 and WC-4: Fabric-backed vinyl roll stock.

1. Comply with ASTM F793/F793M, Category V, Type II.
2. Total Weight: 20 oz/sq yd (570 g/sq m).
3. Backing: Woven, osnaburg fabric.
4. Color and Pattern:
    a. Type WC-1: As indicated on drawings.
    b. Type WC-2: As indicated on drawings.
    c. Type WC-3: As indicated on drawings.
    d. Type WC-4; As indicatred on drawings.
5. Overcoating: Manufacturer's standard coating for stain resistance.
6. Manufacturers: Subject to compliance with requirements, provide National Solutions; CDigital Custom Digital Image wall covering.
    a. Substitutions: Not permitted.

C. Adhesive: Type recommended by wall covering manufacturer to suit application to substrate.

D. Termination Trim: Extruded plastic, clear.
E. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.
F. Substrate Primer and Sealer: Alkyd enamel type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are prime painted and ready to receive work, and comply with requirements of wall covering manufacturer.
B. Measure moisture content of surfaces using an electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.
C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet (3 mm in 3 m) nor vary at a rate greater than 1/16 inch/ft (1.5 mm/300 mm).

3.02 PREPARATION

A. Fill cracks in substrate and smooth irregularities with filler; sand smooth.
B. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.
C. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
D. Surfaces: Correct defects and clean surfaces that affect work of this section.
E. Marks: Seal with shellac those that may bleed through surface finishes.
F. Apply one coat of primer sealer to substrate surfaces. Allow to dry. Lightly sand smooth.
G. Vacuum clean surfaces free of loose particles.

3.03 INSTALLATION

A. Apply adhesive and wall covering in accordance with manufacturer's instructions.
B. Apply adhesive to wall surface immediately prior to application of wall covering.
C. Use wall covering in roll number sequence.
D. Razor trim edges on flat work table. Do not razor cut on gypsum board surfaces.
E. Apply wall covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface.
F. Butt edges tightly.
G. Horizontal seams are not acceptable.
H. Do not seam within 2 inches (50 mm) of internal corners or within 6 inches (150 mm) of external corners.

I. Install wall covering before installation of bases and items attached to or spaced slightly from wall surface.

J. Do not install wall covering more than 1/4 inch (6 mm) below top of resilient base.

K. Cover spaces above and below windows, above doors, in pattern sequence from roll.

L. Apply wall covering to electrical wall plates prior to replacing.

M. Install termination trim.

N. Remove excess adhesive while wet from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

3.04 CLEANING

A. Clean wall coverings of excess adhesive, dust, dirt, and other contaminants.

B. Reinstall wall plates and accessories removed prior to work of this section.

3.05 PROTECTION

A. Do not permit construction activities at or near finished wall covering areas.

END OF SECTION

SECTION 097800
INTERIOR WALL PANELING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Decorative plastic wall paneling.

B. Paper-resin wall paneling.

C. Accessories.

1.02 REFERENCE STANDARDS

A. ASTM C393/C393M - Standard Test Method for Core Shear Properties of Sandwich Constructions by Beam Flexure; 2020.

B. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2023, with Editorial Revision.

C. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2022.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

E. NSF 35 - High Pressure Decorative Laminates for Surfacing Food Service Equipment; 2024.

F. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's descriptive literature for each specified product. Include anchorage devices specific to project substrate types.

C. Shop Drawings: Submit elevations for each application and location. Indicate details of joints and attachments.

1. Scale of Drawing Elevations: 1/4 inch to 1 foot (1:50), minimum.
2. Scale of Drawing Details: 1-1/2 inches to 1 foot (1:8), minimum.

D. Samples: Submit two samples 12 by 12 inches (300 by 300 mm) in size, indicating finish, surface design, and color for each type of panels.

E. Certificates: Certify that products of this section meet or exceed specified requirements.

F. Manufacturer's Instructions: Provide manufacturer's installation instructions.

G. Manufacturer's qualification statement.

H. Installer's qualification statement.

I. Maintenance Data: Include recommended instructions, methods, and materials for cleaning decorative plastic paneling.

J. Warranty Documentation: Manufacturer warranty; ensure that forms have been completed in Owner's name and registered with manufacturer.
K. Specimen Warranty: Manufacturer warranty.
L. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Panels: Quantity equal to 5 percent of total installed.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least five years of documented experience.
B. Installer Qualifications: Company specializing in installing work of the type specified in this section, and with at least three years of documented experience.

1.05 MOCK-UPS

A. See Section 014000 - Quality Requirements for additional requirements.
B. Construct wall panel mock-up, 8 feet (2.4 m) long by 8 feet (2.4 m) wide of wall paneling of each type, illustrating joints and trim.
C. Locate where directed.
D. Mock-ups may remain as part of the work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project site in manufacturer's original packaging, marked with manufacturer's product identification.
B. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.
C. Packaging Waste Management: See Section 017419.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.
B. Extended Correction Period: Correct defective work within a 5-year period for failure of materials or workmanship commencing on the Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Decorative Plastic Wall Paneling: Subject to compliance with requirements provide Altro Puraguard panels or comparable product by one of the following;
1. Crane Composites, Inc: www.cranecomposites.com/#sle.
2. Marlite, Inc: www.marlite.com/#sle.
3. Nudo Products, Inc: www.nudo.com/#sle.

4. Panolam Surface Systems: www.panolam.com/#sle.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Paper Composite Wall Paneling: Subject to compliance with requirements provide Richlite Company; Paper Composite Wall Panels or comparable product;
1. Substitutions: See Section 01 6000 - Product Requirements.

2.02 REGULATORY REQUIREMENTS

A. Surface Burning Classification: Provide wall paneling assemblies meeting Class A when tested in accordance with ASTM E84.

2.03 DECORATIVE PLASTIC WALL PANELING

A. Decorative Plastic Wall Paneling:
1. Panel Size: 4 by 10 feet (1.2 by 3.0 m).
2. Panel Thickness: 0.075 inch (1.9 mm).
3. Material: Fiber-Reinforced Plastic (FRP) panes.
a. Flexural Strength: Greater than 2000 ft lbf/sq in (14 MPa), when tested in accordance with ASTM C393/C393M.
b. Tensile Strength: Greater than 1300 ft lbf/sq in (9 MPa), when tested in accordance with ASTM D638.
c. Impact Strength: Greater than 1.57 ft lbf/in (84 J/m), when tested in accordance with ASTM D256.
d. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
e. Chemical Cleanability: Excellent chemical resistance to common cleaners and detergents when tested in accordance with ISO 2812-1.
f. Biological Resistance: Rating of 0, when tested in accordance with ISO 846.
g. Water Absorption: 0.2 percent, maximum, when tested in accordance with ASTM D570.

Certifications:

h. NSF 35 certified.
i. UL (GGG) certified.

4. Panel Manufacturing Tolerances:
a. Thickness: Plus or minus ten percent.
b. Width and Length: 1/8 inch (3 mm) variation in panel lengths up to and including 12 feet (4 m).
c. Squareness: Not more than 1/8 inch (3 mm) out of square in any direction.

5. Edges: Square.
6. Color and Pattern: As selected by Architect from manufacturer's full range.

B. Accessories:
1. Trim:
a. Material: Extruded aluminum.
b. Color/Finish: Powder-coated, AAMA 2604, as selected by Architect from manufacturer's full range.
c. Inside Corner Trim: As indicated.
d. Outside Corner Trim: As indicated.
e. Edge Trim: As indicated.
f. Reveal Base Trim: As indicated.
2. Products: Subject to compliance with requirements, provide Fry Reglet Corporation, extruded aluminum trim or comparable products;
a. Eagle Mouldings, Inc: www.eagle-aluminum.com/#sle.
b. Gordon Inc.
c. Substitutions: See Section 01 6000 - Product Requirements.
3. Adhesive: Type recommended by panel manufacturer and meeting VOC limits specified.
4. Sealant: Type recommended by paneling manufacturer; clear.

2.04 PAPER-RESIN WALL PANELING

A. Paper-Resin Sheet Panel System:
1. Applications: Wall cladding.
2. Panel Size: As indicated on drawings.
3. Thickness: 1/4 inch (6 mm), unless indicated otherwise.
4. Colors:
a. Type PRP-1: Natural.
b. Type PRP-2: Black Diamond.
5. Substrate: As indicated on drawings.

B. Material:
1. Paper-resin sheet: Cellulose or hemp-fiber paper heat pressed with phenolic resin; color consistent throughout thickness.
a. Density: 75 pounds per cubic foot (1215 kilogram per cubic mm) minimum.
b. Water Absorption: 0.36 percent for 1 inch (25 mm) thickness, unsealed material, 24 hour fully submerged test.
c. Tensile Strength: 13,100 psi (90.3 MPa).

d. Compressive Strength: 18,400 psi (126.9 MPa)

C. Accessories:

1. Mounting: Aluminum z-clips as recommended by Fabricator.
2. Adhesive: As recommended by wall panel manufacturer.
3. Colors: As selected by Architect from manufacturers standard line.

2.05 FABRICATION

A. Fabricate wall paneling in accordance with ANSI/AWI 0620-18.

1. Grade: Premium.
2. Fabrication Tolerances: 0.016 inch (0.4 mm).

B. Mounting system: Concealed fasteners and clips.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions and substrate flatness before starting work.

B. Verify that substrate surfaces for adhered items are clean and smooth.

1. Test painted or wall covering surfaces for adhesion in inconspicuous area, as recommended by manufacturer.
2. Comply with adhesive manufacturer's recommendations for remedial measures at locations and application conditions where adhesion test results are unsatisfactory.

C. Start of installation constitutes acceptance of project conditions.

3.02 INSTALLATION

A. Install panels in accordance with ANSI/AWI 062-18, Premium Grade and manufacturer's instructions.

B. Cut and drill holes in panels with carbide tipped saw blades, drill bits, or snips.

C. Apply adhesive to back side of panel using trowel recommended by adhesive manufacturer.

D. Apply panels to wall with vertical joints plumb and horizontal joints level and pattern aligned with adjoining panels.

E. Using a roller, apply pressure to panel face to ensure proper adhesion between surfaces.

F. Install panels with manufacturer's recommended gaps for panel field and corner joints.

G. Fill channels in trim with sealant before mounting to panel.

H. Install trim with adhesive.

I. Seal joints at wall base and between panels with approved sealant to prevent moisture intrusion.

J. Remove excess sealant after paneling is installed and prior to curing.

3.03 ADJUSTING

A. Replace paneling installed out of plumb and/or not aligned with adjacent panels or construction.

3.04 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Remove nonpermanent labels immediately after glazing installation is complete.

C. Clean panel faces using cleaning agents and methods recommended by manufacturer to remove soiling.

3.05 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals for closeout submittals.

3.06 PROTECTION

A. Protect installed interior wall paneling from subsequent construction operations.

END OF SECTION

SECTION 098316
SPRAYED ACOUSTIC INSULATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Sprayed cellulose acoustical insulation.

B. Related Sections:
   1. Division 05 Section “Steel Decking”
   2. Fire Protection, Plumbing, Mechanical, Electrical Sections for hangers and connections to metal decking as required.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:
   1. Product data for Credit MR v4.1: For products having recycled content, documentation indicating percentages by weight of pre-consumer and post-consumer recycled content. Include statement indicating cost of each product with recycled content.
   2. Product data for Credit EQ Low Emitting Materials: For primers and coatings applied within the building water proofing envelope, documentation in compliance with Division 01 VOC limitations for sustainability goals indicated.

1.03 INFORMATIONAL SUBMITTALS

A. Submit product data that the product meets or exceeds the following specified requirements.
   1. Bond strength shall be greater than 100 psf per ASTM E 736.
   2. Product shall be Class 1 Class A per ASTM E 84/ UL 723.
   3. Non-corrosive per ASTM C 739.
   4. Bond Deflection per ASTM E 759: 6” Deflection in 10’ Span – No Spalling or Delamination.
   5. Comply with IBC 803.3/2009 IBC 803.10 stability requirements for interior finishes.

B. Manufacturer's written certification that product contains no asbestos, fiberglass or other manmade mineral fibers.

C. Copy of manufacturer’s ISO 9001:2008 Certification.

D. Minimum Fiber Recycled Content to be 75%.

1.04 QUALITY ASSURANCE

A. Manufacturer must have a current listing with ICC.
B. Manufacturer must be in compliance with the 2006 International Building Code.
C. Manufacturer must be ISO 9001:2008 Certified.
D. Applicator: Licensed by manufacturer.
E. Manufacturer must subscribe to independent laboratory follow-up inspection services of
F. Underwriters Laboratories and Factory Mutual. Each bag shall be labeled accordingly.

1.05 COORDINATION

A. Coordinate Ducts, piping, conduit or other suspended equipment shall not be positioned until after the application of sprayed insulation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers
    1. International Cellulose Corporation.
    2. ThermaCoustic Industries.

2.02 MATERIALS

A. Self-Supported, Spray-Applied Cellulosic Insulation: ASTM C 1149, Type I (materials applied with liquid adhesive; suitable for either exposed or enclosed applications), chemically treated forflame-resistance, processing, and handling characteristics.
B. Basis of Design: K-13 Spray-On-Systems.
C. Color shall be custom as selected by the Architect. Contractor shall include up to three colors in use throughout the project.
D. Material Thickness: Apply to 1.0-inches overall thickness, min.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces and report unsatisfactory conditions in writing.
B. Verify surfaces to receive spray insulation to determine if priming/sealing is required to insure bonding and/or to prevent discoloration caused by migratory stains.
C. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Provide masking, drop cloths or other satisfactory coverings for materials/surfaces that are not to receive insulation to protect from over-spray.

B. Coordinate installation of the sprayed cellulose fiber with work of other trades.

C. Prime surfaces as required by manufacturer’s instructions or as determined by examination.

3.03 INSTALLATION

A. A. Install spray applied insulation according to manufacturer’s recommendations.

B. K-13 Sprayed Thermal and Acoustical Insulation Applied at 1.5" Ribbed Metal Deck

C. Cure insulation with continuous natural or mechanical ventilation.

3.04 CLEANING AND PROTECTION

A. Protect finished installation under provision of Division 1.

END OF SECTION

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SECTION 098430

SOUND-ABSORBING WALL AND CEILING UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sound-absorbing panels.

B. Sound-absorbing ceiling baffles.

C. Mounting accessories.

1.02 REFERENCE STANDARDS

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2023.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.

C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2022.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

E. ASTM E795 - Standard Practices for Mounting Test Specimens during Sound Absorption Tests; 2023.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's printed data sheets for products specified.

C. Shop Drawings: Fabrication and installation details, panel layout, fabric orientation, and wood grain orientation.

D. Selection Samples: Manufacturer's color charts for fabric covering, indicating full range of fabrics, colors, and patterns available.

E. Verification Samples: Fabricated samples of each type of panel specified; 12 by 12 inch (305 by 305 mm), showing construction, edge details, and fabric covering.

F. Test Reports: Certified test data from an independent test agency verifying that panels meet specified requirements for acoustical and fire performance.

G. Manufacturer's qualification statement.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.

2. Extra Panels: Quantity equal to 5 percent of total installed, but not less than one of each type.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with at least three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect acoustical units from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until units are needed for installation.

B. Store units flat, in dry, well-ventilated space; do not stand on end.

C. Protect edges from damage.

PART 2 PRODUCTS

2.01 FABRIC-COVERED SOUND-ABSORBING UNITS - WALLS

A. Manufacturers: Basis-of-Design; Subject to compliance with requirements, provide Conwed Designscape; Respond Ultimate 1500 Panels or comparable product by one of the following;

1. Egan Visual Corporation: www.egan.com/#sle.
2. Frasch: www.frasch.com/#sle.
3. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
4. NetWell Noise Control: www.controlnoise.com/#sle.
5. RPG Acoustical Systems, Inc: www.rpgacoustic.com/#sle.
6. Substitutions: See Section 016000 - Product Requirements.

B. General:

1. Prefinished, factory assembled fabric-covered panels.
2. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.

C. Fabric-Covered Acoustical Panels for Walls:

1. Panel Core: Manufacturer's standard rigid or semi-rigid fiberglass core.
2. Panel Size: As indicated on drawings..
3. Panel Thickness: 2 inches (25.4 mm).
4. Edges: Perimeter edges reinforced by a formulated resin hardener.
5. Corners: Square.
6. Fabric: Woven polyester, Maharam Muse #466487.
    a. Application: Railroad.
7. Color: As selected by Architect from manufacturer's full range.

8. Mounting Method: Back-mounted with Z-clips and mechanical fasteners.

2.02 PLASTIC SOUND-ABSORBING UNITS - CEILINGS

A. Products: Subject to compliance with requirements, provide Armstrong World Industries, Inc., FELTWORKS Open Cell Ebbs and Flows system or comparable product.
   1. Substitutions: See Section 016000 - Product Requirements.

B. Polyester Baffles for Ceilings:
   1. Material: Non-woven layered and formed Polyester felt (PET) fiber.
   2. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
   3. Sound Absorption: Noise Reduction Coefficient (NRC) or Sound Absorption Average (SAA) of _____ when tested in accordance with ASTM C423 for Type A mounting, complying with ASTM E795.
   4. Module Size: 48 by 48 inches (1220 by 1220 mm).
   5. Mounting: suspended from ceiling.
   6. Edge Profile: Square.
   7. Light Reflectance: 0.80 per ASTM E1477
   8. Color: As selected by Architect from manufacturer's full range.

2.03 FABRICATION

A. Panels and Baffles, General: Fabricate to sizes and configurations as indicated.

B. Tolerances: Fabricate to finished tolerance of plus or minus 1/16 inch (1.6 mm) for thickness, overall length and width, and squareness from corner to corner.

C. Factory-applied finishes on wood veneer panels to be uniform, smooth, and without blemishes.

2.04 ACCESSORIES

A. Back-Mounting Accessories: Manufacturer's standard accessories for concealed support, designed to allow panel removal, and as follows:
   1. Two-part clip and base-support bracket system; brackets designed to support full weight of panels and clips designed for lateral support, with one part mechanically attached to back of panel and the other attached to substrate.

B. Ceiling-Suspended Accessories: Manufacturer's standard accessories at locations as indicated on each acoustical unit, sized appropriately for weight of acoustical unit.
   1. Through-threaded eyelets bolted through concealed perimeter frame.
   2. Provide woven stainless steel wire cable for suspension from ceiling at heights as indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates for conditions detrimental to installation of acoustical units. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install acoustical units in locations as indicated, following manufacturer's installation instructions.

B. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.

C. Install mounting accessories and supports in accordance with shop drawings.

D. Align panels accurately, with edges plumb and top edges level. Scribe to fit accurately at adjoining work and penetrations.

E. Suspend ceiling baffles at locations and heights as indicated.

F. Install acoustical units to construction tolerances of plus or minus 1/16 inch (1.6 mm) for the following:

1. Plumb and level.
2. Flatness.
3. Width of joints.

3.03 CLEANING

A. Clean sound-absorptive panels upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

3.04 PROTECTION

A. Provide protection of installed acoustical panels until Date of Substantial Completion.

B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

END OF SECTION

SECTION 099123
INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.

1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
2. Mechanical and Electrical:
    a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.

D. Do Not Paint or Finish the Following Items:

1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
2. Items indicated to receive other finishes.
3. Items indicated to remain unfinished.
4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
5. Floors, unless specifically indicated.
6. Glass.
7. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 099600 - High-Performance Coatings for exterior and AESS coatings.

1.03 DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

B. MPI Gloss Definitions:

1. Gloss Level 1: A traditional flat or matte finish with a gloss range at maxium 5 units when measured at a 60 degree meter, and maximum 10 units when measured at an 85 degree meter.
2. Gloss Level 2: A "velvet-like" finish, with a gloss range at maximum 10 units when measured at a 60 degree meter, and 10-35 units at an 85 degree meter.

3. Gloss Level 3: "Eggshell" a low-sheen finish with a gloss range between 10 and 25 units when measured at a 60 degree meter, and 10 to 35 units when measured at an 85 degree meter.
4. Gloss Level 4: A "satin-like" finish, with a gloss range at 25 to 35 units when measured at a 60 degree meter, and minimum of 35 units when measured at 85 degree meter.
5. Gloss Level 5: A traditional semi-gloss finish, refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60 degree meter.
6. Gloss Level 6: A traditional gloss finish, refers to high-sheen finish with a gloss range of 70 to 85 units, when measured at a 60 degree meter.
7. Gloss Level 7: A high-gloss finish, with a gloss range more than 85 units at a 60 degree meter.

1.04 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.
B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2024.
C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.
D. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.
E. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
F. SCAQMD 1113 - Architectural Coatings; 1977, with Amendment (2016).
G. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
H. SSPC-SP 2 - Hand Tool Cleaning; 2018.
I. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide complete list of products to be used in table format, with the following information for each:
    1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
    2. Show availability of CDPH certificate for VOC emissions for each product in accordance with referenced sustainability standard.

3. MPI product number (e.g., MPI #47).
4. Cross-reference to specified paint system products to be used in project; include description of each system.
5. Manufacturer's installation instructions.
6. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
1. Where sheen is specified, submit samples in only that sheen.
2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.
3. Allow 30 days for approval process, after receipt of complete samples by Architect.
4. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, have been approved.

D. Samples: Submit two paper chip samples, 6 x 6 inch (152 x 152 mm) in size illustrating range of colors and textures available for each surface finishing product scheduled.

E. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

F. Manufacturer's Instructions: Indicate special surface preparation procedures.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Paint and Finish Materials: 1 gal (4 L) of each color; from the same product run, store where directed.
3. Label each container with color in addition to the manufacturer's label.

1.06 MOCK-UP

A. See Section 014000 - Quality Requirements, for general requirements for mock-up.

B. Provide panel, 3 feet (1 m) long by 3 feet (1 m) wide, illustrating paint color, texture, and finish for each color selected.

C. Locate where directed by Architect.

D. Mock-up may not remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Minimum Application Temperatures for Paints: 50 degrees F (10 degrees C) for interiors unless required otherwise by manufacturer's instructions.

D. Provide lighting level of 80 fc (860 lux) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.

1. Substitution of other products by the same manufacturer is preferred over substitution of products by a different manufacturer.
2. Substitution of a different paint system using MPI-approved products by the same manufacturer will be considered.

B. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide paints and coatings from Sherwin-Williams Company, or a comparable from one of the following:

1. Benjamin Moore Paints.
2. PPG Paints: www.ppgpaints.com/#sle.

C. Primer Sealers: Same manufacturer as top coats.

D. Substitutions: See Section 016000 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.

1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
3. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
4. Supply each paint material in quantity required to complete entire project's work from a single production run.
5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:
   1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
      a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
      b. SCAQMD 1113 Rule.
      c. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; www.otcair.org; specifically:
         1) Opaque, Flat: 50 g/L, maximum.
         2) Opaque, Nonflat: 150 g/L, maximum.
         3) Opaque, High Gloss: 250 g/L, maximum.
      d. USGBC LEED Rating System for interior wall and ceiling finishes (all coats), anti-corrosive paints on interior ferrous metal, sanding sealers, other sealers, and floor coatings.
   2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

D. Colors: To be selected from manufacturer's full range of available colors.
   1. Selection to be made by Architect after award of contract.

2. Allow for minimum of twelve colors for each system, unless otherwise indicated, without additional cost to Owner.
3. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted.

2.03 PAINT SYSTEMS - INTERIOR

A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board and wood.
   1. Two top coats and one coat primer.
   2. Top Coat(s): High Performance Architectural Interior Latex; MPI #138, 139, 140, 141, or 142.
      a. Products:
         1) Sherwin-Williams ProMar 200 HP Series, Eg-Shel. (MPI #139)

B. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals:
   1. Medium duty applications include doors and door frames.
   2. Two top coats and one coat primer.
   3. Top Coat(s): Interior Light Industrial Coating, Water Based; MPI #151, 153, or 154.
      a. Products:
         1) Sherwin-Williams Pro Industrial Acrylic Coating, Semi-Gloss. (MPI #153)

C. Paint I-OP-MD-WC - Medium Duty Vertical: Including gypsum board, concrete masonry units, and interior painted handrails.
   1. Medium duty applications include stair well walls, corridor walls, storage spaces, mechanical and electrical spaces, other utility spaces, and kitchens, custodial rooms, toilet rooms and where indicated on Drawings.
   2. Two top coats and one coat primer.
   3. Top Coat(s): Interior Epoxy-Modified Latex; MPI #115 or 215.
      a. Products:
         1) Sherwin-Williams Waterbased Catalyzed Epoxy, Semi-Gloss.

D. Paint I-OP-DF - Dry Fall: Metals; exposed structure and overhead-mounted services, including shop primed steel deck, structural steel, metal fabrications, galvanized ducts, galvanized conduit, and galvanized piping.
   1. Shop primer by others.
   2. One top coat ; color as scheduled.
   3. Top Coat: Latex Dry Fall; MPI #118, 155, or 226.

a. Products:

1) Sherwin-Williams Waterborne Acrylic Dryfall, Flat. (MPI #118)

2.04 PAINT SYSTEMS - EXTERIOR

A. Exterior Painting: See Section 099600 - High-Performance Coatings.

2.05 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.

1. Interior/Exterior Latex Block Filler; MPI #4.

a. Products:

1) Sherwin-Williams ConFlex Block Filler. (MPI #4)

2. Interior Latex Primer Sealer; MPI #50.

a. Products:

1) Sherwin-Williams ProMar 200 Zero-VOC Interior Latex Primer.

3. Interior Rust-Inhibitive Water Based Primer; MPI #107.

a. Products:

1) Sherwin-Williams Pro-Cryl Universal Primer. (MPI #107)

4. Stain Blocking Primer, Water Based; MPI #137 or #172.

a. Products:

1) Sherwin-Williams ProBlock Zero Interior Latex Primer.

2.06 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials.

D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:

1. Gypsum Wallboard: 12 percent.

2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.

3. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Masonry:

1. Prepare surface as recommended by top coat manufacturer.

F. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

G. Galvanized Surfaces:

1. Prepare surface according to SSPC-SP 2.

H. Ferrous Metal:

1. Solvent clean according to SSPC-SP 1.
2. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning in accordance with SSPC-SP 6/NACE No.3. Protect from corrosion until coated.

I. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

E. Sand wood and metal surfaces lightly between coats to achieve required finish.

F. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

G. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

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SECTION 099600
HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. High performance coatings.

B. Surface preparation.

1.02 RELATED REQUIREMENTS

A. Section 099123 - Interior Painting: Requirements for mechanical and electrical equipment surfaces.

1.03 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; Current Edition.

B. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2023.

C. ASTM D4259 - Standard Practice for Preparation of Concrete by Abrasion Prior to Coating Application; 2018.

D. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.

E. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

F. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. SCAQMD 1113 - Architectural Coatings; 1977, with Amendment (2016).

H. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

I. SSPC-SP 2 - Hand Tool Cleaning; 2018.

J. SSPC-SP 6/NACE No.3 - Commercial Blast Cleaning; 2006.

K. SSPC-SP 13/NACE No.6 - Surface Preparation of Concrete; 2018.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide complete list of all products to be used in table format, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
2. Show availability of CDPH certificate for VOC emissions for each product in accordance with referenced sustainability standard.
3. MPI product number (e.g. MPI #47).

4. Cross-reference to specified coating system(s) product is to be used in; include description of each system.
5. If proposal of substitutions is allowed under submittal procedures, explanation of all substitutions proposed.

C. Samples: Submit two samples 8 by 8 inch (203 by 203 mm) in size illustrating colors available for selection.

D. Manufacturer's Certificate: Certify that high-performance coatings comply with VOC limits specified.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

F. Maintenance Data: Include cleaning procedures and repair and patching techniques.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Coating Materials: 1 gallon (4 liters) of each type and color.
3. Label each container with manufacturer's name, product number, color number, and room names and numbers where used.

1.05 QUALITY ASSURANCE

A. Maintain one copy of each referenced document that applies to application on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

C. Applicator Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of coating, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Coating Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the coating product manufacturer.

C. Do not install materials when temperature is below 55 degrees F (13 degrees C) or above 90 degrees F (32 degrees C).

D. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.

E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

F. Restrict traffic from area where coating is being applied or is curing.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for bond to substrate.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Exterior Decorative Metal Railings

B. Exterior AESS Steel Building Elements

2.02 MANUFACTURERS

A. Only materials (primers, coatings, etc.) listed in the latest edition of the MPI Approved Product List (APL) are acceptable for use on this project.

B. Provide high performance coating products from the same manufacturer to the greatest extent possible.

1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.

C. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide products from Sherwin-Williams Company, or one of the following:

1. PPG Paints: www.ppgpaints.com/#sle.
2. Tnemec Company, Inc: www.tnemec.com/#sle.
3. Substitutions: Section 016000 - Product Requirements.

2.03 HIGH-PERFORMANCE COATINGS

A. MPI Standards: Provide products that comply with MPI standards indicated and are listed in MPI Approved Products List.

B. Provide coating systems that meet the following minimum performance criteria, unless more stringent criteria are specified:

1. Surface Burning Characteristics: Flame spread/Smoke developed index of 0/0, maximum, when tested in accordance with ASTM E84.
2. NFPA 101, Class A rated.
3. Meet or exceed characteristics of the Basis-of-Design products listed below.

2.04 TOP COAT MATERIALS

A. Coatings - General: Provide complete multi-coat systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated; number of coats specified does not include primer or filler coat.

1. Lead Content: Not greater than 0.06 percent by weight of total nonvolatile content.
2. Chromium Content, as Hexavalent Chromium, Zinc Chromate, or Strontium Chromate: None.
3. Colors: Selected from manufacturer's standard colors.

B. Urethane Coating:

1. Number of Coats: Two.
2. Product Characteristics:
    a. Percentage of solids by volume: 63 percent plus or minus 4 percent, minimum.
    b. Dry film thickness, per coat: three mils, minimum.
3. Top Coat(s): Polyurethane, Two-Component; MPI #72, #174.
    a. Sheen: Semi-Gloss.
    b. Products:
        1) Sherwin-Williams Hi Solids Polyurethane 250, B65 Series: www.protective.sherwin-williams.com/#sle.

2.05 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by coating manufacturer.

1. Rust-Inhibitive, Water Based; MPI #107.
    a. Products:
        1) Sherwin-Williams; Pro Industrial Pro-Cryl Universal Primer: www.protective.sherwin-williams.com/#sle. (MPI #107)

2. Primer for Galvanized Metal, Water Based; MPI #134.
    a. Products:
        1) Sherwin-Williams Pro Industrial Pro-Cryl Universal Acrylic Primer.
3. Alkali Resistant, Water Based, Exterior; MPI #3.
    a. Products:
        1) Sherwin-Williams; Loxon Concrete and Masonry Primer/Sealer: www.protective.sherwin-williams.com/#sle. (MPI #3)
4. Zinc Rich, Epoxy; MPI #20.
    a. Products:
        1) Sherwin-Williams; Zinc Clad III HS 100: www.protective.sherwin-williams.com/#sle.
        2) Substitutions: Section 016000 - Product Requirements.
5. Direct-To-Metal Wash Primer.
    a. Products:
        1) Sherwin-Williams; DTM Wash Primer: www.protective.sherwin-williams.com/#sle.

2.06 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of coated surfaces.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Do not begin application of coatings until substrates have been properly prepared.
C. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.
D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
F. Test shop-applied primer for compatibility with subsequent cover materials.
G. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
    1. Cementitious Substrates: Do not begin application until substrate has cured 28 days minimum and measured moisture content is not greater than 12 percent.
    2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.

3. Wood: Do not begin application if substrate has moisture content over 12 percent.

H. Proceed with coating application only after unacceptable conditions have been corrected.
   1. Commencing coating application constitutes Contractor's acceptance of substrates and conditions.

3.02 PREPARATION

A. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.
B. Clean surfaces of loose foreign matter.
C. Remove substances that would bleed through finished coatings. If unremovable, seal surface with shellac.
D. Remove finish hardware, fixture covers, and accessories and store.
E. Existing Painted and Sealed Surfaces:
   1. Remove loose, flaking, and peeling paint. Feather edge and sand smooth edges of chipped paint.
   2. Clean with mixture of trisodium phosphate and water to remove surface grease and foreign matter.
F. Concrete:
   1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
   2. Clean surfaces with pressurized water. Use pressure range of 1,500 to 4,000 psi (10,350 to 27,580 kPa) at 6 to 12 inches (150 to 300 mm). Allow to dry.
   3. Clean concrete according to ASTM D4258. Allow to dry.
   4. Prepare surface as recommended by coating manufacturer and in accordance with SSPC-SP 13/NACE No.6.
G. Masonry:
   1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
   2. Prepare surface as recommended by coating manufacturer.
H. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

2. Prepare surface according to SSPC-SP 2.

I. Ferrous Metal:

1. Solvent clean according to SSPC-SP 1.
2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning in accordance with SSPC-SP 6/NACE No.3, and protect from corrosion until coated.

3.03 PRIMING

A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

3.04 COATING APPLICATION

A. Apply coatings in accordance with manufacturer's written instructions, to thicknesses specified and recommendations in MPI - Architectural Painting and Specification Manual.

B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.05 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for general requirements for field inspection.

B. Dry Film Thickness Testing: Owner will engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.

1. Touch up and restore coated surfaces damaged by testing.
2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, and specified thickness, Contractor shall pay for retesting and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations, and specified thickness.

3.06 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Clean surfaces immediately of overspray, splatter, and excess material.

C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

D. See Section 017419 - Construction Waste Management and Disposal for additional requirements.

3.07 PROTECTION

A. Protect finished work from damage.

END OF SECTION

SECTION 101100
VISUAL DISPLAY UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Porcelain enamel steel markerboards.

1.02 RELATED REQUIREMENTS

A. Section 061053 - Miscellaneous Rough Carpentry: Blocking and supports.

B. Section 092116 - Gypsum Board Assemblies: Concealed supports in metal stud walls.

C. Section 099123 - Interior Painting: Finishing of wood frame and marker rail.

1.03 REFERENCE STANDARDS

A. ASTM A424/A424M - Standard Specification for Steel, Sheet, for Porcelain Enameling; 2018.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's data on porcelain enamel steel markerboard and accessories.

C. Shop Drawings: Indicate wall elevations, dimensions, joint locations , special anchor details.

D. Samples: Two, 2 by 2 inches (50 by 50 mm) in size illustrating materials and finish, color and texture of porcelain enamel steel markerboard.

E. Test Reports: Show compliance to specified surface burning characteristics requirements.

F. Manufacturer's printed installation instructions.

G. Manufacturer's Qualification Statement.

H. Maintenance Data: Include data on regular cleaning, stain removal .

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

PART 2 PRODUCTS

2.01 VISUAL DISPLAY UNITS

A. Porcelain Enamel Steel Markerboards, (MW#).
   1. Color: White.
   2. Steel Face Sheet Thickness: 24 gauge, 0.0239 inch (0.61 mm).
   3. Core: Honeycomb, manufacturer's standard thickness, laminated to face sheet.
   4. Backing: Galvanized steel sheet, laminated to core.
   5. Size: As indicated on drawings.
   6. Frame: No frame, face sheet wraps edges of panels, with concealed fasteners.
   7. Accessories: Provide magnetic cup, tray and hook for cleaning cloth.
   8. Products: Subject to compliance with requirements, provide Magnatag Visual Display Systems, WhiteWalls Magnetic Dry-Erase steel Wall Panels or comparable product by one of the following;
      a. Egan Visual Corporation: www.egan.com/#sle.
      b. Substitutions: See Section 016000 - Product Requirements.

2.02 MATERIALS

A. Porcelain Enameled Steel Sheet: ASTM A424/A424M, Type I, Commercial Steel, with fired-on vitreous finish.

B. Steel Sheet Backing: 28 gauge, 0.0149 inch (0.38 mm), galvanized.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

C. Verify flat wall surface for frameless adhesive-applied boards.

3.02 PREPARATION

A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install boards in accordance with manufacturer's instructions.

B. Secure units level and plumb.

C. Butt Joints: Install with tight hairline joints.

D. Carefully cut holes in boards for thermostats.

3.04 CLEANING

A. Clean board surfaces in accordance with manufacturer's instructions.

B. Cover with protective cover, taped to frame.

C. Remove temporary protective cover at Date of Substantial Completion.

END OF SECTION

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SECTION 101200
DISPLAY CASES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Freestanding display cases.

1.02 RELATED REQUIREMENTS

A. Section 061053 - Miscellaneous Rough Carpentry: Blocking and supports.

B. Section 092116 - Gypsum Board Assemblies: Concealed supports in metal stud walls.

C. Division 26 - Electrical: Electrical service for case lighting.

1.03 REFERENCE STANDARDS

A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

B. ASTM A555/A555M - Standard Specification for General Requirements for Stainless Steel Wire and Wire Rods; 2023.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.

D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit complete printed data and installation details indicating products to be provided as specified.

1. Submit color charts for selection by the Architect.

C. Shop Drawings: Submit complete installation details. Include dimensioned elevations.

D. Samples: Submit samples of material and trim to illustrate finish, color, and texture.

E. Manufacturer's Qualification Statement.

F. Specimen Warranty.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver display cases and materials to the Project site with manufacturer's protective crate covering and do not open until ready for use.

B. Protect display cases before, during, and after installation. In case of damage, immediately provide necessary repairs and replacements.

1.07 FIELD CONDITIONS

A. Field Measurements: Verify field measurements for recessed application for display cases before preparation of shop drawings and before fabrication to ensure proper installation.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty against defects and in materials, finish product and workmanship.

PART 2 PRODUCTS

2.01 DISPLAY CASES

A. Basis-of-Design Product: Subject to compliance with requirements, provide products by Gaylord Archival; Curator Gallery Museum Case, or a comparable product from one of the following:

1. Claridge Products and Equipment, Inc.
2. Platinum Visual Systems.
3. Substitutions: See Section 016000 - Product Requirements.

B. Freestanding Display Case: Factory-fabricated steel-framed display case with adjustable glass shelves, finished interior, custom size.

1. Width: 36 inches.
2. Height: 39 inches.
3. Depth: 15 inches.
4. Components:
   a. Glazed Doors: Sliding.
      1) Number of Doors: One pair.
   b. Side Panels: Glazing.
   c. Back Panel: Laminate-faced.
   d. Top Panel: Aluminum trim..

e. Bottom Panel: Aluminum trim.

2.02 COMPONENTS

A. Frameless Case Construction: 1/4 inch (6 mm), minimum, clear UV-filtering laminated tempered glass construction with fully welded integral steel frame and aluminum trim.

B. Glazed Hinged Doors:
   1. 1/4 inch (6 mm) clear UV-filtering laminated tempered glass.
   2. Hinges: 1 inch by .040 inch (25 mm by 1 mm) manufacturer's standard hinges.
   3. Lock: Glass door cylinder lock.

C. Glass Shelves:
   1. 1/4 inch (6 mm) clear tempered glass with flat-polished edges.
   2. Shelf Depth: 14 inches.
   3. Shelves per Unit: Four.

D. Cable Display Systems: Sizes and configurations indicated on drawings.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following;
      a. Arakawa Hanging Systems: www.arakawagrip.com/#sle.
      b. AS Hanging Display Systems, Inc: www.ashanging.com/#sle.
      c. Nova Display Systems, Inc: www.novadisplay.com/#sle.
      d. Substitutions: See Section 016000 - Product Requirements.
   2. Description:
      a. Tensioned cable display system used to support shelving from ceilings with the following components:
         1) Tensioned Fittings: Top and bottom fixed piers.
            (a) Top Fitting Mounting: Ceiling.
            (b) Bottom Fitting Mounting: Floor.
         2) Wire Cable: 7x7 construction.
            (a) Stainless Steel: ASTM A555/A555M; ASTM A666, Type 304 or Type 316.
            (b) Size: 1/16-inch (1.5 mm) diameter.
            (c) Cable End: P-End fitting.
         3) Cable Gripper Fittings: Provide stainless steel side shelf supports and multiposition supports.

E. Laminate Back Panel: Low-pressure laminate on one face of plywood substrate.
   1. Laminate Color and Texture: As selected by Architect from manufacturer's full range.

F. Lighting: Manufacturer's standard LED light fixture housed at top of case with louvered aluminum access door with keyed lock.

1. Recessed: Fixture with manufacturer's standard diffuser.
2. Controls: On/Off using room overhead lighting switch.

G. Humidity Control: Manufacturer's standard silica-gel compartment with keyed access door.

2.03 MATERIALS

A. Aluminum Extrusions for Framing and Trim: Alloy as recommended by manufacturer for construction and specified finish; nominal 1/8 inch (3.2 mm) wall thickness.

B. Aluminum Extrusions: ASTM B221 (ASTM B221M), 6063 alloy, T5 temper.

1. Finish: Factory finished; AAMA 2603: Powder coat; color as selected by Architect.

C. Plywood: Softwood plywood with veneer core, waterproof glue, 3/4 inch (19 mm) thick.

D. Heat-Strengthened and Fully Tempered Glass: ASTM C1048, Kind FT, minium 99 percent UV filtering.

E. Laminated Glass: Manufacturer's standard heat-strengthened or fully tempered glass with 0.30 mil PVB interlayer.

PART 3 EXECUTION

3.01 PREPARATION

A. Electrical pre-wiring, and final finishing are by other trades.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Anchor to supporting construction to prevent tipping over.

C. Clean case and glass using manufacturers recommended procedures.

D. Connect case lighting to electrical circuit.

3.03 ADJUSTING AND CLEANING

A. Verify that all accessories are installed as detailed for each unit.

B. At completion of work, clean glass surfaces, back panels and trim in accordance with manufacturer’s recommendations leaving units ready for use.

3.04 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

END OF SECTION

SECTION 101419
DIMENSIONAL LETTER SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Dimensional letter signage.

1.02 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's product literature for each type of dimensional letter sign, indicating style, font, colors, locations, and overall dimensions of each sign.

C. Shop Drawings:

1. Include dimensions, locations, elevations, materials, text and graphic layout, and attachment details.

D. Samples: Submit one sample of each type of dimensional letter sign of size similar to that required for project, indicating sign style, font, and method of attachment.

E. Selection Samples: Where materials, colors, and finishes are not specified, submit two sets of selection charts or chips.

F. Verification Samples: Submit samples showing colors and finishes specified.

G. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Package dimensional letter signs as required to prevent damage before installation.

B. Store under cover and elevated above grade.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Dimensional Letter Signs:

2.02 DIMENSIONAL LETTERS

A. Applications: Building identification.

1. Use individual metal letters.
2. Mounting Location: Exterior as indicated on drawings.
3. Letter Size: As indicated on Drawings
4. Text: Final text shall be determined by Owner. Quantity of letters shall be no less than the quantity shown on Drawings.D.

B. Metal Letters:
   1. Material: Aluminum casting.
   2. Thickness: 1/2 inch (12 mm) minimum, unless indicated otherwise.
   3. Letter Height: As indicated on drawings.
   4. Text and Typeface:
      a. Character Font: As selected by Architect from Manufacturer's full range.
   5. Finish: Brushed, satin.
   6. Color: As selected.
   7. Mounting: Concealed screws and/or Studs.

2.03 ACCESSORIES

A. Concealed Screws: Noncorroding metal; stainless steel, galvanized steel, chrome plated, or other.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.
B. Notify Architect if conditions are not suitable for installation of signs; do not proceed until conditions are satisfactory.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install with horizontal edges level.
C. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

END OF SECTION

SECTION 101423
PANEL SIGNAGE

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Panel signs for life safety purposes as required by the Building Code, including but not limited to the following:
      a. Mechanical, electrical and telecom rooms.
      b. Stair identification and internal stair signage.
      c. Toilet rooms.
      d. Other signage as indicated on drawings.

1.02 DEFINITIONS

A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Shop Drawings: Show fabrication and installation details for signs.
   1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
   2. Provide signage schedule, message list, typestyles, graphic elements including tactile characters and Braille and layout for each sign.
C. Samples: For each sign type and for each color and texture required.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with applicable provisions in ICC/ANSI A117.1.

PART 2 PRODUCTS

2.01 MATERIALS

A. Aluminum Castings: ASTM B 26/B 26M, of alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated.
B. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 5005-H32.
C. Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), Type UVA (UV absorbing).

D. Applied Vinyl: Die-cut characters from vinyl film of nominal thickness of 3 mils with pressure-sensitive adhesive backing, suitable for exterior applications.

2.02 PANEL SIGNS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following :
   1. ACE Sign Systems, Inc.
   2. Advance Corporation; Braille-Tac Division.
   3. Allen Industries Architectural Signage
   4. Allenite Signs; Allen Marking Products, Inc.
   5. APCO Graphics, Inc.
   6. ASI-Modulex, Inc.
   7. Best Sign Systems Inc.
   8. Bunting Graphics, Inc.
   9. Fossil Industries, Inc.
   10. Gemini Incorporated.
   11. Grimco, Inc.
   12. Innerface Sign Systems, Inc.
   13. InPro Corporation
   14. Matthews International Corporation; Bronze Division.
   15. Mills Manufacturing Company.
   16. Mohawk Sign Systems.
   17. Nelson-Harkins Industries.
   18. Seton Identification Products.
   19. Signature Signs, Incorporated.
   20. Supersine Company (The)

B. Interior Panel Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner, laminated complying with the following requirements:
   1. Acrylic Sheet, UV resistant, non-glare;
      a. Face sheet: 3/16 inch thick.
      b. Back painted face sheet.
      c. Painted backer sheet: 1/16 inch thick.
   2. Color: As selected by Architect from manufacturer's full range.

3. Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch above surface with contrasting colors.

C. Changeable Message Inserts: Fabricate signs to allow insertion of changeable messages in the form of transparent covers with paper inserts printed by Owner.
   1. Furnish insert material and software for creating text and symbols for PC-Windows computers for Owner production of paper inserts.
   2. Furnish insert material cut-to-size for changeable message insert.

D. Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.
   1. Panel Material: Opaque acrylic sheet and clear acrylic sheet with opaque color coating, subsurface applied.
   2. Raised-Copy Thickness: Not less than 1/32 inch.

E. Subsurface Copy: Apply minimum 4-mil- thick vinyl copy to back face of clear acrylic sheet forming panel face to produce precisely formed opaque image. Image shall be free of rough edges.

F. Applied Vinyl: Die-cut characters from vinyl film of nominal thickness of 3 with pressure-sensitive adhesive backing. Apply copy to exposed face of panel sign and glass and doors.
   1. Vinyl shall be of type appropriate for exterior use, UV resistant and non-fade.

G. Colored Coatings for Acrylic Sheet: For copy and background and frame colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are UV and water resistant for five years for application intended.
   1. Color: Clear

2.03 ACCESSORIES

A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.04 FABRICATION

A. General: Provide manufacturer's standard signs of configurations indicated.

1. Welded Connections: Comply with AWS standards for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded surfaces of welding flux and dress exposed and contact surfaces.
2. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
3. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

2.05 ALUMINUM FINISHES

A. Interior: Clear Anodic Finish; Manufacturer's standard Class 1 clear anodic coating, 0.018 mm or thicker, over a satin (directionally textured) mechanical finish, complying with AAMA 611.
B. Exterior: Manufacturer's standard exterior paint suitable for substrate. 3-coat, primer and two finish coats

2.06 ACRYLIC SHEET FINISHES

A. Colored Coatings for Acrylic Sheet: For copy and background and frame colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for five years for application intended.

PART 3 EXECUTION

3.01 INSTALLATION

A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.
   1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
   2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.
B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.
   1. Two-Face Tape: Mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
   2. Hook-and-Loop Tapes: Mount signs to smooth, nonporous surfaces.

3. Silicone-Adhesive Mounting: Attach signs to irregular, porous, or vinyl-covered surfaces.
4. Shim Plate Mounting: Provide 1/8-inch- thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other mounting methods are not practicable. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach panel signs to plate using method specified above.
5. Signs Mounted on Glass: Provide matching opaque plate on opposite side of glass to conceal mounting materials.

C. Exterior Signs: Comply with Manufacturer's written installation instructions.
1. Provide concrete footing of diamater suitable for mounting hardware and base trim. Ensure min. 3" concrete cover over steel reinforcing or bolt hardware.
2. Footing shall extend to a minimum 24" below grade. Set in 4" of #57 stone. Ensure soil substrate is solid, compacted and suitable for supporting sign weights.

END OF SECTION

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SECTION 102123
CUBICLE CURTAINS AND TRACK

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Curtain tracks and curtain carriers.
   2. Cubicle curtains.
   3. Surface mounted overhead curtain track and guides.

B. Related Sections include the following:
   1. Division 09 Section "Acoustical Panel Ceilings" for metal framing and furring for mounting items requiring anchorage.
   2. Section 055000 - Metal Fabrications: Track supports above ceiling.

1.02 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

B. NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films; 2023, with Errata.

1.03 PERFORMANCE REQUIREMENTS

A. Curtains: Provide curtain fabrics with the following characteristics:
   1. Fabrics are launderable to a temperature of not less than 160 deg F.
   2. Fabrics are flame resistant and are identical to those that have passed NFPA 701 when tested by a testing and inspecting agency acceptable to authorities having jurisdiction.
      a. Identify fabrics with appropriate markings of applicable testing and inspecting agency.

1.04 SUBMITTALS

A. Product Data: Include durability, laundry temperature limits, fade resistance, and fire-test-response characteristics for each type of curtain fabric indicated.
   1. Include data on each type of applied curtain treatment.

B. Shop Drawings: Show layout and types of cubicles, sizes of curtains, number of carriers, anchorage details, and conditions requiring accessories. Indicate dimensions taken from field measurements.

C. Sustainable Design Submittals:
   1. Provide the following supporting LEEDv4.1 documentation for permanently installed products:

a. Sourcing of Raw Materials:
   1) Recycled Content - Provide manufacturer supporting documentation indicating post-consumer and pre-consumer recycled content.
   2) Regional - Provide the location and distance to the project site. For products with recycled content, biobased content, or FSC certified wood.
b. Environmental Product Declaration (EPD): Provide the published manufacturer EPD.
c. Material Ingredients: Provide the published manufacturer material ingredient report according to 018113.
d. Low Emitting Materials:
   1) For wet applied products installed on the interior indicate the VOC content and provide certificates indicating compliance.
   2) For all other products installed on the interior, including wet applied products and subject to section '018113 Sustainable Design Requirements', provide certificates indicating compliance with the VOC Emissions Evaluation.
   3) For composite wood products installed on the interior, subject to section '018113 Sustainable Design Requirements', provide certificates indicating compliance with Formaldehyde Emissions Evaluation.

2. Include a completed LEEDv4 Submittal form when submitting sustainable design product information.

D. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Suspended ceiling components.
   2. Structural members to which suspension systems will be attached.
   3. Items penetrating finished ceiling, including the following:
      a. Lighting fixtures.
      b. Air outlets and inlets.
      c. Speakers.
      d. Sprinklers.
      e. Access panels.

E. Samples for Initial Selection: For each type of curtain material indicated.

F. Manufacturer Certificates: Signed by manufacturers certifying that products comply with requirements.

G. Operation and Maintenance Data: For curtains, track, and hardware to include in operation and maintenance manuals.

H. See Section 013000 - Administrative Requirements, for submittal procedures.

1.05 PROJECT CONDITIONS

A. Environmental Limitations: Do not install cubicles until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 PRODUCTS

2.01 CURTAINS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Cubicle Curtain Factory, Inc., or a product which meets all of the technical, performance, and aesthetic characteristics of the following:

1. Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
2. Inherently flame resistant or flameproofed; capable of passing NFPA 701 test.
3. Cubicle Curtain Fabric: Maharam "Sing" 511490, 72" wide.
    a. Color: As selected by Architect from manufacturer's full range.
    b. Material: 100% FR Polyester.
4. Curtain Grommets: Two-piece, rolled-edge, rustproof, nickel-plated brass; spaced not more than 6 inches o.c.; machined into top hem.
5. Mesh Top: No. 50 nylon mesh.
6. Extruded-Aluminum Track: Not less than 1-1/4 inch wide by 3/4 inch high.
7. Track Accessories: Fabricate splices, end caps, connectors, end stops, coupling and joining sleeves, wall flanges, brackets, ceiling clips, and other accessories from same material and with same finish as track.
    a. End Stop: Removable with carrier hook.
8. Curtain Carriers: Two nylon rollers and nylon axle with chrome-plated steel hook.
9. Exposed Fasteners: Stainless steel.
10. Concealed Fasteners: Stainless steel.

2.02 CURTAIN FABRICATION

A. Fabricate curtains to comply with the following requirements:

1. Width: Equal to track length from which curtain is hung plus 10 percent added fullness, but not less than 12 inches added fullness.
2. Length: Equal to floor-to-ceiling height minus 18 inches from finished ceiling at top, and minus distance above the finished floor at bottom as follows:
    a. Cubicle Curtains: 15 inches.

3. Mesh Top: Top hem not less than 1 inch and not more than 1-1/2 inches wide, triple thickness, reinforced with integral web, and double lock stitched. Double lock stitch bottom of mesh directly to 1/2-inch triple thickness, top hem of curtain fabric.
4. Bottom Hem: Not less than 1 inch and not more than 1-1/2 inches wide, triple thickness, reinforced, and double lock stitched.
5. Side Hems: Not less than 1/2 inch and not more than 1-1/4 inches wide, with triple turned edges, and single lock stitched.
6. Vertical Seams: Not less than 1/2 inch wide, double turned and double stitched. Align vertical pattern.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.
C. Verify that surfaces and supports above ceiling are ready to receive work of this Section.
D. Verify that field measurements are as indicated.

3.02 INSTALLATION

A. General: Install tracks level and plumb, according to manufacturer's written instructions.
B. Up to 16 feet in length, provide track fabricated from 1 continuous length.
    1. Curtain Track Mounting: Surface.
C. Surface Track Mounting: Fasten surface-mounted tracks at intervals of not less than 24 inches. Fasten support at each splice and tangent point of each corner. Center fasteners in track to ensure unencumbered carrier operation. Attach track to ceiling as follows:
    1. Attach track to suspended ceiling grid with manufacturer's proprietary clip.
D. Track Accessories: Install splices, end caps, connectors, end stops, coupling and joining sleeves, and other accessories as required for a secure and operational installation.
E. Curtain Carriers: Provide curtain carriers adequate for 6-inch spacing along full length of curtain plus an additional carrier.
F. Curtains: Hang curtains on each curtain track.

G. Install curtain track to be secure, rigid, and true to ceiling line.

H. See Section 055000 for track supports above ceiling.

I. Secure track to ceiling system.

J. Install end cap and stop device.

K. Install curtains on carriers ensuring smooth operation.

END OF SECTION

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SECTION 102213

WIRE MESH PARTITIONS

PART 2 PRODUCTS

1.01 WIRE MESH PARTITIONS

A. Wire Mesh Partitions: Factory-fabricated modular assemblies of panels, doors, anchors, hardware, and accessories as required to provide a complete system.

1.02 COMPONENTS

A. Woven Wire Mesh: Heavy duty.
   1. Material: ASTM A510/A510M uncoated crimped steel wire.
   2. Wire Size: 6 gauge, 0.192 inch (4.9 mm).

B. Doors: Same material as partitions, fully framed; manufacturer's standard construction and hardware for swing operation.
   1. Locking: Mortise type cylinder locks as specified in Section 087100.

1.03 FASTENERS

A. Bolts, Nuts and Washers: Hot dip galvanized.

B. Anchorage Devices: Provide power driven, powder actuated, and drilled expansion bolts.

1.04 ACCESSORIES

A. Plates, Gussets, Clips: Formed sheet steel, thickness determined for conditions encountered, manufacturer's standard shapes, same finish as framing members.

B. Post Caps: Manufacturer's standard.

C. Floor and Ceiling Pilaster Shoe: Manufacturer's standard.

D. Floor Base: Manufacturer's standard.

1.05 FABRICATION

A. Fit and assemble in largest practical sections for delivery to site, ready for installation.

B. Make exposed joints flush or tight.

1.06 FINISHES

A. Painted Finish: Manufacturer's standard powder coat finish.
   1. Color: To be selected by Architect from manufacturer's full range.

END OF SECTION

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SECTION 102240
SINGLE PANEL OPERABLE PARTITIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Top-supported single panel operable partitions, horizontal opening.

1.02 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2022.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

C. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

D. ASTM E413 - Classification for Rating Sound Insulation; 2022.

E. ASTM E557 - Standard Guide for Architectural Design and Installation Practices for Sound Isolation Between Spaces Separated by Operable Partitions; 2012 (Reapproved 2020).

F. ASTM E596 - Standard Test Method for Laboratory Measurement of Noise Reduction of Sound-Isolating Enclosures; 2022.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene at project site seven calendar days prior to scheduled beginning of construction activities of this section to review section requirements.

1. Require attendance by representatives of installer and other entities directly affecting, or affected by, construction activities of this section.
2. Notify Architect four calendar days in advance of scheduled meeting date.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on partition materials, operation, hardware and accessories, and colors and finishes available.

C. Design Data: Design calculations, bearing seal and signature of structural engineer licensed to practice in the State in which the Project is located, showing loads at points of attachment to the building structure.

D. Shop Drawings: Indicate opening sizes, track layout, details of track and required supports, static and dynamic loads, adjacent construction and finish trim, and stacking depth.

E. Samples for Selection: Submit two samples of full manufacturer's color range for selection of colors.

F. Samples for Review: Submit two samples of surface finish, 12 by 12 inches (300 by 300 mm) size, illustrating quality, colors selected, texture, and weight.

G. Certificates: Certify that partition system meets or exceeds specified acoustic requirements.

H. Manufacturer's Instructions: Indicate special procedures.

I. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods. Describe cleaning materials detrimental to finish surfaces and hardware finish.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until installation.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within five year period after Date of Substantial Completion.

C. Provide two year manufacturer warranty against defects in material and workmanship, excluding abuse.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Folding Panel Partitions - Horizontal Opening: Subject to compliance with requirements, provide Modernfold, a DORMA Group Company, Acousti-Seal Encore or comperable by one of the following;

1. Kwik-Wall Company: www.kwik-wall.com/#sle.
2. Moderco, Inc: www.moderco.com/#sle.
3. Substitutions: See Section 016000 - Product Requirements.

2.02 SINGLE PANEL OPERABLE PARTITIONS - HORIZONTAL OPENING

A. Single Panel Operable Partitions: Center pivot; individual panels; center stacking; manually operated.

B. Panel Construction:

1. Frame: 16 gauge, 0.0598 inch (1.52 mm) thick formed sheet steel frame top, bottom, jambs, and intermediates; welded construction, with acoustical insulation fill.
2. Substrate: Particle board.
3. Panel Substrate Facing: Steel sheet, manufacturer's standard thickness.
4. Hardware: Latching door handles of cast steel, satin chrome finish.
5. Panel Properties:
    a. Thickness With Finish: 4.25" inches (108 mm).
    b. Width: Standard width.
    c. Weight: 8 lb/sq ft (40 kg/sq m).

C. Panel Finishes:
1. Facing: Markerboard.
2. Exposed Metal Trim: Custom powder coated paint finish.

D. Panel Seals:
1. Panel to Panel Seals: Grooved and gasketed astragals, with continuous flexible ribbed vinyl seal fitted to panel edge construction; color to match panel finish.
2. Acoustic Seals: Automatically operating flexible acoustic seals at jambs, ceilings, retractable floor seals, and above track to structure acoustic seal. Seals shall be be of type and size to acheive performance characterisitics. .

E. Suspension System:
1. Track: Formed steel; 1-1/4 by 1-1/4 inch (32 by 32 mm) size; thickness and profile designed to support loads, steel sub-channel and track connectors, and track switches.
2. Carriers: Nylon wheels on trolley carrier at top of every panel, sized to carry imposed loads, with threaded pendant bolt for vertical adjustment.

F. Performance:
1. Acoustic Performance:
    a. Noise Reduction Coefficient (NRC): ASTM E596, NRC of 0.65 minimum.
    b. Sound Transmission Class (STC): 56 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90, on panel size of 100 sq ft (9.3 sq m).
2. Surface Burning Characteristics of Panel Finish: Flame spread/smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.
3. Installed partition system track capable of supporting imposed loads, with maximum deflection of 1/360 of span.

2.03 MATERIALS

A. Particleboard: ANSI A208.1; composed of wood chips, sawdust, or flakes of medium density, made with waterproof resin binders; of grade to suit application; sanded faces.

B. Markerboard: Porcelain enamel on steel, laminated to core; white low sheen color.

C. Acoustic Insulation:

1. Type: As required for acoustic performance indicated.
2. Thickness: As required for acoustic performance indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify track supports are laterally braced and will permit track to be level within 1/4 inch (6.4 mm) of required position and parallel to the floor surface.

C. Verify floor flatness of 1/8 inch in 10 feet (3 mm in 3 m), non-cumulative.

D. Verify wall plumbness of 1/8 inch in 10 feet (3 mm in 3 m), non-cumulative.

3.02 INSTALLATION

A. Install partition in accordance with manufacturer's instructions and ASTM E557.

B. Fit and align partition assembly and pocket doors level and plumb.

C. Lubricate moving components.

D. Install acoustic sealant to achieve required acoustic performance.

E. Coordinate electrical connections.

3.03 ADJUSTING

A. Adjust partition assembly to provide smooth operation from stacked to full open position. Do not over-compress acoustic seals.

B. Visually inspect partition in full extended position for light leaks to identify a potential acoustical leak.

C. Adjust partition assembly to achieve lightproof seal.

3.04 CLEANING

A. Clean finish surfaces and partition accessories.

3.05 CLOSEOUT ACTIVITIES

A. Demonstrate operation of partition and identify potential operational problems.

END OF SECTION

SECTION 102800

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

B. Commercial shower and bath accessories.

C. Under-lavatory pipe supply covers.

D. Utility room accessories.

1.02 RELATED REQUIREMENTS

A. Section 061053 - Miscellaneous Rough Carpentry: Concealed supports for accessories, including in wall framing and plates.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures; 2011 (Reaffirmed 2022).

C. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2022.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.

F. ASTM B86 - Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings; 2023.

G. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2017 (Reapproved 2022).

H. ASTM C1036 - Standard Specification for Flat Glass; 2021.

I. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2024.

J. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping; 2021.

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

L. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

M. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.01 TOILET ACCESSORIES SCOPE

A. Toilet Accessories shall be provided by Contractor unless indicated otherwise.

B. Refer to Drawings for Accessories that shall be Owner-furnished and Contractor-installed. For Owner-furnished accessories, product data is included herein for informational purposes.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

1. Grind welded joints smooth.
2. Fabricate units made of metal sheet of seamless sheets with flat surfaces.

B. Keys: Provide six keys for each accessory to Owner.

C. Stainless Steel Sheet: ASTM A666, Type 304.

D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.

E. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

F. Zinc Alloy: Die cast, ASTM B86.

G. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

H. Adhesive: Two component epoxy type, waterproof.

I. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

J. Expansion Shields: As recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

B. Chrome/Nickel Plating: ASTM B456, SC 2, polished finish, unless otherwise noted.

2.04 COMMERCIAL TOILET ACCESSORIES

A. Toilet Paper Dispenser, Item TA01: Single roll, surface mounted bracket type, plastic.
   1. Capacity: Two 6 inch diameter rolls of toilet tissue
   2. Color: As selected by Architect.
   3. Products: Basis-of-Design Product: Subject to compliance with requirements provide Von Drehle SINGLE JR JUMBO ROLL DISPENSER, Model AE42V, JRT DISPENSER.
      a. Substitutions: Not permitted.

B. Paper Towel Dispenser, Item TA04: Manual Hard Roll Dispener type, plastic, surface-mounted, with viewing slots on sides as refill indicator and tumbler lock.
   1. Capacity: 1.75" core
   2. Finish: Black Plastic.
   3. Products: Basis-of-Design Product; Subject to compliance with requirements, provide Kimberly Clark Professional Sanitouch Manual Hard Roll Towel Dispenser , Model 09996, or comparable product by one of the following:
      a. AJW Architectural Products
      b. American Specialties, Inc.
      c. Bobrick Washroom Equipment, Inc.

C. Paper Towel Dispenser, Item TA05: Folded paper type, stainless steel, surface-mounted, with viewing slots on sides as refill indicator and tumbler lock.
   1. Capacity: 350 multi-fold or 200 C-fold, minimum.
   2. Finish: Brushed #4.
   3. Products: Basis-of-Design Product; Subject to compliance with requirements, provide Bradley, Model 252, or comparable product by one of the following:
      a. AJW Architectural Products
      b. American Specialties, Inc.
      c. Bobrick Washroom Equipment, Inc.

D. Soap Dispenser, Surface-Mounted, Item TA06: Foam soap dispenser, wall-mounted,
   1. Minimum Capacity: 40 ounces (1.18 liter).
   2. Products: Basis-of-Design Product: Subject to compliance with requirements provide Kutol Designer Series Deco Foam Dispenser Model SS001BK31, Black, or comparable product by one of the following:
      a. AJW Architectural Products: www.ajw.com/#sle.
      b. American Specialties, Inc: www.americanspecialties.com/#sle.

c. Bobrick Washroom Equipment, Inc.

E. Mirrors, Framed, Item TA12: Stainless steel framed, 1/4 inch (6 mm) thick annealed float glass; ASTM C1036.
   1. Size: 18 inches wide by 36 inches high.
   2. Frame: 0.05 inch (1.3 mm)angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
   3. Backing: Full-mirror sized, minimum 0.03 inch (0.8 mm) galvanized steel sheet and nonabsorptive filler material.
   4. Products: Subject to compliance with requirements, provide one of the following products;
      a. AJW Architectural Products: www.ajw.com/#sle.
      b. American Specialties, Inc: www.americanspecialties.com/#sle.
      c. Bobrick Washroom Equipment, Inc.
      d. Bradley Company, LLC.
      e. Substitutions: See Section 016000 - Product Requirements.

F. Grab Bars, Items TA07: Stainless steel, smooth surface.
   1. Standard Duty Grab Bars:
      a. Push/Pull Point Load: 250 pound-force (1112 N), minimum.
      b. Dimensions: 1-1/4 inch (32 mm) outside diameter, minimum 0.05 inch (1.3 mm) wall thickness, concealed flange mounting, 1-1/2 inch (38 mm) clearance between wall and inside of grab bar.
      c. Finish: Satin.
      d. Length and Configuration: 18 inches, vertical.
      e. Products: Basis-of-Design Product; Subject to compliance with requirements, provide Bradley Model 832-18, or comparable product by one of the following:
         1) AJW Architectural Products
         2) American Specialties, Inc.
         3) Bobrick Washroom Equipment, Inc.
         4) Substitutions: See Section 016000 - Product Requirements

G. Grab Bars, Items TA08: Stainless steel, smooth surface.
   1. Standard Duty Grab Bars:
      a. Push/Pull Point Load: 250 pound-force (1112 N), minimum.
      b. Dimensions: 1-1/4 inch (32 mm) outside diameter, minimum 0.05 inch (1.3 mm) wall thickness, concealed flange mounting, 1-1/2 inch (38 mm) clearance between wall and inside of grab bar.

c. Finish: Satin.
d. Length and Configuration: 36 inches, horizontal.
e. Products: Basis-of-Design Product; Subject to compliance with requirements, provide Bradley Model 832-36, or comparable product by one of the following:
1) AJW Architectural Products.
2) American Specialties, Inc.
3) Bobrick Washroom Equipment, Inc.
4) Substitutions: See Section 016000-Product Requirements.

H. Grab Bars, Items TA09: Stainless steel, smooth surface.
1. Standard Duty Grab Bars:
a. Push/Pull Point Load: 250 pound-force (1112 N), minimum.
b. Dimensions: 1-1/4 inch (32 mm) outside diameter, minimum 0.05 inch (1.3 mm) wall thickness, concealed flange mounting, 1-1/2 inch (38 mm) clearance between wall and inside of grab bar.
c. Finish: Satin.
d. Length and Configuration: 42 inches, horizontal.
e. Products: Basis-of-Design Product; Subject to compliance with requirements, provide Bradley Model 832-42, or comparable product by one of the following:
1) AJW Architectural Products.
2) American Specialties, Inc.
3) Bobrick Washroom Equipment, Inc.
4) Substitutions: See Section 016000-Product Requirements.

I. Sanitary Napkin Disposal Unit, Item TA10: Plastic, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
1. Products: Basis-of-Design Product; Subject to compliance with requirements, provide Alpine Sanitary Napkin Receptacle , Model ALP452 Series, Plastic, or comparable product by one of the following:
a. AJW Architectural Products
b. American Specialties, Inc.
c. Bobrick Washroom Equipment, Inc.
d. Substitutions: See Section 016000 - Product Requirements

J. Sanitary Napkin/Tampon Dispenser Unit TA11:
1. Products: Basis-of-Design Product: Bobrick B-370634C

2.05 COMMERCIAL SHOWER AND BATH ACCESSORIES

A. Robe Hook, Item TA03 : Heavy-duty stainless steel, single-prong, rectangular-shaped bracket and backplate for concealed attachment, satin finish.

2.06 UNDER-LAVATORY PIPE AND SUPPLY COVERS

A. Under-Lavatory Pipe and Supply Covers:
   1. Insulate exposed drainage piping, including hot, cold, and tempered water supplies under lavatories or sinks to comply with ADA Standards.
   2. Exterior Surfaces: Smooth non-absorbent, non-abrasive surfaces.
   3. Construction: 1/8 inch (3.2 mm) flexible PVC.
      a. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
      b. Comply with ASTM C1822, type indicated.
      c. Comply with ASME A112.18.9.
      d. Comply with ICC A117.1.
      e. Microbial and Fungal Resistance: Comply with ASTM G21.
   4. Color: White.
   5. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces.
   6. Products: Subject to compliance with requirements, provide one of the following products:
      a. IPS Corp., Truebro; Soft Guard Plus.
      b. Plumberex Specialty Products, Inc; Plumberex Handy-Shield Maxx: www.plumberex.com/#sle.

2.07 UTILITY ROOM ACCESSORIES

A. Combination Utility Shelf/Mop and Broom Holder: TA02, 0.05 inch (1.3 mm) thick stainless steel, Type 304, with 1/2 inch (12 mm) returned edges, 0.06 inch (1.6 mm) steel wall brackets.
   1. Drying rod: Stainless steel, 1/4 inch (6 mm) diameter.
   2. Hooks: Three, 0.06 inch (1.6 mm) stainless steel rag hooks at shelf front.
   3. Mop/broom holders: Four spring-loaded rubber cam holders at shelf front.
   4. Length: 36 inches (900 mm).
   5. Products: Subject to compliance with requirements, provide one of the following products;

a. American Specialties, Inc; Model 1315-4: www.americanspecialties.com/#sle.
b. Bobrick Washroom Equipment, Inc. ;Model B-224 .
c. Bradley Corporation ;Model 9984 .
d. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.
B. Verify exact location of accessories for installation.
C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.
D. Verify that field measurements are as indicated on drawings.
E. See Section 061053 for installation of blocking and reinforcing plates in walls.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.
B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
B. Install plumb and level, securely and rigidly anchored to substrate.
C. Mounting Heights: As indicated on drawings

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

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SECTION 104300

EMERGENCY AID SPECIALTIES - QE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Automated external defibrillators (AEDs).

B. Emergency aid cabinets.

C. Evacuation chairs.

D. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Wood blocking product and execution requirements.

1.03 DEFINITIONS

A. Automated External Defibrillator (AED): A Food and Drug Administration (FDA)-approved portable device, which automatically analyzes the heart rhythm and recognizes the presence of ventricular fibrillation and/or tachycardia. If defibrillation is warranted, the AED automatically charges and prompts (visual and/or audio) the operator to deliver an electrical shock.

1.04 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide AED operational features, color and finish, anchorage details, and installation instructions.

C. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.

D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Maintenance Data: Include test schedules and recertification requirements.

PART 2 PRODUCTS

2.01 PRODUCTS

A. Automated External Defibrillators (AEDs): Subject to compliance with requirements, provide one of the following or comparable product;

1. Philips Medical Systems; HeartStart FRx: www.usa.philips.com/#sle.

2. Stryker Corporation; HeartSine samaritan PAD 350P Defibrillator - PAD 350p: www.stryker.com/#sle.
3. ZOLL Medical Corporation; AED3 with Real CPR Help: www.zoll.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

B. Evacuation Chair: Subject to compliance with requirements, provide one of the following or comparable product;
1. Evac+Chair North America LLC; Evac+Chair 500H.
2. Substitutions: See Section 016000-Product Requirements.

C. Emergency Aid Cabinets and Accessories: Subject to requirements, provide one of the following or comparable product;
1. Activar Construction Products Group, Inc. - JL Industries: www.activarcpg.com/#sle.
2. Modern Metal Products, a division of Technico, Inc: www.modern-metal.com/#sle.
3. Substitutions: See Section 016000 - Product Requirements.

2.02 AUTOMATED EXTERNAL DEFIBRILLATORS (AEDS)

A. Automated External Defibrillators (AEDs) - General: FDA approval required.
1. Provide automated external defibrillators (AEDs) as indicated. AED Performance requirements includes the following;
a. Waveform: Self-compensating output, pulse envelope (SCOPE) optimized biphasic escalting waveforem compensates energy, slope and duration for paitent impedance.
b. Meets IEC/EN 60601-2-4
c. Impedance range: 20-230 ohms, minimum
d. Use instructions.
e. Automatic shock delivery with motion detection.
f. Battery capacity: 13 hours, minimum.
g. Standby life: 6 years, minimum.
h. Storage case.
i. Accessories: Pad-Pak electrodes, 2 pairs.
j. Warranty: 8 years.

2.03 EVACUATION CHAIR

A. Provide evacuation chair(s) as indicated, with the following characterisitics;
1. Capacity: 500 pound patient load.
2. Stair slope: between 28 and 45 degrees.

3. Patient restraint system.
4. Wall mounted.
5. Capable of one person operation.
6. Additional assist handles at bottom of chair.
7. Accessories: Manufacturer's standard dust cover and wall signage.
8. Warranty: 20 years, minimum.

2.04 EMERGENCY AID CABINETS

A. Type: Automated external defibrillator (AED) and evacuation chair.

B. Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.

C. Fire-Rated Cabinet Construction: One-hour fire rated.
1. Steel; double wall or outer and inner boxes with 5/8 inch (15.9 mm) thick fire barrier material.

D. Cabinet Configuration: Recessed type.
1. Size to accommodate AED and evacuation chair .
2. Trimless type.
3. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim and door stiles.

E. Door: 0.036 inch (0.9 mm) metal thickness, reinforced for flatness and rigidity with wire pull handle and nylon catch. Hinge door for 180 degree opening with two butt hinges.

F. Door Glazing: Tempered glass, clear, 1/8 inch (3 mm) thick, and set in resilient channel glazing gasket.

G. Cabinet Mounting Hardware: Appropriate to cabinet, with predrilled holes for placement of anchors.

H. Fabrication: Weld, fill, and grind components smooth.

I. Finish of Cabinet Exterior Trim and Door: No.4 - Brushed stainless steel.

J. Finish of Door Pull or Handle: Stainless steel.

K. Finish of Cabinet Interior: White powder coat.

2.05 ACCESSORIES

A. Theft Alarm: Battery operated audible and strobe light alarm, 10 second delay for disarming, activated by opening cabinet door. Alarm deactivated when door is closed.

B. Alarm Contacts: Contact devices.
1. Magnetic door contact for existing alarm systems.

C. Cabinet Door Signage: 'AED" decal, or vinyl self-adhering, prespaced black lettering and identifying graphic in accordance with authorities having jurisdiction (AHJ).

D. Plastic Wall Signage: Flat style.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, 48 inches (1219 mm) from finished floor to door handle.

C. Secure rigidly in place.

D. Place AEDs in cabinets.

E. Wall Signs:

1. Location: Where shown.
2. Height: Locate bottom of sign 7 feet (2.1m) above finished floor.
3. Apply on walls after field painting is completed and has been accepted.

F. Cabinet Lettering:

1. Location: Face of door framing.
2. Apply lettering on factory-finished cabinets either at the factory or just prior to Substantial Completion.

3.03 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust cabinet doors to operate smoothly without binding. Verify that alarms and integral locking devices operate properly.

C. On completion of cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes. Replace cabinets that cannot be restored to factory-finished appearance. Use materials and procedures recommended by cabinet manufacturer.

3.04 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals for closeout submittals.

B. See Section 017900 - Demonstration and Training for additional requirements.

C. Demonstrate proper operation of AED to Owner's designated representative.

END OF SECTION

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SECTION 104400
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 061053 - Miscellaneous Rough Carpentry: Wood blocking product and execution requirements.

1.03 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).

B. FM (AG) - FM Approval Guide current edition.

C. NFPA 10 - Standard for Portable Fire Extinguishers 2022.

D. UL (DIR) - Online Certifications Directory Current Edition.

1.04 SUBMITTALS

A. See Section 013300 – Submittal Procedures for submittal procedures.

B. Product Data: Provide extinguisher operational features.

C. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.

D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.05 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers:

1. Activar Construction Products Group, Inc. - JL Industries; Cosmic Extinguisher - Multipurpose Chemical: www.activarcpg.com/#sle.
2. Ansul, a Tyco Business: www.ansul.com/#sle.

3. Kidde, a unit of United Technologies Corp: www.kidde.com/#sle.
4. Nystrom, Inc: www.nystrom.com/#sle.
5. Oval Brand Fire Products; Oval Dry Chemical Fire Extinguisher - Multipurpose ABC: www.ovalfireproducts.com/#sle.
6. Potter-Roemer: www.potterroemer.com/#sle.
7. Pyro-Chem, a Tyco Business: www.pyrochem.com/#sle.
8. Substitutions: See Section 016000-Product Requirements.

B. Fire Extinguisher Cabinets and Accessories: Basis-of-Design: Subject to compliance with requirements, provide Activar Construction Products Group, Inc. - JL Industries; Embassy Series: www.activarcpg.com/#sle or comparable product by one of the following;
1. Larsen's Manufacturing Co: www.larsensmfg.com/#sle.
2. Nystrom, Inc: www.nystrom.com/#sle.
3. Substitutions: See Section 016000-Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
1. Cartridge Operated: Spun shell.
2. Class: A:B:C type.
3. Size and classification as scheduled.
4. Finish: Baked polyester powder coat, color as selected.
5. Temperature range: Minus 65 degrees F to 120 degrees F.

2.03 FIRE EXTINGUISHER CABINETS

A. Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.

B. Cabinet Construction: Non-fire rated.
1. Formed primed steel sheet; 0.036 inch thick base metal.

C. Fire Rated Cabinet Construction: One-hour fire rated.
1. Steel; double wall or outer and inner boxes with 5/8 inch thick fire barrier material.

D. Cabinet Configuration: Recessed type.

1. Size to accommodate accessories.
2. Trimless type.
3. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim.

E. Door: Stainless steel, 0.036 inch thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinges.

F. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

G. Door Pull: Intergrated into bottom of door.

H. Fabrication: Weld, fill, and grind components smooth.

I. Finish of Cabinet Exterior Door: White colored enamel.

J. Finish of Cabinet Interior: White colored enamel.

2.04 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

B. Lettering: FIRE EXTINGUISHER decal, Type LDCABFE, or vinyl self-adhering, pre-spaced black lettering in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, 48 inches inches from finished floor to inside bottom of cabinet.

C. Secure rigidly in place.

D. Place extinguishers and accessories in cabinets.

E. Position cabinet signage vertically centered on door.

3.03 MAINTENANCE

A. See Section 017700 – Closeout Procedures for additional requirements relating to maintenance service.

B. Provide a separate maintenance contract for the service and maintenance of fire extinguishers for twelve months from Date of Substantial Completion.

END OF SECTION

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SECTION 105113
METAL LOCKERS - QE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal lockers.

1.02 RELATED REQUIREMENTS

A. Section 061053 - Miscellaneous Rough Carpentry: Wood blocking and nailers.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's published data on locker construction, sizes, and accessories.

C. Shop Drawings: Indicate locker plan layout, numbering plan and combination lock code.

D. Samples: Submit two samples 3 by 6 inches (75 by 150 mm) in size showing color and finish of metal locker material.

E. Manufacturer's Installation Instructions: Indicate component installation assembly.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect locker finish and adjacent surfaces from damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Lockers: Basis-of-Design; Subject to compliance with requirements, provide Penco Products, Inc.; Vanguard Series, or comparable product by one of the following;

1. List Industries, Inc: www.listindustries.com/#sle.
2. Lyon Workspace Products: www.lyonworkspace.com/#sle.
3. Substitutions: See Section 016000 - Product Requirements.

2.02 LOCKER APPLICATIONS

A. Kitchen Lockers Type ML-1: Metal lockers, wall mounted with matching closed base.

1. Width: 15 inches (381 mm).
2. Depth: 12 inches (305 mm).
3. Height: 72 inches (1830 mm)(two 36" high units, stacked).
4. Configuration: Two tier.
5. Fittings: Size and configuration as indicated on drawings.
    a. Hooks: One double prong per unit.
6. Ventilation: Louvers at top and bottom of door panel.
7. Locking: Padlock hasps, for padlocks provided by Owner.
8. Provide sloped top.
9. Color: To be selected from manufacturer's full range by Architect.

2.03 METAL LOCKERS

A. Accessibility: Design units indicated on drawings as 'accessible' to comply with ICC A117.1 and ADA Standards.

B. Locker Case Construction:

1. Standard-Duty, Knocked Down Construction: Made of formed sheet steel; metal edges finished smooth without burrs; powder coat finished inside and out.
    a. Locker Body Components: Formed and flanged from steel sheet of the following type and minimum thicknesses:
        1) Unperforated Steel Sheet: Commercial Steel (CS), Type B, supplied for exposed applications and complying with ASTM A1008/A1008M and the following:
            (a) Uncoated.
        2) Body and Shelves: 24 gauge, 0.0239 inch (0.61 mm).
        3) Backs: 24 gauge, 0.0239 inch (0.61 mm).
        4) Base: 18 gauge, 0.0478 inch (1.21 mm).
            (a) Height: 4 inch (100 mm).
    b. Frames: Formed channel shape, welded and ground flush, welded to body, resilient gaskets and latching for quiet operation.
        1) Door Frame: 16 gauge, 0.0598 inch (1.52 mm), minimum.
    c. Where ends or sides are exposed, provide flush panel closures.
    d. Provide filler strips where indicated, securely attached to lockers.

C. Doors: Channel edge; welded construction, manufacturer's standard stiffeners, grind and finish edges smooth.

1. Door Thickness: 14 gauge, 0.0747 inch (1.90 mm), minimum.
2. Form recess for operating handle and locking device.

D. Latches and Door Handles: Manufacturer's standard.

1. Latching: Manufacturer's standard for locking arrangement selected.

a. Three-Point Pull Handle Gravity Latch: Surface-mounted, provide for doors 18 inches (457 mm) or taller.
   1) Handle: Steel finger lift mechanism.
   2) Latching Mechanism: Spring activated nylon slide latch enclosed in steel latch channel allows closing of door while padlock or built-in lock is in position.
   3) Padlock Eye: Integral with lift handle, sized for use with 9/32 inch (7.1 mm) diameter padlock shackles.

E. Hinges: Continuous piano hinge with powder coat finish to match locker color.

F. Sloped Top: 20 gauge, 0.0359 inch (0.91 mm), with closed ends.

G. Trim: 20 gauge, 0.0359 inch (0.91 mm).

H. Coat Hooks: Stainless steel or zinc-plated steel.

I. Number Plates: Provide oval shaped aluminum plates. Form numbers 3/8 inch inch (9.5 mm) high of block font style with ADA designation, in contrasting color.

J. Locks: Locker manufacturer's standard type indicated in Applications article above.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared bases are in correct position and configuration.

B. Verify bases and embedded anchors are properly sized.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Place and secure on prepared base.

C. Install lockers plumb and square.

D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 pounds (445 N).

E. Bolt adjoining locker units together to provide rigid installation.

F. Install end panels, filler panels, and sloped tops.

G. Install fittings if not factory installed.

H. Replace components that do not operate smoothly.

3.03 CLEANING

A. Clean locker interiors and exterior surfaces.

END OF SECTION

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SECTION 105613

METAL STORAGE SHELVING - QE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Four post shelving.

B. Shelving accessories.

1.02 RELATED REQUIREMENTS

A. Section 061053 - Miscellaneous Rough Carpentry: Blocking and reinforcement in walls for anchoring shelving units.

1.03 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Rated uniform shelf loads.
2. Details of shelving assemblies, including reinforcement.
3. Accessories.
4. Substrate preparation instructions and recommendations.
5. Storage and handling requirements and recommendations.
6. Installation methods.
7. Specimen warranty.
8. Maintenance methods.

C. Test Reports: Provide independent agency test reports documenting compliance with specified structural requirements.

1. In lieu of test reports, detailed drawings stamped and sealed by a Professional Engineer licensed in the State in which the Project is located will be acceptable.

D. Shop Drawings: Indicate location, type, and layout of shelving, including lengths, heights, and aisle layout, and relationship to adjacent construction.

1. Indicate methods of achieving specified anchoring requirements.

E. Product Schedule: For metal storage shelving. Use same designations indicated on Drawings.

F. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and finishes.

G. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Shelves: Two of each size with shelf brackets.
3. Shelf-to-Post Connectors: Full-size units equalt to 5 percent of amount installed for each type indicated, but no fewer than 10 connectors.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years of documented experience and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Inspect for dents, scratches, or other damage. Replace damaged units.

B. Store in manufacturer's unopened packaging until ready for installation.

C. Store under cover and elevated above grade.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide one year manufacturer warranty covering defects of manufacturing and workmanship and rust and corrosion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Four Post Shelving: Subject to compliance with requirements, provide products by one of the following;

1. List Industries, Inc: www.listindustries.com/#sle.
2. Lyon, LLC.
3. Penco Products, Inc: www.pencoproducts.com/#sle.
4. Spacesaver Corporation: www.spacesaver.com/#sle.
5. Tennsco Storage: www.tennsco.com/#sle.
6. Substitutions: See Section 016000 - Product Requirements.

2.02 SHELVING - GENERAL

A. See drawings for layout and sizes.

B. Anchors: Provide anchoring hardware to secure each shelving unit to floor and wall.

1. Provide hardware of type recommended by manufacturer for substrate.

2. See drawings for additional details of anchorage.

2.03 FOUR POST SHELVING

A. Four Post Shelving: Steel post-and-beam type with sway bracing, shelving brackets, shelving surfaces, and accessories as specified.
   1. Unit Width: As indicated on Drawings, center to center of posts.
   2. Shelf Capacity: Uniform distributed load of 50 psf (2.4 kPa), minimum.
   3. Shelf Deflection: 1/4 inch (6 mm) in 36 inches (914 mm), maximum, under specified uniform load.
   4. Shelf Deflection: L/140, maximum, under specified uniform load.
   5. Adjustability of Shelving: At intervals of 1-1/2 inches (38 mm) on center, minimum.
   6. Unit Depth: Not more than 1/4 inch (6 mm) greater than shelf depth.
   7. Shelves per Unit: As indicated on drawings.
   8. Finish: Powder-coated.
   9. Color: As selected by Architect from manufacturer’s standard range.
   10. Number of Units: As indicated on drawings.

B. Posts and Beams: Formed sheet members; perforations exposed on face of members are not acceptable.
   1. Metal Thickness: 16 gauge, 0.0598 inch (1.52 mm).
   2. Post Shape: Tee intermediate posts, angle end posts forming corners.
   3. Post Face Width: 2 inches (51 mm), maximum.
   4. Connecting Hardware: Manufacturer's standard.
   5. Post Bases: Flat steel foot plate , with manufacturer’s recommended adjustable leveling device.

C. Bracing: Formed sheet members.
   1. Back Sway Bracing: Either strap or panel; at back of each unit.
   2. Side Sway Bracing: Either strap or panel; at each side of each unit.
   3. Strap Sway Bracing: One strap installed diagonally, 16 gauge, 0.0598 inch (1.52 mm); welded, riveted, or bolted to uprights.
   4. Panel Sway Bracing: Formed sheet metal panels, 20 gauge, 0.0359 inch (0.91 mm); welded, riveted, or bolted to uprights.

D. Shelves: Formed sheet, with box formed edges with corners lapped and welded, finished on all surfaces .
   1. Metal Thickness: 16 gauge, 0.0598 inch (1.52 mm), minimum.

2. Shelf Edge Profile: Extending 3/4 inch (19 mm), maximum, below top surface of shelf.
3. Shelf Connection to Posts: Manufacturer's standard.

2.04 ACCESSORIES

A. Label Holders: Steel, attached to front face of shelf.
1. Size: 2-1/4 by 3/4 inches (56 by 20 mm).
2. Finish: Manufacturer’s standard.
3. Mounting: Slide-on.

B. Shelf-to-Post Connectors: Manufacturer's standard compression clips.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate is level and that clearances are as specified.
B. Verify that walls are suitable for shelving attachment.
C. Do not begin installation until substrates have been properly prepared.
D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.
B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Anchor and reinforce as specified, as indicated on drawings, and as recommended by manufacturer.
C. Install shelving with shelf surfaces level and vertical supports plumb; adjust feet and bases as required.
D. Out-Of-Square Tolerance - Four Post Shelving: Maximum of 1/8 inch (3 mm) difference in distance between bottom shelf and canopy top, measured along any post in any direction.

3.04 CLEANING

A. Clean shelving and surrounding area after installation.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

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SECTION 107113.43
FIXED SUN SCREENS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Modular, shop fabricated, extruded aluminum sun screens to be mounted on aluminum storefront system using brackets provided by storefront manufacturer.

1.02 RELATED REQUIREMENTS

A. Section 084313 - Aluminum-Framed Storefronts: Mounting substrates and finishes.

1.03 REFERENCE STANDARDS

A. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

E. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs; 2022.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Prior to commencement of fabrication, submit detailed shop drawings, showing all profiles, sections of all components, finishes, fastening details, and manufacturer's technical and descriptive data. Include field dimensions of openings and elevations on shop drawings.

1. Coordination: Submit shop drawings for sun shades with reinforced aluminum storefront system shop drawings showing coordinated design between sun shades and storefront system.

C. Design Data: Submit comprehensive structural analysis of design for the specified loads. Stamp and sign calculations by professional engineer.

D. Samples: 10 inches (254 mm) by 10 inches (254 mm) minimum illustrating design, perforation pattern, workmanship, and finish color.

E. Designer's Qualification Statement.

1.05 MOCK UP

A. See Section 084313 - Aluminum-Framed Storefronts for coordinated mockup requirements.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Perform structural design under direct supervision of a Professional Engineer experienced in design of this type of work licensed in the State in which the Project is located.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site ready for erection.
B. Package using methods that prevent damage during shipping and storage on site.
C. Store materials under cover and elevated above grade.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
B. Sun Screens: Correct defective work within a two year period after Date of Substantial Completion.
C. Finish Warranty: Provide manufacturer's ten year warranty on factory finish against cracking, peeling, and blistering.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fixed Perforated Aluminum Sun Screens:
    1. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide sunshades from Architectural Grilles and Sunshades, Stanley Series, "Tampa", or a comparable product from one of the following:
    2. Arcadia, Inc: www.arcadiainc.com/#sle.
    3. DAMS Incorporated: www.damsinc.com/#sle.
    4. Substitutions: See Section 016000 - Product Requirements.

2.02 SUN SCREENS

A. Aluminum Sun Screens: Shop fabricated, shop finished, extruded aluminum outriggers, louvers, and fascia, free of defects impairing strength, durability or appearance.
    1. Configuration: As indicated on drawings.
    2. Screen Type: Perforated Panel, gradient pattern.
        a. Perforation Pattern: Perforation pattern to consist of rows of increasing diameter holes in 1/8 inch increments, up to 10 different hole sizes. Patterns vary by panel size as indicated in Drawings.

3. Support Bracket: See Section 084313 - Aluminum-Framed Storefronts.
4. Extension Plate: Straight.
    a. Color and Finish: Match Sunshade.
5. Design Criteria: Design and fabricate to resist the following loads without failure, damage, or permanent deflection: As indicated on Drawings and as follows:
    a. Wind: As indicated on Drawings.
    b. Snow: As indicated on Drawings.
    c. Thermal Movement: Plus/minus 1/8 inch (3.175 mm), maximum.
6. Sizes: As indicated on drawings.
7. Exposed Aluminum Finish: Manufacturer's AAMA 2605 factory applied superior performing organic coating, 70 percent PVDF.
    a. Color: Match "Buried Treasure" by Trinar-Ultra.
    b. Primer: Provide primer recommended by topcoat manufacturer.
8. Provide a complete system ready for erection at project site, coordinated with brackets provided by storefront manufacturer.
9. Shop fabricate to the greatest extent possible; disassemble if necessary for shipping.

2.03 MATERIALS

A. Aluminum Extrusions: ASTM B209/B209M or ASTM B221 (ASTM B221M).
B. Concealed Structural Supports: Aluminum, or steel coated for corrosion resistance and dissimilar metal isolation.
C. Fasteners: ASTM F593 stainless steel or ASTM A307 carbon steel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and site area for conditions that might prevent satisfactory installation.
B. Verify that dimensions of supporting structure are within plus/minus 1/8 inch (3.175 mm) of dimensions indicated on shop drawings.
C. Verify that all adjacent painting, roofing, masonry work, and other work that might damage sun screen finish has been completed prior to installation of sun screens.
D. Do not install until after all adjacent painting, roofing and masonry have been completed.
E. Do not proceed with installation until all conditions are satisfactory.

3.02 INSTALLATION

A. Install in accordance with manufacturer's installation instructions.

B. Set units level, plumb, with uniform joints, and aligned with building elements.

C. Separate dissimilar metals using concealed bituminous paint or non-absorbent gasket.

D. Anchor units to structure as indicated on drawings.

E. Do not cut or trim aluminum members without approval of manufacturer; do not install damaged members.

3.03 TOLERANCES

A. Maximum Variation from Level: Plus/Minus 1/8 inch (3.175 mm).

3.04 CLEANING

A. Clean exterior surfaces units of dust and debris; follow manufacturer's cleaning instructions for the finish used.

3.05 PROTECTION

A. Protect units after installation to prevent damage due to other work until Date of Substantial Completion.

END OF SECTION

SECTION 107500

FLAGPOLES - QE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum Flagpoles.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete base and foundation construction.

B. Section 079000 - Joint SeaInts: Sealant between pole and foundation sleeve.

C. Section 312323 - Fill: Sand to fill foundation tube sleeve.

1.03 REFERENCE STANDARDS

A. AASHTO M 36 - Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains; 2016 (Reapproved 2020).

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

D. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube; 2022.

E. NAAMM FP 1001 - Guide Specifications for Design Loads of Metal Flagpoles; 2007.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pole, accessories, and configurations.

C. Shop Drawings: Indicate detailed dimensions, base details, anchor requirements, and imposed loads.

D. Designer's Qualification Statement.

E. Maintenance Data: Provide lubrication and periodic maintenance requirement schedules.

F. Delegated Design Submittal: Provide pole and foundation drawings and calculations stamped and signed by designer.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design flagpole and foundation under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed the State in which the Project is located.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.

B. Protect flagpole and accessories from damage or moisture.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Flagpoles: Subject to compliance with requirements, provide flagpole by one of the following or comparable product;

1. Baartol Company, Inc.: www.baartol.com
2. Concord American Flagpole: www.concordamericanflagpole.com/#sle.
3. Eder Flag Company, Inc.: www.ederflag.com.
4. Morgan-Francis Flagpoles & Accessories: www.morgan-francis.com/#sle.
5. Pole-Tech Co, Inc: www.poletech.com/#sle.
6. Substitutions: See Section 016000 - Product Requirements.

2.02 FLAGPOLES

A. Flagpoles: Designed in accordance with NAAMM FP 1001

1. Material: Aluminum.
2. Design: Cone tapered.
3. Mounting: Ground mounted type.
4. Nominal Height: 30 ft (9.14 m); measured from nominal ground elevation.
5. Halyard: External type, cleat.

B. Performance Requirements:

1. Wind Pressure Loading on Flagpole with Flag: Resistant without permanent deformation to 115 miles/hr (185 km/hr) wind speed, in accordance with NAAMM FP 1001; the factor of safety used is 2.5.

2.03 POLE MATERIALS

A. Aluminum: ASTM B241/B241M , 6063 alloy , T6 temper.

B. Steel: ASTM A53/A53M Type S, Grade B.

2.04 ACCESSORIES

A. Finial Ball: Aluminum, 6 inch (150 mm) diameter.

B. Truck Assembly: Cast aluminum; revolving, stainless steel ball bearings, non-fouling.

C. Cleats: 9 inch (230 mm) size, aluminum with galvanized steel fastenings, one per halyard.

D. Cleat Box: Aluminum, with built-in hinge and hasp assembly, attached to pole with tamper proof screws inside box.

E. Halyard: 5/16 inch (8 mm) diameter nylon, braided, white.

2.05 MOUNTING COMPONENTS

A. Foundation: Cast-in-Place reinforced concrete, see Section 033000.

B. Foundation Tube Sleeve: AASHTO M 36, corrugated 16 gauge, 0.0598 inch (1.52 mm) steel, galvanized, depth as indicated.

C. Pole Base Attachment: Sleeve; aluminum base with base cover.

D. Lightning Ground Rod: 60 inch (1524 mm) long copper rod, 3/4 inch (19 mm) diameter.

E. Lightning Ground Cable: Copper No. 6 AWG, soft drawn.

2.06 FINISHING

A. Metal Surfaces in Contact With Concrete: Asphaltic paint.

B. Concealed Steel Surfaces: Galvanized to ASTM A123/A123M requirements.

C. Aluminum: Anodized to A41 - Class I , clear color.

D. Finial: Gold anodized finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that concrete foundation is ready to receive work and dimensions are as indicated on shop drawings.

3.02 PREPARATION

A. Coat metal sleeve surfaces below grade and surfaces in contact with dissimilar materials with asphaltic paint.

3.03 INSTALLATION

A. Install flagpole , base assembly, and fittings in accordance with manufacturer's instructions.

B. See Section 033000 for placement of foundation, anchor devices and foundation sleeve.

C. Fill foundation tube sleeve with sand specified in Section 312323 and compact.

D. Install foundation plate and centering wedges for flagpoles base set in concrete base and fasten. Fill joint between pole and sleeve with joint sealant.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1 inch (25 mm).

3.05 ADJUSTING

A. Adjust operating devices so that halyard function smoothly.

END OF SECTION

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SECTION 113013
APPLIANCES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Cooking appliances.
   2. Refrigeration appliances.
   3. Cleaning appliances.
   4. Self-contained refrigeration equipment.

1.03 RELATED REQUIREMENTS

A. Section 260583 - Wiring Connections: Electrical connections for appliances.

1.04 COORDINATION

A. Coordinate self-contained refrigeration equipment layout and installation with other work, including layout and installation of lighting fixtures system components.

B. Coordinate sizes, locations, and requirements of the following:
   1. Floor sinks and drains serving refrigeration equipment.

1.05 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include installation details, material descriptions, dimensions of individual components, and finishes for each appliance.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Sustainable Design Submittals:
   1. ENERGY STAR: Product Data for indicated products, showing compliance with requirements for ENERGY STAR product labeling.
   2. Product Data: For water-efficient clothes washer, indicating compliance with requirements.

C. Product Schedule: For appliances. Use same designations indicated on Drawings.

1.06 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For refrigeration units.
   1. Indicate locations of refrigeration equipment and connections to utilities.

B. Key equipment using same designations as indicated on Drawings.
C. Include plans and elevations; clearance requirements for equipment access and maintenance; details of equipment supports; and utility service characteristics.
D. Sample Warranties: For manufacturers' special warranties.

1.07 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each residential appliance and refrigeration units to include in operation and maintenance manuals.
   1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
      a. Product Schedule: For each foodservice equipment item, include the following:
         1) Designation indicated on Drawings.
         2) Manufacturer's name and model number.
         3) List of factory-authorized service agencies including addresses and telephone numbers.

1.08 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of construction contiguous with foodservice equipment by field measurements before fabrication. Indicate measurements on Coordination Drawings.

1.09 WARRANTY

A. Microwave Oven: Full warranty, including parts and labor, for on-site service on the magnetron tube.
   1. Warranty Period: Two years from date of Substantial Completion.
B. Refrigerator/Freezer, Refrigerator, Icemaker, and Sealed System: Full warranty, including parts and labor, for on-site service on the product.
   1. Warranty Period for Sealed Refrigeration System : Five years from date of Substantial Completion.
   2. Warranty Period for Other Components : Two years from date of Substantial Completion.
C. Clothes Washer/Dryer: Limited warranty, including parts and labor for first year and parts thereafter, for on-site service on the product.
   1. Warranty Period: Three years from date of Substantial Completion.
D. Refrigeration Compressor Warranty: Manufacturer agrees to repair or replace compressors that fail in materials or workmanship within specified warranty period.
   1. Failure includes, but is not limited to, inability to maintain set temperature.
   2. Warranty Period: Five years from date of Substantial Completion.

E. Provide five (5) year manufacturer warranty on refrigeration system of refrigerators.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain residential appliances from single source.

2.02 PERFORMANCE REQUIREMENTS

A. Electrical Appliances: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with applicable provisions in the DOJ's 2010 ADA Standards for Accessible Design.

C. NSF Standards: Provide equipment that bears NSF Certification Mark or UL Classification Mark certifying compliance with applicable NSF standards.

D. UL Certification: Provide electric and fuel-burning equipment and components that are evaluated by UL for fire, electric shock, and casualty hazards according to applicable safety standards, and that are UL certified for compliance and labeled for intended use.

2.03 REFRIGERATOR/FREEZERS

A. Refrigerator/Freezer (A-1): 2 DoorTop Freezer Refrigerator.
   1. Basis of Design: GE, model #GTE21GTHWW
      a. Or products manufacturered by KitchenAid or LG.
   2. Type: Freestanding.
   3. Dimensions:
      a. Width: 32-7/8 inches.
      b. Depth: 34 inches.
   4. Height: 66-3/4 inches.
   5. Storage Capacity:
      a. Refrigeration Compartment Volume: 15.1 cu. ft.
      b. Freezer Volume: 6.04 cu. ft.
   6. Freezer Features: Top freezer compartment.
      a. Interior light in freezer compartment.
      b. Automatic ice maker and storage bin.
   7. ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.
   8. Appliance Color/Finish: White.

B. Undercounter Refrigerator (A-2): Free-standing, ADA Accessible.
   1. Capacity: Total minimum storage of 5.1 cubic ft (0.14 cu m).
   2. Dimensions: 24" W x 25" D x >34" H
   3. Energy Usage: Minimum 20 percent more energy efficient than energy efficiency standards set by U.S. Department of Energy (DOE).
   4. Features: Include glass shelves.
   5. Exterior Finish: Stainless steel.
   6. Manufacturers:
      a. Frigidaire Home Products: www.frigidaire.com/#sle.
      b. GE Appliances: www.geappliances.com/#sle.
      c. Whirlpool Corp: www.whirlpool.com/#sle.

2.04 DISHWASHER (A-3)

A. Dishwasher: Complying with AHAM DW-1.
B. Basis-of-Design Product: Subject to compliance with requirements, provide GE Appliances; GLDA690FWW or comparable product by one of the following:
   1. KitchenAid; Whirlpool Corporation.
   2. Maytag; Whirlpool Corporation.
   3. Whirlpool Corporation.
C. Type: Built-in undercounter.
D. Dimensions:
   1. Width: 24 inches.
   2. Depth: 24 inches.
   3. Height: 32-11/32 inches.
E. Tub and Door Liner: Manufacturer's standard with sealed detergent and automatic rinsing-aid dispensers.
F. Rack System: Nylon -coated sliding dish racks, with removable cutlery basket .
G. Controls: Touch-pad controls with four wash cycles and hot-air and heat-off drying cycle options.
H. ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.
I. Front Panel: Manufacturer's standard.
J. Appliance Color/Finish: White.

2.05 CLOTHES WASHERS AND DRYERS

A. Clothes Washer (A-6): Complying with AHAM HLW-1.

1. Basis-of-Design Product: Subject to compliance with requirements, provide GE Appliances; Haier Group; GFW550SSNWW or comparable product by one of the following:
    a. Maytag; Whirlpool Corporation.
    b. Whirlpool Corporation.
    c. GE Appliances; Haier Group.
2. Type: Freestanding , front-loading unit.

B. Dimensions:
    a. Width: 28 inches.
    b. Depth: 32 inches.
    c. Height: 39 3/4 inches.
2. Drum: Manufacturer's standard.
3. Capacity: 4.8 cu. ft .
4. Controls: Touch-pad controls for water-fill levels, wash/rinse water temperatures, and variable-speed and fabric selectors.
    a. Wash Cycles: 10 wash cycles, including regular, delicate, and permanent press.
    b. Wash Temperatures: Five settings.
    c. Speed Combinations: Five.
5. Electrical Power: 120 V, 60 Hz, 1 phase, 15 A .
6. Motor: Manufacturer's standard with built-in overload protector.
7. Features:
    a. Inlet Hoses: Minimum length 60 inches.
    b. Drain Hoses: Minimum length 48 inches.
8. ENERGY STAR: Provide appliances that qualify for the EPA/DOE ENERGY STAR product-labeling program.
9. Water-Efficient Clothes Washer: Provide clothes washer with modified energy factor greater than or equal to 2.0 and water factor less than 5.5.
10. Appliance Finish: Enamel.
    a. Color: White.

C. Clothes Dryer (A-7): Complying with AHAM HLD-1.
1. Basis-of-Design Product: Subject to compliance with requirements, provide GE Appliances; Haier Group; GFD55ESSNWW or comparable product by one of the following:
    a. Maytag; Whirlpool Corporation.

b. Whirlpool Corporation.
c. GE Appliances; Haier Group.

2. Type: Freestanding , frontloading, electric unit.
3. Dimensions:
   a. Width: 28 inches.
   b. Depth: 32 inches.
   c. Height: 39 3/4 inches.
4. Drum: Manufacturer's standard.
   a. Capacity: 7.8 cu. ft.
5. Controls: Touch-pad controls for drying cycle, temperatures, and fabric selectors.
6. Electric-Dryer Power: 120V/240V, 5600W, 24A, 60Hz .
7. Features:
   a. Removable lint filter.
   b. Interior drum light.
8. Appliance Finish: Enamel.
   a. Color: White.

2.06 STACKED CLOTHES WASHER DRYER COMBINATION UNIT (AS-8).

A. Electric laundry center with separate clothes washer and dryer functions in a stacked arrangement.
B. Capacity: Compact.
   1. Washer Capacity: 2.3 cu. ft.
   2. Dryer Capacity: 4.4 cu. ft.
C. Dimensions: 23 3/4" W x 27 3/8" D x 74 7/8" H
D. Controls: Knobs.
E. Cycles: Include normal, permanent press, delicate, soak, and automatic soak.
F. Motor Speed: Single-speed.
G. Features: Include optional second rinse, bleach dispenser, fabric softener dispenser, self-cleaning lint filter, sound insulation, and end of cycle signal.
H. Finish: Painted steel , color white.
I. Basis of Design: GE GUD24ESSMWW, or equal by one of the following Manufacturers:
   1. Frigidaire Home Products; ____: www.frigidaire.com/#sle.
   2. GE Appliances; ____: www.geappliances.com/#sle.
   3. Whirlpool Corp; ____: www.whirlpool.com/#sle.

2.07 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, power connections, and other conditions affecting installation and performance of residential appliances.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation.

C. Examine walls, ceilings, and roofs for suitable conditions where will be installed.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install appliances according to manufacturer's written instructions.

B. Built-in Equipment: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and that rough openings are completely concealed.

C. Freestanding Equipment: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.

D. Utilities: Refer to Divisions 22 and 26 for plumbing and electrical requirements.

3.03 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Perform visual, mechanical, and electrical inspection and testing for each appliance according to manufacturers' written recommendations. Certify compliance with each manufacturer's appliance-performance parameters.
2. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.

3. Operational Test: After installation, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and components.

B. An appliance will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.04 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain residential appliances.

SECTION 114000
FOODSERVICE EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Any perceived omission, discrepancy, or ambiguity in Section 11 40 00 Bid Documents shall be questioned by prospective bidders in writing directly to the foodservice consultant no later than ten (10) days prior to the bid date. An addendum shall be issued to clarify any such issue. Failure to seek such clarification indicates the prospective bidder understands fully the intent of the Bid Documents.

1.02 DESCRIPTION OF WORK

A. Extent of foodservice equipment work is indicated on drawings and by provisions of this section, including schedules and equipment lists associated with either drawings or this section. The Foodservice Equipment Contractor shall be responsible for coordinating his work with other trades. The Foodservice Equipment Contractor shall be responsible for all required permits including but not limited to setting equipment and erection of and connection of walk-in refrigeration.

B. Refer to Division 8 sections for “Overhead Coiling Doors/Shutters” for overhead doors or shutters at kitchen.

C. Refer to Division 22 sections for required traps, vents, valves, pipes and pipe fittings, ductwork, and other materials necessary to complete mechanical hookup of foodservice equipment; not work of this section.

D. Refer to Division 26 sections for wiring, disconnects, and other materials necessary to complete electrical hookup of foodservice equipment; not work of this section.

1.03 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Firms regularly engaged in manufacture of foodservice equipment of types, capacities, and sizes required, whose products have been in satisfactory use in similar service for not less than 10 years.

B. LEED Submittals

1. Product Data for Credit EQ4.1: For adhesives and sealants applied within the building water proofing envelope, documentation including printed statements of VOC content in g/L.

2. Product data for Credit EQ4.4: For composite wood, agrifiber products and laminating adhesives installed within the building water proofing envelope, documentation indicating no added urea formaldehyde resins.

C. Section 11 40 00 Contractor Qualifications: Firms shall hold a Class “A” Virginia Contractor’s License and be regularly engaged in the distribution of foodservice equipment and brands hereinafter specified.

D. Fabricator’s Qualifications: Where indicated units require custom fabrication, provide units fabricated by a shop which is skilled and has a minimum of 5 years of experience in similar work. Fabricate all custom equipment items in same shop. Where units cannot be fully shop-fabricated, complete fabrication work at project site. Custom fabrication shall carry both NSF and UL Custom Certification.

E. Codes and Standards

1. NSF Standards: Comply with applicable National Sanitation Foundation standards and recommended criteria. Provide each principal item of foodservice equipment with a NSF “Seal of Approval”.
2. UL Labels: Where available, provide UL labels on the completed principal item of foodservice equipment. In addition provide UL “recognized marking” on other items with electrical components, signifying listing by UL, where available.
3. ANSI Standards: Comply with applicable ANSI standards for electric powered appliances and for plumbing fittings including vacuum breakers and air gaps to prevent siphonage in water piping.
4. NFPA Codes: Install foodservice equipment in accordance with the following National Fire Protection Codes:
    a. NFPA 70 – National Electric Code
    b. NFPA 96 – “Removal of Smoke & Grease-Laden Vapors from Commercial Cooking Equipment”
5. ASME Boiler Code: Construct steam generating and closed steam heated equipment to comply with American Society of Mechanical Engineers (ASME) Boiler & Pressure Vessel Code; Section IV for units not exceeding 15 psig or 250°F, or Section I for higher pressure/temperature units.
6. Health Code: Install foodservice equipment in accordance with local health department applicable requirements.
7. Commonwealth of Virginia Code §15.2-1804.1 “HB2001”: High Performance Building Requirement for local buildings.

1.04 SUBMITTALS

A. Product Data, Standard Manufactured Models: Submit the latest manufacturer's specification sheet with a separate cover sheet indicating the item number, specific model number, quantity, accessories and utility information.

B. Shop Drawings, Custom Foodservice Equipment: Provide manufacturer prepared detailed shop drawings drawn at a minimum of 1/2"=1'-0" scale consisting of plan views, elevation, sections and enlarged details as required to illustrate compliance with the drawings and specifications of Section 11 40 00. Plot manufacturer's shop drawings at the scale indicated on the shop drawing. Do not modify scale. Do not include any shop drawings in Equipment Brochure.

C. Required Additional Drawings: Provide separate 1/4"=1'-0 scale floor plan with schedule, 1/4"=1'-0" scale, dimensioned plumbing rough-in drawing with schedule, 1/4"=1'-0" scale, dimensioned electrical rough-in drawing with schedule and 1/4"=1'-0" scale, dimensioned special conditions drawing indicating any floor depressions, floor block outs for floor troughs, wall blocking, wall opening locations and heights, vent collars and any other special condition requiring coordination with other Divisions. Coordinate with the Contractor to determine which building features will be present and are most appropriate for dimensioning reference on rough-ins. Dimensioned rough-ins shall employ "Baseline" dimensioning style with "Continuing" style used only for minor dimensions such as faucet spacing. Consult equipment specification sheets and shop drawings for leg locations. Avoid leg locations when placing rough-in, particularly floor drains and floor sinks. Verify locations and coordinate correction of all rough-ins prior to floor pouring. **Indicate rough-in for all existing equipment after field verification of required service. Indicate rough-in for all Owner and Vendor furnished equipment using the Contract Documents to provide the necessary particulars for those items.**

D. All of the above mentioned submittals shall be presented as a single electronic PDF file submittal package. Partial and non-complying submittals shall not be accepted. They shall be returned to the Contractor for correction and resubmittal.

E. Samples for Initial Selection: Submit manufacturer's color charts showing the full range of colors available for exposed products with color finishes.

F. Maintenance Data: Submit the operation, maintenance, and parts data manuals, in quantities as prescribed by Division 1. O & M Manuals shall be arranged as follows:

1. Manuals shall be presented in a locking 3-ring binder of suitable size to securely hold the information. A cover and spine insert shall indicate the name and address of the facility, the type of Equipment, e.g., Kitchen, Servery, Dishroom, the foodservice equipment contractors full name address, phone number and principal contact person.
2. The first page(s), in a clear plastic protective sleeve(s), shall provide an index of equipment arranged alphabetically by manufacturer's name. The index shall include the manufacturer's name, an item description, e.g., "Dishwasher" and the project Item Number. Include the service agents name for each manufacturer and that agent's 24/7 service phone number.
3. Separate each manufacturer's manuals from the next with an appropriately labeled index tab.
4. In lieu of paper submission, the above mentioned O&M Manuals may be presented as a single electronic PDF. File shall include a copy of the plan, the equipment schedule, a cover sheet, and complete index. The index shall include the manufacturer's name, an item description, e.g., "Dishwasher" and the project Item Number. Include the service agents' name for each manufacturer and that agent's 24/7 service phone number. The PDF shall be electronically 'bookmarked' at each item that has a unique project Item Number. Electronic O&M Manual shall be page numbered, and page numbers shall correspond to the index. The approved O&M PDF shall be written to a 'thumb drive' or similar physical digital file exchange device and shall be delivered to the Owner at the equipment demonstration as described in section 3.05 of these specifications.
5. Partial and non-complying O&M Manuals shall not be accepted.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver foodservice equipment in factory-fabricated containers designed to protect equipment and finish until final installation. Make arrangements to receive equipment at project site, or to hold in warehouse until delivery can be made to job site.

B. Foodservice equipment shall be stored in original containers, and in a location that provides adequate protection to equipment while not interfering with other construction operations.

C. Handle foodservice equipment carefully to avoid damage to components, enclosures, and finish. Do not install damaged foodservice equipment; replace and return damaged components to equipment manufacturer.

1.06 PROJECT CONDITIONS

A. Take field measurements to assure accurate fit of fabricated and buyout equipment.

B. Check utility characteristics; provide pressure regulating valves where required for proper operation of equipment.

1.07 SPECIAL REFRIGERATION WARRANTY

A. Warranty on Refrigeration Compressors: Provide written warranty, signed by manufacturer, agreeing to replace/repair, within warranty period, compressors with inadequate and defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform as required; provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period. Replacement is limited to component replacement only, and does not include labor for removal and reinstallation.

1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. It is the intent of these specifications to designate an all-inclusive job, complete and ready for use, except all plumbing, ventilating, and electrical connections made under Division 22, 23 and 26. All equipment shall be set in place completely assembled, jointed together in a workmanlike manner and left ready for the required connections.

B. All equipment shall be permanently and legibly marked, or have a permanent nameplate, with the manufacturer's name. The manufacturer's type, or model number, and the serial number shall also be permanently marked on the machine.

C. All equipment covered by these specifications shall utilize the best and most modern practices of the Foodservice and Cooking Equipment Industry.

D. All specially built equipment shall be made by one manufacturer and shall be uniform throughout as to method and type of construction used.

E. No machinery or equipment covered by these specifications shall be acceptable from any manufacturers who shall not have had equipment of approximately the same type and design as that specified operating successfully for at least one year. Machines installed for test purposes shall not come within the category of successful commercial operation.

F. Appliances shall be new, of manufacturer's current production and furnished complete with motors, driving mechanism, starters and controllers including master switches, timers, cutouts, reversing mechanism, and other electrical equipment, if and as applicable with wiring on the appliance installed in rigid metal conduit (except that flexible conduit may be used as necessary to permit adjustment of motors with drive belts or chain) and permanently connected. Wiring and connection diagrams shall be furnished with electrically operated machines.

G. Appliances shall be of rigid construction, free from objectionable vibration, and quiet in operation.

H. Substitutions may be considered, subject to Owner's approval, only in accordance with the requirements of Division 1 of these specifications, for equipment items included in the Equipment Schedule. The brands and models indicated in the written specifications are deemed to be the design standard. Coordination and any corresponding costs incurred by other Divisions due to any substitutions is the responsibility of the Section 11 40 00 contractor.

2.02 ELECTRICAL REQUIREMENTS

A. Supply motors and heating elements for operation and electrical characteristics indicated on contract drawings or as stipulated under Foodservice Equipment Schedule.

B. A cord of suitable length and size shall be provided for all portable items and those usually so connected. Verify characteristics of receptacles being provided under other Sections of these specifications and provide matching plug all completely wired for plug-in operation. Receptacles provided as a part of integral unit of items shall be congruent or match those above.

C. Motors shall be of the drip-proof, splash-proof, or totally enclosed type, having a 2-hour duty cycle and ball bearings (except small timing motors which may have sleeve bearings). All motors shall have windings impregnated to resist moisture. Motors located where subject to deposits of dust, lint, or other similar matter from the machine on which installed shall be of the totally enclosed type. Motors shall have ample power to operate the machines for which designated under full load operating conditions without exceeding their nameplate ratings. Horsepower requirements on driven equipment shall be determined by the manufacturer based on normal operation at maximum capacities. The nominal rated motor horsepower shall be not

less than the horsepower required for normal operation of the equipment at maximum capacity.

2.03 MATERIALS

A. General: Unless otherwise indicated on drawings, the following requirements shall apply.

B. Stainless Steel: AISI Type 304. Provide non-magnetic sheets, free of buckles, waves, and surface imperfections. Provide No. 4 polished finish for any surfaces which will be exposed.

C. Galvanized Steel Sheet: ASTM A 526, except ASTM A 527 for extensive forming; ASTM A 525, G90 zinc coating, chemical treatment.

D. Stainless Steel Tube: ASTM A 554, Type 304 with No. 4 polished finish.

E. White Metal: Corrosion-resistant metal containing not less than 21% nickel. Make casting free from pit marks, runs, checks, burrs, and other imperfections; rough grind, polish and buff to bright luster. In lieu of white metal castings, 18-8 stainless steel die-cast or stamped may be used.

F. Plastic Materials and Components: Except for plastic laminate, provide plastic materials and components which comply with NSF 51.

G. Sound Deadening: Heavy-bodied resinous coating, filled with granulated cork or other resilient material, compounded for permanent, non-flaking adhesion to metal in 1/8" thick coating. Apply coating of sound deadening material to underside of tops, drainboards, dishtables, and sinks.

H. Sealants: Provide low VOC sealant that when fully cured and washed meets requirements of Food and Drug Administration Regulation 21 CFR 177.2600 for use in areas where it comes in contact with food. Provide closed cell polyethylene backer rod as required.

1. Adhesives and Sealants applied within the building waterproofing envelope: Comply with low-emitting requirements in Division01 Section “Indoor Air Quality Requirements”.

I. Gaskets: Solid or hollow (not cellular) neoprene or PVC; light gray, minimum 40 Shore A hardness, self-adhesive or prepared for either adhesive application or mechanical anchorage.

J. Fasteners: Shall be stainless steel of a style appropriate for the task. Fasteners shall be Phillips truss head machine screws, Phillips truss head sheet metal screws or Phillips flathead machine screws. Shields and toggles shall be used where

necessary to fasten to CMU and concrete. Drive pins are not acceptable foodservice attachment devices.

2.04 STAINLESS STEEL FABRICATIONS

A. General: Unless otherwise indicated on drawings, the following requirements shall apply.

B. Tops: Fabricate of 14-gauge stainless steel, with exposed edges rolled on 1-1/2" diameter radius front and back edges. Ends shall be turned down 90 degrees. Unless otherwise indicated in the Itemized Specifications where tops are adjacent to walls or adjoining equipment, turn up 6" and back 2" on 45° angle. Cove horizontal and vertical corners with not less than 3/4” radius.

C. Dishtables and Drainboards: Fabricate of 14-gauge stainless steel with exposed edges formed into 1-1/2" x 180° rolled rim approximately 3" high. Provide built-in pitch of 1/8" per foot minimum. Provide 10" high backsplashes with 2" return on 45° angle or 1-1/2" diameter rolled rim, as indicated. Construct front rim and backsplash on drainboards with continuous level plane with sink it adjoins. Support drainboards up to 36" in length by 1" diameter stainless steel tube welded to underside of drainboard and leg gusset. Support drainboards 36" and longer with legs. Cove horizontal and vertical corners with not less than 3/4" radius.

D. Prewash Sinks in Soiled Dishtables: Fabricate of 14-gauge stainless steel measuring 20” square and 6” deep unless otherwise indicated in Itemized Specifications. Sinks shall have radius cove corners, a perforated lift-out scrapping basket constructed of 16-gauge stainless steel with 1” 16-gauge stainless steel tubing rack slides/handles and 1” stainless steel legs to facilitate draining. If a disposer is specified a disposer collar weldment, control panel bracket and vacuum breaker hole punch shall be substituted for the scrap basket. The rack slides shall be welded to removable stainless steel angle brackets at each end.

E. Framing: Mount tops on 4" wide x 3/4” high 14-gauge stainless steel “U” channels. Mount dishtables and drainboards on 4" wide x 14-gauge stainless steel “U” channels.

1. Run framework the entire length of unit at the centerline and cross brace at each leg assemble and no more than 48" on center between legs. For dishtables and drainboards, run framing from front to back at each leg location, and run additional channel lengthwise, located at center of table width and secured with a double row of 10-24 stainless steel blind weld studs 12" centers. Provide each stud with

suitable stainless steel locking acorn nut. Tables wider than 30: shall have two rows of “U” channel running the entire length of the table. Weld cross channels to main channels and tack weld all ends to the top.

F. Legs and Cross Rails: Construct legs of 1-5/8" O.D. x 16-gauge stainless steel tubing, with fully enclosed stainless steel bullet shaped adjustable foot with minimum adjustment of 1" up or down without any threads showing. Fasten legs to 4" high stainless steel conical gusset with top completely sealed by means of stainless steel plate. Weld gusset continuously to bottom of unit framing.

G. Inserts: Where cold pans and other inserts are installed in cabinet bases, provide apron full depth of insert and of same material as bodies with reinforced openings as required. Form in openings on all sides.

H. Drawers: Unless otherwise indicated in Itemized Specifications drawers shall be Component Hardware model S90-0020-N or equal.

I. Shelves: Construct of 14-gauge stainless steel.

1. Bottom Shelves: Extend forward and turn down at front so as to be flush with front facing of cabinet.
2. Fixed Intermediate Shelves: Weld to front stiles and to 14-gauge stainless steel brackets so that shelf is 1" away from back and ends of cabinet.
3. Adjustable Shelves: Channel on all 4 sides, weld corners, and mount on removable stainless steel standards.

J. Open Base Shelving: Construct of 16-gauge stainless steel with edges rolled down on open sides, and 2" turn up with 3/4" radius on rear and ends where adjacent to walls and other equipment. Neatly notch corners and weld to legs. Reinforce shelving longitudinally with14-gauge stainless steel “U” channel welded to underside. Construct removable shelves as above, but fit over cross rails. Do not exceed shelving sections of 30" long; where one section abuts another, turn down edges 1".

K. Wall Shelves: Construct of 14-gauge stainless steel with 1-1/2” roll on front and exposed ends, and with 2” turn up on back and ends where adjacent to walls or other fixtures. Weld all corners. Construct wall brackets of 14-gauge stainless steel with 1-1/2” flange at wall and completely welded to underside of shelf. Fasten each bracket to wall with minimum of two fasteners. Fasten shelf to wall bracket by means of studs welded to shelf and suitable stainless steel locking acorn nut. Unless otherwise specified in the Itemized Specification wall shelves shall be mounted 64” AFF to the work surface.

L. Overshelves: Set shelves mounted over equipment not adjacent to walls on 1" x 14-gauge stainless steel tubular standards fitted with stainless steel base flanges. Completely weld top of tubular standard to 14-gauge stainless support channels, run channels full width of overshelf. Run 1/2" steel tension rods through counter tops and reinforcing angle framing, secure with nuts and lockwashers to assure stable sway-free structure. Unless otherwise specified in the Itemized Specifications wall shelves shall be mounted 64” AFF to the work surface

1. Where shelves are mounted over drainboards or dishtables, mount on upturned rolled edges omitting flanges, and scribe lower end of tube to match contour of roll.

M. Wall Mounted Pot Racks: Construct of 3/16” x 2” stainless steel bar stock with double-bar construction. Supply 16-gauge stainless steel end/wall brackets. Provide stainless steel double-pronged pot hooks – one every 12”. Mount 90” AFF to top of rack.

N. Table Mounted Pot Racks: Construct of 3/16” x 2” stainless steel bar stock with triple-bar construction. 1-5/8” tubular stainless steel supports. Provide stainless steel double-pronged pot hooks – one every 12”. Mount 90” AFF to top of rack.

O. Sinks: Fabricate from 14-gauge stainless steel with interior corners rounded to 3/4" radius, both horizontally and vertically, forming cove in bottom. Construct with butt edge joints, welded and ground smooth so no evidence of welding shall appear. Divide multiple compartment sinks with double wall 14-gauge stainless steel partitions rounded to 1/2" radius on top and having corners rounded same as other corners in sinks, continuously welded in place with welds ground smooth and polished. Provide back, bottom, and front of one continuous piece with no overlapping joints or open spaces between compartments. Pitch bottom of each compartment, and crease to die-stamped recess to receive lever type drain, without use of solder, rivets, or welding.

1. Finish front and exposed ends of sink with 1-1/2", 180° rolled edge. Finish back and ends adjacent to walls or other fixtures with backsplash. Punch back backsplash to receive wall-mounted faucets.
2. For sinks in worktops, construct as above but omit roll edges and backsplash. Fabricate bowls to be flush with work surface.

2.05 MILLWORK/STAINLESS STEEL FABRICATION

A. General: Unless otherwise indicated on drawings, the following requirements shall apply.

B. Tops: Shall be fabricated from 30cm thick quartz material of the highest grade or as specified in the itemized specifications. Installation shall be performed by manufacturer trained and certified installers using the manufacturer's specific guidelines for the particular installation. Top shall be reinforced with a stainless steel or galvanized sub top or framing as recommended by the top material manufacturer with extra bracing at locations of cutouts for drop-in equipment and where large countertop equipment shall be placed.

C. Customer side horizontal surfaces (for example a plate shelf beneath top): Shall be constructed of the same material as the top unless described differently in the itemized specifications.

D. Cabinet bodies: shall be constructed of fully welded 18-gauge stainless steel reinforced with stainless steel 14-gauge hat channel on the underside of all tops and shelves.

E. Legs and casters: Shall be as indicated in the itemized specifications. Stainless steel legs shall be a minimum of 6" high with a stainless steel adjustable foot. Casters shall be 5" diameter heavy duty plate casters with brakes attached to the hat channel underbracing of the cabinet body.

F. Toe plate: Shall be securely attached with stainless steel machine screws to stainless steel brackets attached to the underbody of the cabinet. Material and finish of the toe plates shall be specified in the itemized specifications.

G. Millwork façade: Shall be constructed of cabinet grade ¾" plywood of species wood with wood trim and finish as indicated on the itemized specifications or laminated with high pressure laminate (HPL) as indicated in the itemized specifications. The rear of laminated panels shall be laminated in a cleanable material matching the expansion and contraction specifications of the exposed HPL. Panels shall be attached in a secure concealed manner while remaining removable for replacement in the future. Plywood and all laminating glues shall be free of added urea-formaldehyde.

H. Doors: Shall be as described in the itemized specifications constructed of cabinet grade ¾" plywood fitted with Blum Concealed hinges and Component Hardware pulls. Where necessary provide doors with louver cuts to properly ventilate refrigeration condensing units. Plywood and all laminating glues shall be free of added urea-formaldehyde.

I. Cutouts and special features: Shall be coordinated with and accommodate the associated equipment regardless of the source of the equipment.

2.06 REMOTE REFRIGERATION EQUIPMENT

A. General: Provide refrigeration condensing units of size and capacities as indicated, consisting of compressors, condensers, receivers, motors, mounting bases, vibration isolators, refrigeration components, safety devices, electrical controls, refrigerant and protective controls; all factory assembled and tested.

B. Refrigeration Specialties: Provide refrigerant dryer, liquid line solenoid valve, suction line filter, expansion valve, and water regulating valve (for water cooled condensers only). Provide pump down control circuits consisting of thermostat and solenoid valve. Maintain box temperature from thermostat and liquid line solenoid valve, control compressor from suction pressure.

C. Leak Testing: After all lines are connected, the entire system shall be leak tested. The complete system shall be pressurized to 150 psig with refrigerant and dry nitrogen (or dry CO_2). An electronic type leak detector shall be used to identify leaks. Pressure shall be held for a minimum of 12 hours and then rechecked. Coordinate test observation with the owner's representative on site.

D. Evacuation: A good, deep vacuum pump shall be connected to both the low and high side evacuation valves with copper tube or high vacuum hoses (1/4" ID minimum). If the compressor has service valves, they shall remain closed. A deep vacuum gauge capable of registering pressure in microns shall be attached to the system for pressure readings. A shut off valve between the gauge connection and vacuum pump shall be provided to allow the system pressure to be checked after evacuation. Do not turn off vacuum pump when connected to an evacuated system before closing shut off valve. The vacuum pump shall be operated until pressure of 1,500 microns absolute pressure is reached – at which time the vacuum shall be broken with the refrigerant to be used in the system through a drier until the system pressure rises above 0 psig. Repeat this operation a second time. Open the compressor service valves and evacuate the entire system to 500 microns absolute pressure. Raise the pressure to 2 psig with the refrigerant and remove the vacuum pump.

E. Refrigeration Line Insulation: Refrigeration lines shall be insulated with Aeroflex USA Aerocel White/Gray 25/50 pipe insulation. Thickness of insulation shall be in accordance with insulation manufacturer's recommendation. Butt joints and seams shall be sealed with contact adhesive.

PART 3 - EXECUTION

3.01 INSPECTION

A. Rough-In Work: Examine roughed-in plumbing, mechanical and electrical services, and installation of floors, walls, columns and ceilings, and other conditions under which foodservice work is installed; verify dimensions of services and substrates before fabricating work. Notify Contractor of unsatisfactory locations and dimensions of other work, and of unsatisfactory conditions for proper installation of foodservice equipment. Do not proceed with fabrication and installation until unsatisfactory dimensions and conditions have been corrected.

3.02 INSTALLATION

A. General: Set each item of non-mobile and non-portable equipment securely in place, level and adjust to correct height. Anchor to supporting substrate where indicated and where required for sustained operation and use without shifting or dislocation. Conceal anchorages where possible. Adjust counter tops and other work surfaces to level tolerance of 1/16" maximum offset, and maximum variation from level or indicated slope of 1/16" per ft. Height of tops and work surfaces shall not exceed 2’-10” AFF.

B. Field Joints: Complete field-assembly joints in work (joints which cannot be completed in shop) by welding, bolting-and-gasketing, or similar methods. Grind welds smooth and restore finish. Set or trim gaskets flush, except for “T” gaskets as indicated.

C. Closure Plates and Strips: Install, with joints coordinated with units of equipment.

D. Cut-Outs: Provide cut-outs in foodservice equipment to run plumbing, electric, or steam lines through equipment items for final connections.

E. Sealants and Gaskets: Install all around each unit to make joints air-tight, watertight, vermin-proof, and sanitary for cleaning purposes. In general, make sealed joints not less than 1/8" wide, and stuff backer rod to shape sealant bead properly, at 1/4" depth. Shape exposed surfaces of sealant slightly concave, with edges flush with faces of materials at joint. At internal-corner joints, apply sealant or gaskets to form a sanitary cove, of not less than 3/8" radius. Provide sealant-filled or gasketed joints up to 1/4" joint width; stainless steel closure strips for wider joints, with sealant application each side of strips. Anchor gaskets mechanically or with adhesives to prevent displacement.

F. Piping: Install necessary piping from relief valves on kettles and steamers to exhaust in manner to avoid steam coming in contact with operating personnel, and in

accordance with applicable codes. Install required piping from indirect drain connections to floor drains.

G. Custom Sink Faucets: For single compartment sinks mount faucet over center line; for double compartment sinks center faucet over partition; for triple compartment sinks mount two faucets, one over each partition.

3.03 FIELD QUALITY CONTROLS

A. Testing: Do not start-up foodservice equipment until service lines have been tested, balanced, and adjusted for pressure, voltage, and similar considerations; and until water and steam lines have been cleaned and treated for sanitation. Before testing, lubricate each equipment item in accordance with manufacturer's recommendations.

B. Test each item of operational equipment to demonstrate that it is operating properly, and that controls and safety devices are functioning. Repair or replace equipment which is found to be defective in its operation, including units which are below capacity or operating with excessive noise or vibration.

3.04 CLEANING

A. After completion of installation, and completion of other major work in foodservice areas, remove protective coverings, if any, and clean foodservice equipment, internally and externally. Restore exposed and semi-exposed finishes to remove abrasions and other damages; polish exposed-metal surfaces and touch-up painted surfaces. Replace work which cannot be successfully restored.

B. Final Cleaning: After testing and start-up, and before time of Substantial Completion, thoroughly clean foodservice equipment, and leave in condition ready for sanitizing by foodservice personnel.

C. Any cleaning agents that are acid based, contain bleach, or other caustic agents or chemicals not specifically approved for use on stainless steel SHALL BE STRICTLY FORBIDDEN IN ALL FOODSERVICE SPACES. Failure to observe this will result in permanent damage to stainless steel equipment and stainless steel components and will VOID manufacturers’ warranties. Section 114000 shall inform the General Contractor of its responsibility to enforce this requirement.

3.05 CLOSEOUT PROCEDURES

A. Provide services of Installer’s technical representative, and manufacturer's technical representative, to instruct Owner's personnel in operation and maintenance of foodservice equipment.

B. Schedule training with Owner, provide 7-day notice to Contractor and Architect of training date.

PART 4 - ITEMIZED EQUIPMENT SPECIFICATIONS

ITEM NO. 1A, 1B, 1C AND 2A, 2B, 2C – WALK-IN COOLER/FREEZER COMBINATION
Walk-in Cooler/Freezer Combination shall be Kolpak Model No. CUSTOM, shaped as indicated on Drawing QF101, 17'–4" wide x 16'–4-1/2" deep front-to-back x 8'–10-1/4" high overall. Provide .125 diamond tread aluminum Dura-Floor rated at 12000 pounds per square foot depressed flush with adjacent kitchen floor. Depress slab 4" to ensure that interior walk-in floor is flushed with finished kitchen floor. Cooler/Freezer shall be finished in .040 stucco embossed aluminum in/out where exposed with white stucco embossed ceiling. Provide each compartment with a 36" wide x 78" high door where indicated, equipped with 1/8" diamond tread kick plates inside and out, doors and frames to 36" AFF. Provide doors with Kason Series K-77 positive latch hardware with cylinder locks finished in polished chrome. Provide 14" x 24" heated view windows in each door. Provide one (1) side mounted Kolpak Air Shield for each door. Provide 12-gauge stainless steel threshold plate with thermostatically controlled heater for both cooler and freezer doors. Install door stops as necessary. Provide a 2" x 6" stainless steel hat channel bumper rail full length of exposed exterior wall except door and door frames, mount at 30" above finished floor and fully enclose ends and seal to walk-in wall. Trim Cooler/Freezer with matching aluminum closures to walls and ceiling. Furnish and mount four (4) additional Kason 1810LCT LED light fixtures where indicated on Drawing QF203. Coordinate connection of lights with Division 26. Provide a "Special Conditions Drawing" with submittal detailing location and size of floor depression and masonry opening. The box shall be set at a level to allow the door(s) to swing freely over the adjacent exterior floor.

Provide HCFC-free water-cooled Condensing Unit Model KPC68MWZPD-3E with matching Unit Cooler Model KAM26-073-1EC-PR-8 for the medium temperature compartment and HCFC-free water-cooled Condensing Unit Model KPC248LWZPD-3E with matching Unit Cooler Model KEL26-066-2EC-PR-8 for the low temperature compartment. Mount Condensing Units and hang Unit Coolers where indicated on Drawing QF101. Provide low ambient kits and UL listed weather covers. Connection of refrigeration and drain lines shall be by a licensed refrigeration technician using refrigeration grade hard copper following the manufacturer's and ASHRAE guidelines under Section 114000. All copper tubing shall be soldered, no shark bite fittings shall be used. Wrap all condensate drain lines with heat tape where exposed to freezing temperatures. Verify distance of refrigeration line runs and adjust line size and condensing unit size to conform to manufacturer's recommendations.

After all lines are connected, the entire system shall be leak tested. The complete system shall be pressurized to 150 psig with refrigerant and dry nitrogen (or dry CO2). An electronic type leak detector shall be used to identify leaks. Pressure shall be held for a minimum of 12 hours and then rechecked. Coordinate test observation with the owner's representative on site.

A good, deep vacuum pump shall be connected to both the low and high side evacuation valves with copper tube or high vacuum hoses (1/4" ID minimum). If the compressor has service valves, they shall remain closed. A deep vacuum gauge capable of registering pressure in microns shall be attached to the system for pressure readings. A shut off valve between the gauge connection and vacuum pump shall be provided to allow the system

pressure to be checked after evacuation. Do not turn off vacuum pump when connected to an evacuated system before closing shut off valve. The vacuum pump shall be operated until pressure of 1,500 microns absolute pressure is reached – at which time the vacuum shall be broken with the refrigerant to be used in the system through a drier until the system pressure rises above 0 psig. Repeat this operation a second time. Open the compressor service valves and evacuate the entire system to 500 microns absolute pressure. Raise the pressure to 2 psig with the refrigerant and remove the vacuum pump.

Refrigeration lines shall be insulated with Aeroflex USA Aerocel White/Gray 25/50 pipe insulation. Thickness of insulation shall be in accordance with insulation manufacturer's recommendation. Butt joints and seams shall be sealed with contact adhesive.

After completion of the electrical connections under Division 26, trim the Cooler/Freezer to the building, clean inside and out, test, charge and start system, install the shelving, adjust temperature to 35 degrees for the medium temperature compartment and 0 degrees for the low temperature compartment, leave ready for use.

Kolpak is owner preferred brand. Other brands shall not be considered.

ITEM NO. 3 – WALK-IN SHELVING UNIT
Walk-In Shelving Unit shall be Cambro Model No. Camshelving Elements XTRA-L003, sized and arranged as indicated on Drawing QF101
Provide the following options:
Manufacturer's Standard Features and
Four (4) #EXU214864V4480 stationary starter unit
Eight (8) #EXA214864V4480 stationary add-on unit
Four (4) #EXA215464V4480 stationary add-on unit
Cambro is owner preferred brand. Other brands shall not be considered.

ITEM NO. 4 – DRY STORAGE SHELVING UNIT
Dry Storage Shelving Unit shall be Cambro Model No. Camshelving Elements XTRA-L003, sized and arranged as indicated on Drawing QF101
Provide the following options:
Manufacturer's Standard Features and
One (1) #EXU246072V5480 stationary starter unit
One (1) #EXA246072V5480 stationary add-on unit
Six (6) #EXA244872V5480 stationary add-on unit
Two (2) #EXA243672V5480 stationary add-on unit
One (1) #EXCC5480 corner connector set
Cambro is owner preferred brand. Other brands shall not be considered.

ITEM NO. 5 – SPARE NUMBER

ITEM NO. 6 – DUNNAGE RACK
Dunnage Rack shall be Metro Model No. HP2260PD-L003
Provide the following options:
Manufacturer's Standard Features

ITEM NO. 7 – DUNNAGE RACK
Dunnage Rack shall be Metro Model No. HP2236PD-L003
Provide the following options:
Manufacturer's Standard Features

ITEM NO. 8 – FIRST-IN FIRST-OUT CAN RACK
First-In First-Out Can Rack shall be Channel Model No. CSR-156-L003
Provide the following options:
Manufacturer's Standard Features

ITEM NO. 9 – UTILITY CART
Utility Cart shall be Cambro Model No. SC225110-L003
Provide the following options:
Manufacturer's Standard Features
Cambro is owner preferred brand. Other brands shall not be considered.

ITEM NO. 10 – SPARE NUMBER

ITEM NO. 11 – PORTABLE PAN STORAGE UNIT
Portable Pan Storage Unit shall be Cambro Model No Camshelving Premium Mobile-L003
Provide the following options:
Manufacturer's Standard Features and
One (1) #CPMU244875V4480 starter unit
Four (4) #CPMDB000 donut bumper
Cambro is owner preferred brand. Other brands shall not be considered.

ITEM NO. 12 – UNIVERSAL ANGLE PAN RACK
Universal Angle Pan Rack shall be Cres Cor Model No. 207UA13A-L003
Provide the following options:
Manufacturer's Standard Features

ITEM NO. 13 – PEDESTAL HAND SINK WITH ELECTRONIC EYE
Pedestal Hand Sink with Electronic Eye shall be Eagle Group Model No. HSA-10-FA-PE MOD-L003
Provide the following options:
Manufacturer's Standard Features and
One (1) T&S Model #EC-3101TMVHGF10
One (1) Laminar Flow model #B-0199-21 faucet with cord and plug, battery operation, and hydro electric option.
Use Laminar Flow in lieu of aerator in gooseneck spout

ITEM NO. 14 – PREP TABLE WITH SINKS
Prep Table with Sinks shall be Eagle Group Model No. T30120SEM-10BS-L003, sized and arranged as indicated on Drawing QF101
Provide the following options:
Manufacturer's Standard Features and
10" high backsplash
Marine edge top
Omit undershelf where indicated on Drawing QF101
One (1) #502946 NSF listed fully-enclosed stainless steel drawer assembly
One (1) disposer provision package
One (1) T&S #B-0133-V-B pre-rinse faucet with wall bracket and vacuum breaker
One (1) T&S #B-0156 add-on faucet
One (1) T&S #B-3952-01 twist waste valve with overflow assembly
One (1) 20" x 20" x 14" deep stainless steel sink bowl on right
One (1) 20" x 20" x 8" deep stainless steel sink bowl on left
One (1) welded stainless steel twist waste rod support tab
Fully welded legs, crossrails, and undershelf

ITEM NO. 15 – DISPOSER WITH CONTROL PANEL
Disposer with Control Panel shall be InSinkErator Model No. SS-200-7-CC202-L003
Provide the following options:
Manufacturer's Standard Features and
One (1) syphon breaker
One (1) dejamming wrench

ITEM NO. 16 – WALL SHELF
Wall Shelf shall be Eagle Model No. SWS1236-14/3-L003
Provide the following options:
Manufacturer's Standard Features and
Mount wall shelf at 60" AFF to top of shelf

ITEM NO. 17 – ELECTRIC CAN OPENER
Electric Can Opener shall be Edlund Model No. 203-L003
Provide the following options:
Manufacturer's Standard Features

ITEM NO. 18 – FOOD PROCESSOR
Food Processor shall be Robot Coupe Model No. R2N-L003
Provide the following options:
Manufacturer's Standard Features and
One (1) #SP5DISC 5 disc package
One (1) #R255 disc plate rack

ITEM NO. 19 – MANUAL CAN OPENER
Manual Can Opener shall be Edlund Model No. S-11E-L003
Provide the following options:
Manufacturer's Standard Features

ITEM NO. 20 – HOT WATER DISPENSER WITH FILTER
Hot Water Dispenser with Filter shall be Hatco Model No. AWD-12-L003
Provide the following options:
Manufacturer's Standard Features and
One (1) #AWD-FILTER water filtration system
Mount top of water filter 60" AFF

ITEM NO. 21 – 20-QT MIXER ON STAND
20-QT Mixer on Stand shall be Hobart Model No. HL200-1-L003
Provide the following options:
Manufacturer's Standard Features and
One (1) #BOWL-HL20P 20-qt stainless steel mixer bowl
One (1) #BBEATER-HL20 20-qt "B" flat beater
One (1) #DWHIP-HL20 20-qt "D" wire whip
One (1) #EDDOUGH-HL20 20-qt "ED" dough arm
One (1) #BOWL-HL12 12-qt stainless steel mixer bowl
One (1) #BBEATER-HL12 12qt "B" flat beater
One (1) #DWHIP-HL12 12-qt "D" wire whip
One (1) #EDDOUGH-HL12 12-qt "ED" dough arm
One (1) #TABLEHW-HL2012 equipment stand

ITEM NO. 22 – WORKTABLE WITH SINK
Worktable with Sink shall be Eagle Group Model No. T3072SE-BS-L003, sized and arranged as indicated on Drawing QF101

Provide the following options:
Manufacturer's Standard Features and
4" backsplash
One (1) 18" x 20" x 14" deep stainless steel sink bowl
One (1) T&S #B-0231 wall mount faucet
One (1) T&S #B-3952-01 twist waste handle drain
One (1) welded stainless steel twist waste rod support tab
Omit undershelf where indicated on Drawing QF101
Fully welded legs, crossbracing, and undershelf

ITEM NO. 23 – WORKTABLE
Worktable shall be Eagle Group Model No. T3072SE-L003, sized and arranged as indicated on Drawing QF101
Provide the following options:
Manufacturer's Standard Features and
One (1) #502946 NSF listed fully enclosed stainless steel drawer assembly
Fully welded legs and undershelf

ITEM NO. 24A – EXHAUST HOOD WITH PSP
Exhaust Hood with PSP shall be CaptiveAire Model No. 6624 ND-2-PSP-F-L003, as indicated on Drawing QF101 and as detailed on Drawings QF301-QF302

ITEM NO. 24B – EXHAUST HOOD WITH PSP
Exhaust Hood with PSP shall be CaptiveAire Model No. 6624 ND-2-PSP-F-L003, as indicated on Drawing QF101 and as detailed on Drawings QF301-QF302

ITEM NO. 24C – FIRE SUPPRESSION SYSTEM
Fire Suppression System shall be CaptiveAire Model No. TANK FS 4.0-L003, as indicated on Drawing QF101 and as detailed on Drawings QF301-QF302

ITEM NO. 24D – FAN CONTROL PANEL
Fan Control Panel shall be CaptiveAire Model No. DCV-111-L003, as indicated on Drawing QF101 and as detailed on Drawings QF301-QF302

ITEM NO. 24E – EXHAUST FAN – ROOF MOUNTED
Exhaust Fan shall be CaptiveAire Model No. DU240HFA-L003, as indicated on Drawing QF101 and as detailed on Drawings QF307-QF308

ITEM NO. 24F – MAKE-UP AIR FAN – ROOF MOUNTED
Make-Up Air Fan shall be CaptiveAire Model No. CAS-HVAC2-E.604-18-10T-MPU-L003, as indicated on Drawing QF101 and as detailed on Drawings QF307-QF308

ITEM NO. 24G – REMOTE FIRE SUPPRESSION ACTUATION DEVICE – INCLUDED IN ITEM NO. 24C

ITEM NO. 24H – ROOM TEMPERATURE MONITOR – INCLUDED IN ITEM NO. 24D

ITEM NO. 25 – UTILITY DISTRIBUTION SYSTEM
Utility Distribution System shall be CaptiveAire Model No. UDI-L003, as indicated on Drawing QF101 and as detailed on Drawings QF305-QF306

ITEM NO. 26 – 30-GAL TILT SKILLET
30-Gal Tilt Skillet shall be Cleveland Model No. SEL30T1-L003
Provide the following options:

Manufacturer's Standard Features and
K-12 extended warranty
K-12 extended 10 year pan warranty
One (1) #TD2SK 2" tangent draw-off valve
One (1) #DPK13 double pantry faucet

Cleveland is owner preferred brand. Other brands shall not be considered.

ITEM NO. 27 – FLOOR TROUGH WITH ADA GRATING
Floor Trough with ADA Grating shall be IMC Teddy Model No. ASFT-2124-SG-ADA-L003
Provide the following options:
Manufacturer's Standard Features and
Modify size to 20" front to back by 24" wide and installed in relation to Cleveland Model No. SEL30T1 per the manufacturer's catalog sheet.
Manufacture grates in two tight fitting equal sections.

ITEM NO. 28 – DOUBLE CONVECTION OVEN
Double Convection Oven shall be Garland Model No. MCO-ED-20-S-L003
Provide the following options:
Manufacturer's Standard Features and
Stainless steel enclosed back per deck
One (1) set of low profile casters
One (1) pair Eagle #CC-S-2 caster cradles

ITEM NO. 29 – 3-PAN OVER 6-PAN STEAMER ON STAND
3-Pan Over 6-Pan Steamer on Stand shall be Cleveland Model No. (2) 22CET63.1-L003
Provide the following options:
Manufacturer's Standard Features and
K-12 extended warranty
One (1) #FLT0040 Optipure water filtration system

Cleveland is owner preferred brand. Other brands shall not be considered.

ITEM NO. 30 – WORKTABLE
Worktable shall be Eagle Group Model No. UT3072SE-L003, sized and arranged as indicated on Drawing QF101
Provide the following options:
Manufacturer's Standard Features and
One (1) #502946 NSF listed fully enclosed stainless steel drawer assembly
Fully welded legs and undershelf

ITEM NO. 31 – 6-PAN OVER 6-PAN COMBI OVEN ON STAND
6-Pan Over 6-Pan Combi Oven on Stand Convotherm Model No. C4 ET 6.20EB-N-L003
Provide the following options:
Manufacturer's Standard Features and
One (1) #C-START combi oven cleaner kit
One (1) #DD-TT disappearing door
One (1) #WBT-QTI1-CR-CON Optipure water treatment system
One (1) #3431606 stacking kit
One (1) #3471200 cleaning chemical drawer
Six (6) #3055637 frying basket
Three(3) #CWR20 oven wire shelf

Convotherm is owner preferred brand. Other brands shall not be considered.

ITEM NO. 32 – WORKTABLE

Worktable shall be Eagle Group Model No. T3072SE-L003, sized and arranged as indicated on Drawing QF101
Provide the following options:
Manufacturer's Standard Features and
One (1) #502946 NSF listed fully enclosed stainless steel drawer assembly
Fully welded legs and undershelf

ITEM NO. 33 – SPARE NUMBER

ITEM NO. 34 – 2-SECTION PASS-THRU HEATED CABINET
2-Section Pass Thru Heated Cabinet shall be Delfield Model No. GAHPT2-S-L003, hinged as indicated on Drawing QF101
Provide the following options:
Manufacturer's Standard Features and
One (1) set of 5" locking casters
Full height glass doors on control side of unit
One (1) #GACONTROLDF digital controls in lieu of standard easyTouch
One (1) #G263-CUW-0032 TS4-H rod type flange support package per section
Delfield is owner preferred brand. Other brands shall not be considered.

ITEM NO. 35 – 2-SECTION PASS-THRU REFRIGERATOR
2-Section Pass Thru Refrigerator shall be Delfield Model No. GARPT2P-S-L003, hinged as indicated on Drawing QF101
Provide the following options:
Manufacturer's Standard Features and
One (1) set of 5" locking casters
Full height glass doors on control side of unit
One (1) #GACONTROLDF digital controls in lieu of standard easyTouch
One (1) #G263-CUW-0030 TS4 rod type flange support package per section
Additional 4 years compressor warranty
Delfield is owner preferred brand. Other brands shall not be considered.

ITEM NO. 36 – TRAY CART
Tray Cart shall be Caddy Model No. T-40-L003
Provide the following options:
Manufacturer's Standard Features

ITEM NO. 37 – REFRIGERATED AIR SCREEN MERCHANDISER
Refrigerated Air Screen Merchandiser shall be Structural Concept Model No. B5932-L003
Provide the following options:
Manufacturer's Standard Features and
One (1) #CLEANSWEEP automatic condenser coil cleaner
End panels cut away with glass
Powder coated SCC Standard Silversan Black for interior color
4000K LED lights on all shelves
Retractable night curtain
Interior Designer shall select the exterior color from the manufacturer's standard options.
Structural Concept is owner preferred brand. Other brands shall not be considered.

ITEM NO. 38 – 2-TIER HEATED DISPLAY MERCHANDISER
2-Tier Heated Display Merchandiser shall be Hatco Model No. GR2SDS-42D-L003
Provide the following options:

Manufacturer's Standard Features and
One (1) #GR2SD42BP 5" front upper sneeze guard
One (1) #GR2SD42BP 5" front lower sneeze guard
Interior Designer shall select the exterior color from the manufacturer's standard options.

ITEM NO. 39 – SERVING COUNTER
Serving Counter shall be Delfield Model No. CUSTOM-L003, sized and arranged as shown on Drawing QF101 and as detailed on Drawing QF311

ITEM NO. 40 – SERVING COUNTER
Serving Counter shall be Delfield Model No. CUSTOM-L003, sized and arranged as shown on Drawing QF101 and as detailed on Drawing QF311

ITEM NO. 41 – 4-WELL HOT/COLD FOOD COUNTER – INCLUDED IN ITEM NO. 40

ITEM NO. 42 – COUNTER PROTECTOR WITH HEAT & LIGHTS – INCLUDED IN ITEM NO. 40

ITEM NO. 43 – PLAIN TOP COUNTER – INCLUDED IN ITEM NO. 40

ITEM NO. 44 – COLD FOOD COUNTER – INCLUDED IN ITEM NO. 40

ITEM NO. 45 – 2-TIER FOOD SHIELD WITH LIGHTS – INCLUDED IN ITEM NO. 40

ITEM NO. 46 – ICE CREAM FREEZER
Ice Cream Freezer shall be Beverage Air Model No. NC43HC-1-W-L003
Provide the following options:
Manufacturer's Standard Features

ITEM NO. 47 – CASHIER COUNTER – INCLUDED IN ITEM NO. 40

ITEM NO. 48 – POS SYSTEM – OWNER FURNISHED

ITEM NO. 49 – PORTABLE CONDIMENT COUNTER
Portable Condiment Counter shall be Delfield Model No. SC-50-NU-L003, sized and arranged as indicated on Drawing QF101 as detailed on Drawing QF311

ITEM NO. 50 – OVERHEAD COILING SHUTTER – REFER TO DIVISION 8

ITEM NO. 51 – POT SINK
Pot Sink shall be Eagle Group Model No. FN2860-3-24-14/3-L003, sized and arranged as indicated on Drawing QF101
Provide the following options:
Manufacturer's Standard Features and
One (1) T&S #B-0290 big flo faucet
One (1) T&S #B-TEE-EZK faucet tee assembly
One (1) T&S #B-0287 pre-rinse unit with big-flo faucet
One (1) T&S #B-0109-02 9" wall bracket
Three (3) T&S # B-3952-01 twist waste valve with overflow assembly
Three (3) twist waste rod support tab
Fully welded legs and crossbracing

ITEM NO. 52 – POT RACK

Pot Rack shall be Eagle Group Model No. WM108APR-L003
Provide the following options:
Manufacturer's Standard Features and
Mount pot rack 72" AFF to bottom of rack

ITEM NO. 53 – SOILED DISHTABLE
Soiled Dishtable shall be Eagle Group Model No. CUSTOM-L003, sized and arranged as indicated on Drawing QF101 and conforming to Section 11 40 00 General Specifications
Provide the following options:
Manufacturer's Standard Features and
10" backsplash adjacent to all walls
One (1) end splash
One (1) 20" x 20" x 5" deep stainless steel pre-wash sink
One (1) set removable stainless steel rack slides
One (1) pass thru shelf as indicated on Drawing QF101
Disposer provision
Fully welded legs and crossrails

ITEM NO. 54 – DISPOSER WITH CONTROL PANEL
Disposer with Control Panel shall be InSinkErator Model No. SS-300-7-CC202-L003
Provide the following options:
Manufacturer's Standard Features and
One (1) dejamming wrench

ITEM NO. 55 – HOSE REEL
Hose Reel shall be T&S Brass Model No. B-7222-C01XS1E-L003
Provide the following options:
Manufacturer's Standard Features and
Mount hose reel so that fully retracted spray head is 60" AFF centered over prewash sink

ITEM NO. 56 – CONVEYOR WAREWASHER WITH BOOSTER HEATER
Conveyor Warewasher with Booster Heater shall be CMA Dishmachines Model No. EST-44-L003
Provide the following options:
Manufacturer's Standard Features and
Electric tank heat
One (1) #E-TEMP booster heater
Chamber 6" higher than standard
One (1) shock absorber
Two (2) extended vent hoods
Four (4) Cambro # PR314151 peg racks
Two (2) Cambro # BR258151 combination racks
Two (2) Cambro # OETR314151 sheet pan racks
One (1) rack limit switch
Drain line tempering kit
Two (2) Eagle DVS-72 fully welded duct extensions to above ceiling with stainless trim at ceiling from dishwasher collar to 2" above finished ceiling. Coordinate connection with Division 23.
CMA is owner preferred brand. Other brands shall not be considered.

ITEM NO. 57 – VENT DUCT EXTENSIONS – INCLUDED IN ITEM NO. 56

ITEM NO. 58 – WAREWASHER EXHAUST FAN

Warewasher Exhaust Fan shall be CaptiveAire Model No. DU50HFA-L003, as indicated on Drawing QF101 and as detailed on Drawings QF307

ITEM NO. 59 – CLEAN DISHTABLE WITH RACK LIMIT SWITCH
Clean Dishtable with Rack Limit Switch shall be Titan Group Model No. CUSTOM-L003, sized and arranged as indicated on Drawing QF101 and conforming to Section 11 40 00 General Specifications
Provide the following options:
Manufacturer's Standard Features and
Stainless steel corner roller conveyor
10" backsplash adjacent to all walls
One (1) end splash with removable stainless steel back cover
One (1) 72" long stainless steel undershelf
Provisions for mounting rack limit switch
Fully welded undershelf, cross rails and legs

ITEM NO. 60 – SPARE NUMBER

ITEM NO. 61 – PORTABLE DRYING RACK
Portable Drying Rack shall be Cambro Model No. EXMU244878V4480-L003
Provide the following options:
Manufacturer's Standard Features

ITEM NO. 62 – FLOOR MOUNTED MOP SINK – REFER TO DIVISION 22

ITEM NO. 63 – NON-FOOD SHELVING UNIT
Non-Food Shelving Unit shall be Cambro Model No. EXMU183670V5480-L003
Provide the following options:
Manufacturer's Standard Features

ITEM NO. 64 – WASHER – REFER TO SECTION 113100

ITEM NO. 65 – DRYER – REFER TO SECTION 113100

ITEM NO. 66 – NON-FOOD STORAGE SHELVING UNIT
Non-Food Storage Shelving Unit shall be Cambro Model No. EXMU183670V5480-L003
Provide the following options:
Manufacturer's Standard Features
Cambro is owner preferred brand. Other brands shall not be considered.

ITEM NO. 67 – EMPLOYEE LOCKERS – REFER TO DIVISION 10

ITEM NO. 68 – ICE MAKER WITH BIN
Ice Maker with Bin shall be Manitowoc Model No. IYT0300W-L003
Provide the following options:
Manufacturer's Standard Features and
One (1) #D570 ice bin
One (1) #K00463 ice scoop
One (1) #K00461 external ice scoop holder

ITEM NO. 69 – ICE MAKER WATER FILTER
Ice Maker Water Filter shall be Everpure Model No. EV932401-L003
Provide the following options:
Manufacturer's Standard Features and

Mount top of water filter 60” AFF

ITEM NO. 70 – STAINLESS STEEL CORNER GUARD
Stainless Steel Corner Guard shall be Custom Fabrication, installed where indicated on drawings, constructed of 18-gauge stainless, formed at 90 degrees or 180 degrees ("U" shaped) with hug edges on long sides. Match radius of CMU walls. Corner Guards shall extend from top of floor cove base to 60" above finished floor. Secure corner guards to walls with construction adhesive and a minimum number of #8 stainless steel truss head screws and plastic shields. Seal all edges including top and bottom with NSF approved sealant.

CULINARY ARTS LAB

ITEM NO. C1 – PREP TABLE WITH SINKS
Prep Table with Sinks shall be Eagle Group Model No. T30144SEM-10BS-L003, sized and arranged as indicated on Drawing QF102
Provide the following options:
Manufacturer’s Standard Features and
10” high backsplash
Marine edge top
Omit undershelf where indicated on Drawing QF102
Two (2) #502946 NSF listed fully-enclosed stainless steel drawer assembly
Two (2) 20” X 20” X 14” stainless steel sink bowls
One (1) T&S #B-0133-V-B pre rinse faucet with wall bracket and vacuum breaker
One (1) T&S #B-0156 add-on faucet
Two (2) T&S #B-3952-01 twist waste valve with overflow assembly
Two (2) welded stainless steel twist waste rod support tab
Fully welded legs, crossrails, and undershelf

ITEM NO. C2 – WALL MOUNTED SHELF
Wall Mounted Shelf shall be Eagle Group Model No. SWS1248-14/3-L003
Provide the following options:
Manufacturer’s Standard Features and
Mount lower wall shelf at 48” AFF and upper one at 66” AFF to top of shelf

ITEM NO. C3 – WORKTABLE
Worktable shall be Eagle Group Model No. T3072SE-BS-L003, sized and arranged as indicated on Drawing QF102
Provide the following options:
Manufacturer’s Standard Features and
One (1) end splash
Square edge table
Fully welded legs and undershelf

ITEM NO. C4 – ICE MAKER WITH BIN
Ice Maker with Bin shall be Scotsman Model No. UC2024MW-1-L003
Provide the following options:
Manufacturer’s Standard Features and
One (1) #KLP8S stainless steel leg kit
One (1) San Jamar #SI2000 scoop holder
One (1) San Jamar #SI7700 20oz scoop

ITEM NO. C5 – ICE MAKER WATER FILTER

Ice Maker Water Filter shall be Everpure Model No. EV932401-L003
Provide the following options:
Manufacturer's Standard Features and
Mount top of water filter 60" AFF

ITEM NO. C6 – 2-SECTION REACH-IN REFRIGERATOR
2-Section Reach-In Refrigerator shall be Delfield Model No. GAR2NP-S-L003, hinged as indicated on Drawing QF102
Provide the following options:
Manufacturer's Standard Features and
Stainless steel back and compressor grill
Two (2) #AS3978330 narrow additional shelf
Delfield is owner preferred brand. Other brands shall not be considered.

ITEM NO. C7 – 2-SECTION REACH-IN FREEZER
2-Section Reach-In Freezer shall be Delfield Model No. GAF2P-S-L003, hinged as indicated on Drawing QF102
Provide the following options:
Manufacturer's Standard Features and
Stainless steel back and compressor grill
Two (2) #AS3978333 additional chrome shelf
Delfield is owner preferred brand. Other brands shall not be considered.

ITEM NO. C8 – PEDESTAL HAND SINK WITH ELECTRONIC EYE
Pedestal Hand Sink with Electronic Eye shall be Eagle Group Model No. HSA-10-FA-PE MOD-L003
Provide the following options:
Manufacturer's Standard Features and
One (1) T&S Model #EC-3101TMVHGF10
One (1) Laminar Flow model #B-0199-21 faucet with cord and plug, battery operation, and hydro electric option.
Use Laminar Flow in lieu of aerator in gooseneck spout

ITEM NO. C9 – ADA HAND SINK
ADA Hand Sink shall be Eagle Group Model No. HSAP-14-FW-L003
Provide the following options:
Manufacturer's Standard Features and
One (1) #313305 T&S extra heavy duty wrist handle gooseneck faucet

ITEM NO. C10 – WORKTABLE
Worktable shall be Eagle Group Model No. T3060SE-L003, sized and arranged as indicated on Drawing QF102
Provide the following options:
Manufacturer's Standard Features and
Fully welded legs and undershelf

ITEM NO. C11 – WORKTABLE
Worktable shall be Eagle Group Model No. T3060SE-L003, sized and arranged as indicated on Drawing QF102
Provide the following options:
Manufacturer's Standard Features and
Fully welded legs and undershelf

ITEM NO. C12 – ADA WORKTABLE

ADA Worktable shall be Eagle Group Model No. T3060STE-L003, sized and arranged as indicated on Drawing QF102
Provide the following options:
Manufacturer's Standard Features and
One (1) set of #E17 special height legs
Reduce overall height to 34" for ADA
Fully welded legs and crossrails

ITEM NO. C13 – DEMO TABLE WITH OVERHEAD MIRROR
Demo Table with Overhead Mirror shall be Eagle Group Model No. DT3672SE-L003, sized and arranged as indicated on Drawing QF102
Provide the following options:
Manufacturer's Standard Features and
Fully welded legs and undershelf

ITEM NO. C14 – 5-QT MIXER
5-QT Mixer shall be Hobart Model No. N50A-10-L003
Provide the following options:
Manufacturer's Standard Features and
K-12 extended warranty
One (1) #DWHIP-SST005 5-QT "D" wire whip
One (1) #EDDOUGH-ALU005 5-QT "ED" spiral dough arm

ITEM NO. C15A – EXHAUST HOOD WITH PSP
Exhaust Hood with PSP shall be CaptiveAire Model No. 6624 ND-2-PSP-F-L003, as indicated on Drawing QF102 and as detailed on Drawings QF303-QF304

ITEM NO. C15B – EXHAUST HOOD WITH PSP
Exhaust Hood with PSP shall be CaptiveAire Model No. 6624 ND-2-PSP-F-L003, as indicated on Drawing QF102 and as detailed on Drawings QF303-QF304

ITEM NO. C15C – FIRE SUPPRESSION SYSTEM
Fire Suppression System shall be CaptiveAire Model No. TANK FS 4.0/4.0-L003, as indicated on Drawing QF102 and as detailed on Drawings QF303-QF304

ITEM NO. C15D – FAN CONTROL PANEL
Fan Control Panel shall be CaptiveAire Model No. DCV-1111-L003, as indicated on Drawing QF102 and as detailed on Drawings QF303-QF304

ITEM NO. C15E – EXHAUST FAN – ROOF MOUNTED
Exhaust Fan shall be CaptiveAire Model No. DU240HFA-L003, as indicated on Drawing QF102 and as detailed on Drawings QF309-QF310

ITEM NO. C15F – MAKE-UP AIR FAN – ROOF MOUNTED
Make-Up Air Fan shall be CaptiveAire Model No. CAS-HVAC2-E.604-18-10T-MPU, as indicated on Drawing QF102 and as detailed on Drawings QF309-QF310

ITEM NO. C15G – REMOTE FIRE SUPPRESSION ACTUATION DEVICE – ICLUDED IN ITEM NO. C15C

ITEM NO. C15H – ROOM TEMPERATURE MONITOR – INCLUDED IN ITEM NO. C15D

ITEM NO. C16 – 4-BURNER INDUCTION RANGE
4-Burner Induction Range shall be Garland Model No. GME36-I14C-L003

Provide the following options:
Manufacturer's Standard Features and
One (1) set of non-height adjustable casters
One (1) pair Eagle #CC-S-2 caster cradles

ITEM NO. C17 – 4-BURNER GAS RANGE
4-Burner Gas Range shall be Garland Model No. GFE24-4L-L003
Provide the following options:
Manufacturer's Standard Features and
One (1) set of adjustable height swivel casters with front brakes
One (1) pair Eagle #CC-S-2 caster cradles

ITEM NO. C18 – WORKTABLE
Worktable shall be Eagle Group Model No. UT3618STEB-L003, sized and arranged as indicated on Drawing QF102
Provide the following options:
Manufacturer's Standard Features and
Fully welded stainless steel undershelf

ITEM NO. C19 – POT SINK
Pot Sink shall be Eagle Group Model No. FN2860-3-36-14/3-MOD-L003, sized and arranged as indicated on Drawing QF102
Provide the following options:
Manufacturer's Standard Features and
Modify drain board lengths per QF101
One (1) T&S #B-0290 big flo faucet
One (1) T&S #B-TEE-EZK faucet tee assembly
One (1) T&S #B-0287 pre-rinse unit with big-flo faucet
One (1) T&S #B-0109-02 9" wall bracket
Three (3) T&S # B-3952-01 twist waste valve with overflow assembly
Three (3) twist waste rod support tab
Fully welded legs, undershelf and crossbracing

ITEM NO. C20 – POT RACK
Pot Rack shall be Eagle Group Model No. WM108APR-L003
Provide the following options:
Manufacturer's Standard Features and
Mount pot rack at 72" AFF to bottom of rack

ITEM NO. C21 – UNDERCOUNTER WAREWASHER
Undercounter Warewasher shall be Hobart Model No. LXNH-1-L003
Provide the following options:
Manufacturer's Standard Features and
One (1) #CORD-PWRKIT-H2LX power cord kit
One (1) #DWT-BAS-LXN drain water tempering kit
One (1) #DISHRAK-PEG20 peg rack
One (1) #DISHRAK-COM20 combination rack

ITEM NO. C22 – MOP CABINET
Mop Cabinet shall be Eagle Model No. F1916-VSCS-DL-L003
Provide the following options:
Manufacturer's Standard Features

ITEM NO. C23 – STACKED WASHER/DRYER – REFER TO SECTION 113100

ITEM NO. C24 – SPARE NUMBER

ITEM NO. C25 – DRYING RACK
Drying Rack shall be Cambro Model No. Camshelving Elements XTRA-L003, sized and arranged as indicated on Drawing QF102
Provide the following options:
Manufacturer's Standard Features and
One (1) #EXMU244878V4480

ITEM NO. C26 - AIR CURTAIN INSECT FAN
Air Curtain Insect Fan shall be Berner Model No. SHD07-1036A-L003
Provide the following options:
Manufacturer's Standard Features and
Automatic plunger door switch
Coordinate mounting of door switch with Division 26 on STRIKE side of door where indicated on Drawing QF202

ITEM NO. C27 – DUAL ZONE DISPLAY CASE
Dual Zone Display Case shall be Federal Industries Model No. CGR5048DZ-L003
Provide the following options:
Manufacturer's Standard Features and
One (1) set of 4" casters; including cord & plug

NURSE'S CLINIC IN ROOM 109

ITEM NO. NC1 – ICE MAKER WITH BIN AND WATER FILTER
Ice Maker with Bin and Water Filter shall be Manitowoc Model No. UDE0065A-L003
Provide the following options:
Manufacturer's Standard Features and
One (1) Everpure #EV932401 water filtration system
One (1) Everpure #EV961222 water filter cartridge
Mount top of water filter at 60" AFF

END OF SECTION

SECTION 115313
LABORATORY FUME HOODS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Standard laboratory fume hoods.

B. Exhaust blowers.

C. Work surfaces.

D. Service fittings and outlets.

E. Airflow indicators and alarms.

1.02 RELATED REQUIREMENTS

A. Section 061053 - Miscellaneous Rough Carpentry: Blocking and nailers for anchoring fume hoods.

B. Section 123553.13 - Metal Laboratory Casework: Additional requirements for base cabinets for fume hoods.

C. Section 230593 - Testing, Adjusting, and Balancing for HVAC: Field quality-control testing of fume hoods.

1.03 REFERENCE STANDARDS

A. ASHRAE Std 110 - Methods of Testing Performance of Laboratory Fume Hoods; 2016, with Errata.

B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2023a.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.

D. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.

E. SEFA 1 - Laboratory Fume Hoods; 2010.

F. SEFA 2 - Installations; 2010.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate installation of fume hoods with laboratory casework and other laboratory equipment.

B. Preinstallation Meeting: Conduct preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide fume hood exterior and interior dimensions and construction, utility and service requirements and locations.

C. Shop Drawings: Indicate locations, large scale plans, elevations, cross sections, rough-in and anchor placement dimensions and tolerances, clearances required, locations and types of service fittings.

D. Samples: Submit two samples of exterior, interior, and work top finish surfaces, 4 by 4 inch (100 by 100 mm) in size illustrating color and finish.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements. Provide documentation of successful Factory Acceptance Testing.

F. Test Reports: Indicate that each type of fume hood has been factory-tested and meets specified ASHRAE Std 110 (AM) requirements.

G. Manufacturer's Installation Instructions: Indicate special installation requirements.

H. Operation Data: Include description of equipment operation and required adjusting and testing.

I. Maintenance Data: Identify system maintenance requirements, servicing cycles, lubrication types required and local spare part sources.

J. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

K. Project Record Documents: Record actual locations of concealed utility connections.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

D. Preconstruction Testing: Factory-test each type of hood as per referenced standard.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or another suitable material.

1.08 FIELD CONDITIONS

A. Ambient Conditions: Maintain temperature and relative humidity at occupancy levels during and after installation of fume hoods.

1.09 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
B. Correct defective Work within a five year period after Date of Substantial Completion.
C. Provide one year manufacturer warranty for manufacturer's standard items (listed by part number in manufacturer's official publication).

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Laboratory Fume Hoods: Subject to compliance with requirements, provide Kewaunee Scientific Corporation, Supreme Air Venturi or comparable product;
   1. Mott Manufacturing Ltd: www.mott.ca/#sle.
   2. Multilab: www.multilab.net/#sle.
   3. Substitutions: See Section 016000 - Product Requirements.

2.02 VARIABLE AIR VOLUME (VAV) FUME HOODS

A. Restricted-Bypass Fume Hoods:
   1. Provide a compensating bypass arrangement above the sash to open after sash is closed to less than 20 percent open. Bypass to maintain exhaust capacity of at least 25 CFM per square foot (127 L/s per square meter) of work surface regardless of sash position.
   2. Provide an electronic control unit designed to use input from a sensor that monitors face velocity or sash position to modulate a dedicated exhaust damper in order to maintain a near-constant fume hood face velocity.
      a. Provide control unit with a manual-override switch that allows the operator to fully open the exhaust damper.
      b. Provide control unit with outputs for interfacing with building's HVAC control system.

2.03 PERFORMANCE REQUIREMENTS

A. Fume hoods complying with the following when tested in accordance with ASHRAE Std 110:
   1. As-Manufactured (AM) Rating: AM 0.01 (0.01 ppm).
   2. As-Installed (AI) Rating: AI 0.10 (0.10 ppm).
   3. Average Face Velocity: 100 FPM (0.51 m/s) plus or minus 10 percent with sashes fully open.

4. Face-Velocity Variation: Not more than 10 percent of average face velocity across the face opening with sash(es) fully open.
5. Release Rate: 4.0 L/min.
6. Static-Pressure Loss: Not more than 1/2-inch w.g. (124 Pa) at 100 FPM (0.51 m/s) face velocity with sash fully open when measured at four locations 90 degrees apart around the exhaust duct and at least three duct diameters downstream from duct collar.

2.04 FUME HOODS

A. General Requirements:
   1. Comply with SEFA 1.

B. Type EQ03 , Fume Hood:
   1. Ventilation: Variable Air Volume (VAV).
   2. Configuration: Standing-height; bench mounted.
   3. Nominal Interior Height: 48 inches (1219 mm).
   4. Sash Type: Vertical rising.
      a. Leak-free enclosure box, manufacturer's standard construction, for vertical rising sash.
      b. Glazing: Laminated safety glass.
      c. Sash Guides: Corrosion-resistant polyvinyl chloride (PVC) track.
      d. Vertical Sash mechanism: Designed to prevent sash drop in case of mechanism failure.
         1) Cable: Minimum 3/32 inch (2 mm) thick stainless steel of construction standard with the manufacturer.
      e. Vertical Sash Pull: Type 316 stainless steel, with No.4 finish.
   5. Top Front Panel: Standard integral grille stamped into panel of same materials as fume hood exterior.
   6. Exterior: Stainless steel.
   7. Interior Lining: Type 316 stainless steel, 18 gauge thick, with No.4 finish.
   8. Service Fittings and Fixtures:
      a. As specified in 123553.13 - Metal Laboratory Casework.
   9. Access Panels: Provide removable panels on both sides hood exterior and interior lining panels.
   10. Work Surface:
      a. Work Top for Fume Hoods Other Than Floor-mounted Type: Epoxy resin.
         1) Edge: Raised rim with rounded edges and corners.
         2) Full width drain trough at rear.

C. Fume Hood Base Cabinets:
   1. See Section 123553.13 - Metal Laboratory Casework.
   2. Exterior construction: Metal cabinets.
   3. Material: Stainless steel.
   4. Color/Finish: Matching fume hood finish.

D. Light Fixtures: UL labeled, vaporproof, one-tube, T-5 fluorescent light fixtures. Number and length of fixtures as necessary for fume hood width. Mounted above sealed safety glass panel. White baked-enamel finish on fixture interior.
   1. Average Interior Illumination Level: 80 footcandles.
   2. Coordinate access to light fixture with ceiling extension configuration and construction.

2.05 FABRICATION

A. General: Assemble fume hoods in factory to greatest extent possible. Disassemble fume hoods only as necessary for shipping and handling limitations, or as necessary to permit movement through a 35 inches by 79 inches (889 mm by 2007 mm) clear door opening.

B. Stainless-Steel Exterior: Fabricated from stainless-steel sheet, 0.050 inch (1.27 mm) thick, with component parts screwed together to allow removal of end panels, front fascia, and airfoil, and to allow access to plumbing lines and service fittings.

C. Ends: Fabricated with double-wall end panels. Close area between double walls at front of fume hood and as needed to house sash counterbalance weights, utility lines, and remote-control valves.

D. Splayed top and sides of face opening to provide an aerodynamic shape to ensure smooth, even flow of air into fume hood.

E. Lining Assembly: Unless otherwise indicated, assembled with stainless-steel fasteners or epoxy adhesive, concealed where possible. Joints sealed by filling with chemical-resistant sealant during assembly.
   1. Punched fume hood lining side panels for service fittings and remote controls. Removable plug buttons for holes not used for indicated fittings.

F. Rear Baffle: Same material as fume hood lining, unless otherwise indicated, at rear of hood with openings at top and bottom, with corrosion-resistant fasteners. Fabricated for removal to facilitate cleaning behind baffle.

G. Exhaust Plenum: Full width of fume hood, sized and configured to provide uniform airflow, of same material as hood lining, and with duct stub for exhaust connection.
   1. Duct-Stub Material: stainless steel, unless otherwise indicated.

H. Airfoil: At bottom of fume hood face opening, with 1 inch (25.4 mm) gap between bottom of airfoil and work top. Sash to close on top of airfoil. Designed to direct airflow across work.
   1. Fabricated from 14 gauge, 0.0781 inch (1.98 mm) stainless steel with No.4 finish.

I. Filler Strips: As needed to close spaces between fume hoods and/or fume hood base cabinets and adjacent building construction. Fabricated from same material and with same finish as fume hoods or fume hood base cabinets, as applicable. Flange, notch, and reinforce filler strips. Fabricate to form well-fitting closures, free from oil-canning.

J. Ceiling Extensions: Filler panels matching fume hood exterior to enclose space above fume hoods at front and sides of fume hoods, and extending from tops of fume hoods to approximately 4 inches (102 mm) above ceiling. Flange, notch, and reinforce ceiling extensions as required for rigidity. Fabricate to form well-fitting closures, free from oil-canning.
   1. Provide bottom-hinged access panels within the front ceiling extension filler panel to facilitate access to light fixture and other fume hood components at top of hood not readily accessible by other means.

K. Finished Back Panels: Where rear surfaces of fume hoods are exposed to view, provide finished back panels matching rest of fume hood enclosure.

L. Perchloric Acid Fume Hood Washdown System: System consisting of stainless-steel spray nozzles, washdown valve, and associated piping. Design system to thoroughly rinse all surfaces of fume hood interior, including areas behind and above baffles, and to direct rinse water toward drain trough at rear of work top. Provide T-fitting for extending system to additional spray nozzles in exhaust ducts.

M. Comply with requirements of other sections for factory installation of water and laboratory gas service fittings, piping, electrical devices, and wiring. Securely anchor fittings, piping, and conduit to fume hoods, unless otherwise indicated.

2.06 MATERIALS

A. Steel Sheet: Cold-rolled, commercial steel (CS) sheet, complying with ASTM A1008/A1008M; matte finish; suitable for exposed applications.

B. Stainless-Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304, stretcher-leveled standard of flatness.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Fasteners: Stainless-steel, where exposed to fumes.

2.07 ACCESSORIES

A. Airflow Monitors/Indicators and Alarms: Provide each fume hood with a airflow monitor/indicator complete with an audible and visual alarm that activates when airflow sensor reading is outside of preset range.
   1. Source: Fume hood manufacturer.
   2. Airflow Monitor/Indicator Functionality:
      a. Type: A sensor module that monitors fume hood face velocity, and a display module that presents data as digital readout.
         1) Input power: 9 to 30 V AC/DC. Include power supply module or functionality.
         2) Display Range: 0 to 1,000 FPM (0 to 5.08 m/s).
         3) Alarm Condition Range: 50 to 250 FPM (0.25 to 1.27 m/s).
         4) Mounting: Flush.
         5) Readings: Remote sensor inserted in airflow stream.
         6) Accuracy: Maximum plus or minus 5 percent of set point.
         7) Visual Status Display: Green, yellow, and red LEDs.
         8) Airflow Display: Digital display of face velocity reading.
         9) Operating temperature: 55 to 86 degrees F (13 to 30 degrees C) .
   3. Airflow Alarm functionality: Audible (85 dB @ 4 inch (102 mm) distance), and visual alarm that activates when airflow sensor reading is outside of preset range.
      a. Reset and test mode.
      b. Programmable Switch: Designed to silence audible alarm and automatically reset when airflow returns to within preset range. Warning light to stay on when alarm is silenced.
      c. Capability for integration with BAS (Building Automation System) via BACnet.

B. Fume Hood Controller: Airflow Indicator/monitor with built-in electronics to control a dedicated exhaust fan and/or exhaust valve.
   1. Fume hood manufacturer's standard controller.

C. Sash Alarms: Audible and visual alarm that activates when sash is opened beyond preset position.
   1. Programmable silence and test switches.
   2. Sash Alarm integrated with Airflow Alarm.

D. Sash Stops: Spring-loaded stops to limit hood opening to 18 inches (457 mm) height. Manually releasable to open sash fully, and to reset automatically when sash is lowered below set level.

E. Bypass Grille Blank-off Panel: On bypass grille, designed for use with sash stops to reduce exhaust air volume and provide design face velocity with sash at 50 percent open position.

2.08 EXHAUST BLOWERS

A. Dedicated exhaust blower at each fume hood indicated to be individually exhausted, of airflow capacity recommended by fume hood manufacturer.
   1. Type: Direct drive.
   2. Materials: Epoxy-coated steel.
   3. Controls: On/Off using Fan switch located on fume hood post, unless indicated otherwise.
   4. Model selection coordinated with building electrical services.
   5. Model selection coordinated with expected static pressure losses in exhaust ductwork.

2.09 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.
B. Factory testing of each type of fume hood.
C. Non-Complying Work: See Section 014000.

PART 3 EXECUTION

3.01 EXAMINATION

A. Locate concealed framing, blocking, and reinforcements that support fume hoods by field measurements before being enclosed, and indicate measurements on Shop Drawings.
B. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fume hoods.
C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install fume hoods according to manufacturer's written instructions. Install level, plumb, and true; shim as required, using concealed shims, and securely anchor to building and adjacent laboratory casework. Securely attach access panels but provide for easy removal and secure reattachment. Where fume hoods abut other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.
B. Large Components: Ensure that large components can be moved into final position without damage to other construction.

C. Comply with indicated requirements for installing water and laboratory gas service fittings, and electrical and telecommunications devices.
   1. Install fittings in accordance with shop drawings, installation requirements in SEFA 2, and manufacturer's written instructions. Set bases and flanges of sink and work top-mounted fittings in sealant recommended by manufacturer of sink or work-top material. Securely anchor fittings to fume hoods.

D. Exhaust Blowers:
   1. Turn over to appropriate trade contractor(s) for installation.

3.03 FIELD QUALITY CONTROL

A. Field test fume hoods as specified below.
   1. General: Test fume hoods as installed to assess airflow velocity and level of containment. Perform tests with static mode (set sash position) conditions. Conduct testing as outlined below for hoods provided in the Project.
   2. Preparation:
      a. Inspect each fume hood to confirm its installation complies with drawings and specifications.
      b. Inspect laboratory space to verify that construction complies with drawings and specified requirements.
      c. Do not proceed with fume hood testing until an acceptable TAB report has been received.
      d. Verify that proper temperature and pressurization of the lab space can be maintained, with door(s) to the space in closed and open positions.
      e. Adjust non-complying physical and control systems until conditions favorable to testing fume hoods are present.
   3. Operating Conditions Tests:
      a. Conduct face velocity tests to confirm that target velocities are being achieved within acceptable tolerances.
      b. Conduct airflow indicator/monitor tests to confirm acceptable variation from corresponding measured value. Calibrate and adjust device to function within specified accuracy parameters.
      c. Conduct exhaust flow and static pressure tests of the HVAC system and its controls to confirm flow volume and static pressures are within acceptable tolerances.

d. In projects with VAV lab ventilation systems, conduct response time and stability tests to confirm how the HVAC supply and exhaust systems respond to different sash opening positions.
e. Conduct tests of alarm device by shutting off the fume hood exhaust and verify that the individual fume hood alarm activates and operates in specified manner.
f. Conduct tests of individual controls provided at the fume hood (such as unoccupied cycle override, alarm override, etc.) to verify they operate in specified manner.

4. Containment Performance Tests:
   a. Conduct airflow visualization tests (local smoke challenges) to provide a visual indication of fume hood's capture performance.
      1) Coordinate disabling of local fire alarm system when performing this test.
      2) Compensate for smoke discharge velocity and exposure outside of the fume hood.
      3) If required to be performed, do not proceed with the large volume challenge test if the hood has failed the local challenge test.
      4) Record a video of the test(s).
   b. Conduct tracer gas containment tests, using mannequins to confirm gas concentrations meet (are below) specified criteria.
      1) Use tracer gas agreed-upon with Owner.

B. Reporting Requirements: Comply with Section 5 of NEBB Fume Hood Testing (FHT) Standard, current edition. Organize and include, at a minimum, the following information:
   1. Report title.
   2. Report certification.
   3. Table of contents.
   4. Report summary/ remarks.
   5. Appropriate forms.
   6. Instrument calibration.
   7. List of abbreviations used.
   8. A room layout drawing for each tested item. Identify: walls; doors; fume hood(s); other present environmental enclosures (e.g. biological safety cabinet(s), laminar flow hood(s), canopy hood(s), etc.); location and airflow pattern of all air supply, return, and exhaust grilles, registers and diffusers.

3.04 ADJUSTING

A. Adjust moving parts for smooth, near silent, accurate sash operation with one hand only. Adjust sashes for uniform contact of rubber bumpers. Verify that counterbalances operate without interference.

3.05 CLEANING

A. Clean finished surfaces, including both sides of glass; touch up as required; and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

3.06 DEMONSTRATION

A. Demonstrate proper operation of fume hoods and their accessories to Owner's designated representative.

END OF SECTION

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SECTION 122400
WINDOW SHADES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior manual roller shades.

B. Interior motorized roller shades.

C. Motor controls.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

B. Section 081416 - Flush Wood Doors: Door security shade.

C. Section 262726 - Wiring Devices: Finish requirements for wall controls specified in this section.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

C. WCMA A100.1 - Standard for Safety of Window Covering Products; 2022.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Where motorized shades are to be controlled by control systems provided under other sections, coordinate the work with other trades to provide compatible products.
2. Coordinate the work with other trades to provide rough-in of electrical wiring as required for installation of hardwired motorized shades.

B. Preinstallation Meeting: Convene one week prior to commencing work related to products of this section; require attendance of affected installers.

C. Sequencing:

1. Do not fabricate shades until field dimensions for each opening have been taken with field conditions in place.
2. Do not install shades until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
   1. Motorized Shades: Include power requirements and standard wiring diagrams for specified products.
C. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.
   1. Motorized Shades: Provide schematic system riser diagram indicating component interconnections. Include requirements for interface with other systems.
D. Certificates: Manufacturer's documentation that line voltage components are UL listed or UL recognized.
E. Source Quality Control Submittals: Provide test reports indicating compliance with specified fabric properties.
F. Selection Samples: Include fabric samples in full range of available colors and patterns.
   1. Motorized Shades: Include finish selections for controls.
G. Verification Samples: Minimum size 6 inches (150 mm) square, representing actual materials, color and pattern.
H. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.
I. Project Record Documents: Record actual locations of control systems and show interconnecting wiring.
J. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.
K. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.
L. Maintenance contracts.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of this type with minimum five years of documented experience with shading systems of similar size and type.
   1. Manufacturer's authorized representative.
   2. Factory training and demonstrated experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 MOCK-UP

A. Mock-Up: Provide full size mock-up of window shade system complete with selected shade fabric including example of seams and batten pockets when applicable.
   1. Obtain Architect's approval of light and privacy characteristics of fabric prior to fabrication.
   2. Full-sized mock-up may become part of the final installation.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.

B. Handle and store shades in accordance with manufacturer's recommendations.

1.09 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.10 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
   1. Shade Hardware: One year.
   2. Electric Motors: One year.
   3. Electronic Control Equipment: One year.
   4. Fabric: One year.
   5. Aluminum and Steel Coatings: One year.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Interior Manually Operated Roller Shades: Basis of Design: Subject to compliance with requirements, provide WT Shade, An Inpro Architectural Products Company; HeliaRise Slim System manual roller shade or comparable product by one of the following;
   1. Draper, Inc: www.draperinc.com/#sle.
   2. Hunter Douglas Architectural: www.hunterdouglasarchitectural.com/#sle.
   3. Lutron Electronics Co., Inc: www.lutron.com/#sle.
   4. MechoShade Systems LLC: www.mechoshade.com/#sle.
   5. SWFcontract, a division of Springs Window Fashions, LLC.: www.swfcontract.com/#sle.
   6. Substitutions: See Section 016000 - Product Requirements.

B. Interior Motorized Roller Shades, Motors and Motor Controls: Basis of Design: Subject to compliance with requirements, provide WT Shade, An Inpro Architectural Products Company; MotoRise MR150 Slim System motorized shade or comparable product by one of the following;
   1. Draper, Inc: www.draperinc.com/#sle.
   2. Hunter Douglas Architectural: www.hunterdouglasarchitectural.com/#sle.
   3. Lutron Electronics Co., Inc.: www.lutron.com/#sle.
   4. MechoShade Systems LLC: www.mechoshade.com/#sle.
   5. SWFcontract, a division of Springs Window Fashions, LLC: www.swfcontract.com/#sle.
   6. Substitutions: See Section 016000 - Product Requirements.

C. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

2.02 ROLLER SHADES

A. General:
   1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
   2. Provide shade system that operates smoothly when shades are raised or lowered.
   3. Motorized Shades: Motor system housed inside roller tube, controlling shade movement via motor controls indicated; listed or recognized to UL 325.
      a. Comply with NFPA 70.

b. Electrical Components: Listed, classified, and labeled as suitable for the purpose intended. Where applicable, system components to be FCC compliant.
c. Motors: Size and configuration as recommended by manufacturer for the type, size, and arrangement of shades to be operated; integrated into shade operating components and concealed from view; fully compatible with controls to be installed.
d. Audible Noise: Maximum 38 dBA measured 3 feet from the motor unit; no audible clicks when motor starts and stops.

B. Interior Manual Roller Shades Type RS-2, RS-2a and RS-4:
1. Description: Single roller, manually operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and other components necessary for complete installation.
2. Drop Position: Regular roll.
3. Mounting:
a. Type RS-2: Window jamb mounted - outside, on face of jambs.
b. Type RS-4: Wall mounted.
c. Size: As indicated on drawings.
d. Fabric: Light filtering fabric. As indicated under Shade Fabric article.
e. Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
1) Hardware Type:
(a) Type RS-2: Headbox.
(b) Type RS-4: Wall clip and closure panels.
4. Roller Tubes: As required for type of shade operation; designed for removal without removing mounting hardware.
a. Material: Extruded aluminum or steel, with wall thickness and material selected by manufacturer.
b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge.
d. Capable of being removed and reinstalled without affecting roller shade limit adjustments.

e. Hembars: Designed to maintain bottom of shade straight and flat, selected from manufacturer's standard options.
   1) Style: Closed pocket; aluminum elliptical slat inside pocket with heat-sealed ends.

5. Manual Operation:
   a. Clutch Operator Location: Right side.
   b. Clutch Operator: Manufacturer's standard material and design, permanently lubricated.
   c. Drive Chain: Continuous loop, stainless steel, beaded ball chain, 95 lb (43 kg) minimum breaking strength; comply with WCMA A100.1. Provide upper and lower limit stops.
   d. Shade Lift Assistance: Manufacturer's standard spring device contained in the idler end of roller tube to reduce force required to lift shades; as required based on shade weight.
   e. Chain Retainer:
      1) Chain tensioning device complying with WCMA A100.1.
      2) Manufacturer's standard clip.
   f. Idler Assembly: Molded nylon with adjustable length idler pin or spring-loaded idler to facilitate easy installation and removal of shade for service.

6. Accessories:
   a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to mounting end caps, without exposed fasteners; powder coat finish.
      1) Color: As selected by Architect from manufacturer's full range..
   b. Exposed Headbox: Extruded aluminum, size as required to conceal shade mounting; powder coat finish.
      1) Color: As selected by Architect from manufacturer's full range.
   c. Ceiling Pockets: Premanufactured metal shade pocket for recess mounting shade hardware into ceiling. Provide removable closure panel to conceal underside of brackets and roller tubes.
   d. End Cap Covers: Match fascia or headbox finish.
   e. Fasteners: Noncorrosive, and as recommended by shade manufacturer.

C. Interior Manual Roller Shades Type RS-3:
   1. Description: Double roller, manually operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and other components necessary for complete installation.

a. Drop Position: Regular roll.
b. Mounting: Window jamb mounted - outside, on face of jambs.
c. Size: As indicated on drawings.
d. Fabric: Light filtering and blackout. As indicated under Shade Fabric article.

2. Brackets and Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
   a. Hardware Type: Headbox.
   b. Double Roller Mounting: Configured for light-filtering and blackout shades in one opening.
   c. Light-Filtering Fabric: Glass-side of opening.
   d. Blackout Fabric: Room-side of opening.
3. Roller Tubes: As required for type of shade operation; designed for removal without removing mounting hardware.
   a. Material: Extruded aluminum or steel, with wall thickness and material selected by manufacturer.
   b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
   c. Fabric Attachment: Utilize extruded channel in tube to accept vinyl spline welded to fabric edge.
   d. Capable of being removed and reinstalled without affecting roller shade limit adjustments.
4. Hembars: Designed to maintain bottom of shade straight and flat, selected from manufacturer's standard options.
   a. Style: Closed pocket; aluminum elliptical slat inside pocket with heat-sealed ends.
   b. Blackout Shades: Provide a slot in bottom bar with wool-pile light seal.
5. Manual Operation:
   a. Clutch Operator: Manufacturer's standard material and design, permanently lubricated.
   b. Drive Chain: Continuous loop, stainless steel, beaded ball chain, 95 lb (43 kg) minimum breaking strength; comply with WCMA A100.1. Provide upper and lower limit stops.
   c. Shade Lift Assistance: Manufacturer's standard spring device contained in the idler end of roller tube to reduce force required to lift shades; as required based on shade weight.

d. Chain Retainer:
    1) Manufacturer's standard clip.
6. Accessories:
    a. Light Gap Reduction Channels: Provide extruded aluminum side, center, and sill channels as required for blackout shade applications.
    b. Exposed Headbox: Extruded aluminum, size as required to conceal shade mounting; powder coat finish.
        1) Color: As selected by Architect from manufacturer's full range..
    c. Fasteners: Noncorrosive, and as recommended by shade manufacturer.

D. Interior Motorized Single Roller Shades Type RS-1.
1. Description: Single roller, motor-operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and other components necessary for complete installation.
2. Drop Position: Regular roll.
3. Mounting: Window jamb mounted - outside, on face of jambs.
4. Size: As indicated on drawings.
5. Fabric: Light filtering fabric. As indicated under Shade Fabric article.
6. Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
    a. Hardware Type: Headbox.
7. Roller Tubes: As required for type of shade operation; designed for removal without removing mounting hardware.
    a. Material: Extruded aluminum or steel, with wall thickness and material selected by manufacturer.
    b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
    c. Fabric Attachment: Utilize double-sided adhesive tape.
    d. Capable of being removed and reinstalled without affecting roller shade limit adjustments.
    e. Hembars: Designed to maintain bottom of shade straight and flat, selected from manufacturer's standard options.
        1) Style: Closed pocket; aluminum elliptical slat inside pocket with heat-sealed ends.
8. Shade Motor: Quiet 120V AC motor (sound level of 38 dBA or less), located as indicated on drawings.
9. Accessories:

a. Fascia: Extruded aluminum, size as required to conceal shade mounting, attachable to mounting end caps, without exposed fasteners; powder coat finish.
   1) Color: As selected by Architect from manufacturer's full range.
b. Exposed Headbox: Extruded aluminum, size as required to conceal shade mounting; powder coat finish.
   1) Color: As selected by Architect from manufacturer's full range.
c. Fasteners: Noncorrosive, and as recommended by shade manufacturer.

2.03 SHADE FABRIC

A. General:
   1. Flammability: Nonflammable, pass NFPA 701 large and small tests.
   2. Impervous to heat and moisture, and able to retain its shape under normal operation.
   3. Material Certifications and Product Disclosures:
      a. Fungal Resistance: No growth when tested according to ASTM G21.
      b. Low-Emitting Material Certification: Greenguard Gold certified and listed in UL (GGG).
      c. Health Product Declaration (HPD): Complete, published declaration with full disclosure of known hazards.
      d. Declare label.
B. Fabric for Light-Filtering Shades, Types RS-1, RS-2, and RS-3.
   1. Product: Basis-of-Design; Subject to compliance with requirements, provide Mermet Corporation; E Screen-3% or comparable product.
      a. Substitutions: See Section 016000 - Product Requirements.
   2. Material: Woven fiberglass and vinyl.
   3. Weave: Basketweave.
   4. Openness Factor: 3 percent.
   5. Weight: Not less than 12 ounces per square yard (393 grams per square meter).
   6. Roll Width: Not less than 78 inches (1981 mm).
   7. Color: As selected by Architect from manufacturer’s full range of colors.
   8. Fabrication:
      a. Fabric Orientation: Up the bolt.
C. Fabric for Privacy Shades, Types RS-2a and RS-4.
   1. Product: Basis-of-Design; Subject to compliance with requirements, provide Mermet Corporation; E Screen-1% or comparable product.

a. Substitutions: See Section 016000-Product Requirements.

2. Material: Woven fiberglass and vinyl.
3. Weave: Basketweave.
4. Openness Factor: 1 percent or less.
5. Weight: Not less than 13 ounces per square yard (452 grams per square meter).
6. Roll Width: Not less than 78 inches (1981 mm).
7. Color: As selected by Architect from manufacturer's full range of colors.
8. Fabrication:
   a. Fabric Orientation: Up the bolt.

D. Fabric for Blackout Shades, Type RS-3 and RS-7.
1. Product: Basis-of-Design; Subject to compliance with requirements, provide Mermet Corporation; Flocke or comparable product.
   a. Substitutions: See Section 016000-Product Requirements.
2. Material: Textured fiberglass and vinyl with cotton flock backing.
3. Openness Factor: Zero percent.
4. Thickness: Not less than 0.20 inches (0.51 mm).
5. Weight: Not less than 15.93 ounces per square yard (540 grams per square meter).
6. Roll Width: Not less than 94 inches (2387 mm).
7. Color: As selected by Architect from manufacturer's full range of colors.
8. Fabrication:
   a. Fabric Orientation: Up the bolt.

2.04 MOTOR CONTROLS

A. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system that provides the control intent indicated.

B. Provide all components and connections necessary to interface with other systems as indicated.

C. Manual Controls:
1. Control Functions:
   a. Open: Automatically open controlled shade(s) to fully open position when button is pressed.
   b. Close: Automatically close controlled shade(s) to fully closed position when button is pressed.

c. Raise: Raise controlled shade(s) only while button is pressed.
d. Lower: Lower controlled shade(s) only while button is pressed.
e. Presets: For selection of predetermined shade positions.

2. Wall Controls: Provided by shade manufacturer.
   a. Finish: To be selected by Architect.
   b. Button Engraving: Manufacturer's standard engraving, unless otherwise indicated.
   c. Location: Where indicated on drawings.
   d. Programming: Support control of any individual shade or shade group/sub-group in system; customizable button actions.
   e. Power: Low-voltage; NFPA 70, Class 2.
   f. Wired Communications: Low-voltage; RS485.
   g. Style: Architectural Non-Insert Style.
   h. Backlighting: Illuminate buttons and associated engraving; programmable light intensity.
   i. Field-Changeable Replacement Kits: Support field-customization of button color, configuration, and engraving.
   j. Contact Closure Interface: Two contact closure inputs with function independent of buttons.
   k. Products: Basis-of-Design; Subject to compliance with requirements, provide Lutron Electronics, Inc; seeTouch QS Wallstation or comparable product.
      1) Substitutions: See Section 016000 - Product Requirements.
3. Handheld Remote Controls: Battery-powered; wireless (radio frequency) or infrared; provided by shade manufacturer.
   a. Wireless (Radio Frequency) Range: 30 feet (9 m).
   b. Finish: To be selected by Architect.
   c. Quantity: One per each room.
   d. Location: Where directed by Architect.
   e. Programming: Support control of any individual shade or shade group in system.
   f. Mounting: Support mounting on table stand or directly to wall under faceplate with concealed mounting hardware.
   g. Battery Life: 10 years.
   h. Configurations:

1) 3-Button with raise/lower control and shade (text) button marking.

i. Products: Basis-of-Design; Subject to compliance with requirements, provide Lutron Electronics, Inc; Pico Wireless Control or comparable product.

1) Substitutions: See Section 016000 - Product Requirements.

2.05 ROLLER SHADE FABRICATION

A. Field measure finished openings prior to ordering or fabrication.

B. Dimensional Tolerances: Fabricate shades to fit openings within specified tolerances.

1. Vertical Dimensions: Fill openings from head to sill with 1/2 inch (13 mm) space between bottom bar and window stool.
2. Horizontal Dimensions - Inside Mounting: Fill openings from jamb to jamb.
3. Horizontal Dimensions - Inside Mounting: Provide symmetrical light gaps on both sides of shade not to exceed 3/4 inch (19.05 mm) total.
4. Horizontal Dimensions - Outside Mounting: Extend shades 2 inches (50 mm) beyond jambs on each side.

C. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine finished openings for deficiencies that may preclude satisfactory installation.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Start of installation shall be considered acceptance of substrates.

3.02 PREPARATION

A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.

B. Coordinate with window installation and placement of concealed blocking to support shades.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.

B. Replace shades that exceed specified dimensional tolerances at no extra cost to Owner.

C. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.04 SYSTEM STARTUP

A. Motorized Shade System: Provide services of a manufacturer's authorized representative to perform system startup.

3.05 CLEANING

A. Clean soiled shades and exposed components as recommended by manufacturer.

B. Replace shades that cannot be cleaned to "like new" condition.

3.06 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate operation and maintenance of window shade system to Owner's personnel.

D. Training: Train Owner's personnel on operation and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours training by manufacturer's authorized personnel at location designated by the Owner.

3.07 PROTECTION

A. Protect installed products from subsequent construction operations.

B. Touch-up, repair, or replace damaged products before Substantial Completion.

3.08 MAINTENANCE

A. See Section 017000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide to Owner, a proposal as an alternate to the base bid, a separate renewable maintenance contract for the service and maintenance of a motorized shade system for one year from date of Substantial Completion. Include a complete description of preventive maintenance, systematic examination, adjustment, parts and labor, cleaning, and testing, with a detailed schedule.

END OF SECTION

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SECTION 123553.13

METAL LABORATORY CASEWORK

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Standard and custom metal cabinets and cabinet hardware.
B. Lab Tables.
C. Acid storage cabinets.
D. Flammable storage cabinets.
E. Ceiling service panels.
F. Countertops.
G. Laboratory sinks.
H. Pegboards.
I. Laboratory emergency equipment plumbing fixtures.
J. Service fittings and outlets.

1.02 RELATED REQUIREMENTS

A. Section 061053 - Miscellaneous Rough Carpentry: Blocking and nailers for anchoring casework.
B. Section 092116 - Gypsum Board Assemblies: Reinforcements in metal-framed partitions for anchoring casework.
C. Section 224000 - Plumbing Fixtures: Non-laboratory sinks.

1.03 REFERENCE STANDARDS

A. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).
B. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment; 2014.
C. ASTM A513/A513M - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing; 2020a.
D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.

F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.
G. ASTM C1036 - Standard Specification for Flat Glass; 2021.
H. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
I. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
J. ASTM D522/D522M - Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings; 2017 (Reapproved 2021).
K. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.
L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
M. BHMA A156.9 - Cabinet Hardware; 2020.
N. NFPA 30 - Flammable and Combustible Liquids Code; 2024.
O. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
P. SEFA 1 - Laboratory Fume Hoods; 2010.
Q. SEFA 2 - Installations; 2010.
R. SEFA 3 - Laboratory Work Surfaces; 2020.
S. SEFA 7 - Laboratory Fixtures; 2021.
T. SEFA 8M - Laboratory Grade Metal Casework; 2020.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate installation of casework with related items.
   1. Service Fixtures: Coordinate location and characteristics of service connections.
   2. Equipment and Instruments: Coordinate installation of casework with equipment, scientific instruments, and fume hoods.
B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
C. Keying Conference: Conduct conference prior to ordering keys. Incorporate conference decisions into keying submittal.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Details of materials, component dimensions and configurations, construction details, joint details, attachments; manufacturer's catalog literature on hardware and keying, accessories, and service fittings, if any.

C. Shop Drawings: Indicate casework types, sizes, and locations, using large scale plans, elevations, and cross sections. Include rough-in and anchors and reinforcements placement dimensions and tolerances, clearances required, and utility locations, if any. Include coordinated information for laboratory equipment specified in another section and/or furnished by Owner.

D. Samples For Color Selection: Color charts for each different finish material.

E. Test Reports: Independent laboratory reports showing compliance with chemical and physical resistance requirements for casework finish.

F. Manufacturer's Installation Instructions.

G. Manufacturer's qualification statement.

H. Installer's qualification statement.

I. Maintenance Data: Manufacturer's recommendations for care and cleaning.

J. Finish touch-up kit for each type and color of materials provided.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect items provided by this section, including finished surfaces and hardware items during handling and installation. For metal surfaces, use polyethylene film or other protective material standard with the manufacturer.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 5-year warranty against defects. Complete forms in Owner's name and register with manufacturer. Covered defects include, but are not limited to:

1. Ruptured, cracked, or stained finish coating.
2. Discoloration, or lack of finish integrity.
3. Cracking or peeling of finish.
4. Weld or any other structural failure.

5. Failure of hardware.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Laboratory Casework: Basis-of-Design; Subject to compliance with requirements, provide Kewaunee Scientific Corporation, Research Collection or comparable units.
   1. Substitutions: See Section 016000 - Product Requirements.
B. Countertops and Sinks: Subject to compliance with requirements, provide Kewaunee Scientific Corporation, Kemresin countertops with integral sinks or one of the following or comparable product;
   1. Durcon (Epoxy resin): www.durcon.com/#sle.
   2. Symbiote Inc: www.symbiote.com/#sle.
   3. Substitutions: See Section 016000 - Product Requirements.
C. Water and Gas Service Fittings: Subject to compliance with requirements, provide one of the following or comparable product;
   1. Broen-Lab A/S: www.broen-lab.com/#sle.
   2. Chicago Faucets, a Geberit company: www.chicagofaucets.com/#sle.
   3. WaterSaver Faucet Co: www.wsflab.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.
D. Obtain casework from single source and manufacturer, unless otherwise indicated.

2.02 METAL LABORATORY CASEWORK

A. Casework: Die-formed metal sheet; each unit self-contained and not dependent on adjacent units or building structure for rigidity; factory-fabricated, factory-assembled, and factory-finished.
   1. Style: Flush overlay - square edge.
   2. Primary Cabinet Material: Galvanized steel.
   3. Cabinet Nominal Dimensions: Unless otherwise indicated, provide cabinets of widths and heights indicated on drawings, and with following front-to-back dimensions.
      a. Base Cabinets: 22 inch (559 mm).
      b. Tall Cabinets: 16 inch (406 mm).
      c. Upper Cabinets: 13 inch (330 mm).
   4. Steel Sheet Metal:
      a. Gables, Front and Back Panels, Gusset Plates, Aprons, and Rails: 18 gauge, 0.0478 inch (1.21 mm) minimum thickness.

b. Drawers, Cabinet Floors, Shelves, Filler Panels and Drawer Dividers: 20 gauge, 0.0359 inch (0.91 mm) minimum thickness.
c. Backing Sheet to Door and Door Fronts: 22 gauge, 0.0299 inch (0.76 mm) minimum thickness.

5. Structural Performance: In addition to the requirements of SEFA 3, SEFA 7 and SEFA 8M, provide components that safely support the following minimum loads, without deformation or damage:
   a. Base Units: 500 pounds per linear foot (744 kg/linear m) across the cabinet ends.
   b. Suspended Units: 300 pounds (136 kg), minimum, static load.
   c. Tables: 300 pounds (136 kg) on four legs.
   d. Drawers: 125 pounds (57 kg).
   e. Hanging Upper Cases: 300 pounds (136 kg).
   f. Shelves: 100 pounds (45 kg).
6. Corners and Joints: Without gaps or inaccessible spaces or areas where dirt or moisture could accumulate.
7. Edges and Seams: Smooth. Form counter tops, shelves, and drain boards from continuous sheets.
8. Shelf Edges: Turned down 3/4 inch (19 mm) on each side and returned 3/4 inch (19 mm) front and back.
9. Ends: Close open ends with matching construction.
10. Welding: Electric spot welded; joints ground smooth and flush.
11. Drawers and Doors: Fabricate drawer and door fronts of sandwiched sheets of sheet steel welded together and reinforced for hardware.
    a. Fill with sound-deadening core.
12. Shelves: Adjustable and fixed shelves formed down 3/4 inch (19 mm), returned back 7/8 inch (22 mm), and up 1/4 inch (6 mm) into a channel shape, front and rear; formed down 3/4 inch (19 mm) at each end. Shelves over 42 inches (1067 mm) long reinforced with a channel welded to underside of shelf.
13. Fittings and Fixture Locations: Cut and drill countertops, backs, and other casework components for service outlets and fixtures.
14. Access Panels: Where indicated, for maintenance of utility service fixtures and fittings and mechanical and electrical components.
15. Removable back panels on indicated base cabinets. Partial height back panels at sink cabinets.

16. Fixed panels at backs of open spaces between base cabinets and at ends of utility spaces not otherwise enclosed.
    a. Cutouts for power receptacles where indicated on drawings.
17. Removable cabinet bottoms, dished to contain spills.
18. Filler Panels: Flanged on both sides, of matching construction and finish, for locations where cabinets do not fit tight to adjacent construction.
19. Scribe Panels: Similar to filler panels, except flanges on one side and flat on the other, of matching construction and finish.
20. Surface Finish on Sheet Steel: With chemical resistance equal to Level 0 (no change) or Level 1 (slight change of gloss or slight discoloration) according to SEFA 8M. Test applied finishes using procedures specified in ASTM D522/D522M.
    a. Coating Type: Baked on epoxy; minimum two coats.
    b. Color: As selected from manufacturer's standard selection.
    c. Preparation: Degrease and phosphate etch, and prime.
21. Stainless Steel Finish: No.4, brushed finish.
22. Separation: Use bituminous paint or non-conductive tape to coat metal surfaces in contact with cementitious materials, and to separate dissimilar metals.

B. Acid Storage Cabinets **(EQ02)**: High Density Polyethylene (HDPE) Cabinet:
    1. Basis-of-Design Product: JustRite Acids/Corrosives Plastic Safety Cabinet, Model #24180
    2. Capacity: 36, 2.5 liter bottles
    3. Dimensions, exterior: 35" high, 36" wide, 25" deep
    4. Construction: No metal parts, full plastic construction
    5. Shelves: Perforated or vented, with channels to direct spills to sump; adjustable on 3" increments, with load capacity of 125
    6. Bottom Pan: Removable sump cover.
    7. Sump: fully-integrated, leakproof, 8.5 gallon capacity
    8. Vents: Comply with SEFA 1.
        a. Locate acid storage cabinet vents in accordance with manufacturer's instructions.
        b. Vent base cabinets through work surface with manufacturer's vent kit.
        c. Vent each acid storage cabinet separately.
        d. When acid storage cabinets are installed below fume hoods, provide louvered cabinet doors.

e. Seal penetrations with chemical resistant sealant.

C. Flammable Storage Cabinets **(EQ01)**: Construction identical to other cabinets, with following exceptions:

1. Product Basis of Design: SciMatCo Inc. Model No. SC7023, Floor Flammables Cabinet, Self-closing Doors
2. Size: As indicated on Drawings
3. Capacity: 30 gallons
4. Construct to NFPA 30 and applicable OSHA requirements.
5. Fire Resistance: Maximum internal temperature of 325 degrees F (163 degrees C) at the center, and 1 inch (25.4 mm) from top of the cabinet when cabinet is subjected to a ten minute fire test that simulates fire exposure of a standard time-temperature curve specified in ASTM E119.
6. Steel sheet, 18 gauge, 0.0478 inch (1.21 mm) minimum thickness, double panel construction with 1-1/2 inch (38 mm) space between panels and electrical grounding connection.
7. Shelves: Full depth, adjustable sloped metal shelf.
8. Bottom Pan: 2 inches (50.8 mm) deep liquid-tight pan covering entire bottom of cabinet.
9. Cabinet Hardware: UL-listed.
    a. Hinges: Overlay concealed 170 degree swing.
    b. Manual-closing Doors: 180 degree opening. Three-point latch arrangement, self-latching when pushed closed.
    c. Door Handles: Manufacturer's standard, with slip-resistant grip.
        1) Provide manufacturer's standard cylinder lock and key set.
    d. Grounding screw-lug.
10. Vents: Provide venting capable of achieving at least ten air changes per hour.
    a. Tie into building hazardous exhaust system.
    b. Vent Connections: 1-1/2 inch (38 mm) minimum diameter, corrosion resistant piping having flame spread index of 25 or less, when tested in accordance with ASTM E84.
    c. Vent each cabinet separately with sufficient mixing distance for incompatible chemicals.
    d. Provide minimum of two vents with fire arrestors for each cabinet.
11. Signage: Provide manufacturer's standard signage reading "FLAMMABLE - KEEP FIRE AWAY" or similar message in bright red color.

D. Lab Tables **(EQ05)**: Include fixed height units.
   1. Fixed Height Table Construction: Manufacturer's standard, with epoxy resin countertops, unless noted otherwise.
      a. Formed metal skirting panels welded into a rigid frame. Corners notched and reinforced to receive manufacturer's standard square metal tubular legs, bolted securely in place.
      b. Table Bracing: Removable tube members, in size standard with the manufacturer, installed between legs in manufacturer's standard configuration. Removable bracing designed to be mechanically fixed to concealed U-shaped mounting tabs that are integral with each leg.
      c. 3/8 inch (10 mm) leveling devices.
      d. Slip-on type black PVC shoes.
   2. Primary Materials: Manufacturer's standard for each component.
      a. Tubing: Hot-rolled steel, ASTM A513/A513M.
      b. Sheet Metal: Cold-rolled steel, ASTM A1008/A1008M.
      c. Metal Finish Color: As selected by Architect from manufacturers full range.

E. Ceiling Service Panels **(EQ08)**: Designed to integrate into acoustical panel suspension grids for delivering multiple plumbing and electrical services.
   1. Fabricated to fit in standard 24 inches by 24 inches (600 mm by 600 mm) ceiling grids.
   2. Enclosure Material: 18 gauge sheet steel with chemical-resistant finish specified herein.
   3. Required Fitting Types: Quick-connect fittings and hoses.
      a. Provide (4) duplex power receptacles and (2) gas connections at each service panel
   4. Service Panel Types: Pre-punched panels accepting groups of services.
   5. Quick-Connect Fittings with twist-lock plugs: Male and female types, suitable for service connected, 3/8 inch NPS (10 mm DN).
      a. Provide in up to eight different sizes (keys) to prevent connecting to wrong service.
   6. Accessories:
      a. Service Hoses.
         1) Braided Stainless Steel Hoses: Provide for natural and reactive gases, 3/8 inch NPS (10 mm DN) female inlet and 3/8 inch NPS (10 mm DN) male outlet. 36 inch (914 mm) length.

b. Power Cords.
   1) Single-circuit, 3-wire, 20 AMP/120 VAC, 36 inches (914 mm) long, with Standard Blade plugs.
   2) Dual-circuit, 4-wire, 20 AMP/120 VAC, 36 inches (914 mm) long, with Standard Blade plugs.

F. Table Top Service Box **(EQ07)**:
   1. Table-top unit designed to receive utility drops from Ceiling Service Panel
   2. Mounting: Unit shall mount to Lab Tables with mounting bolts and rest on rubber feet.
   3. Fabrication:
      a. Unit shall be constructed of aluminum or steel, with manufacturer's baked-on/powder-coat finish matching metal casework finish.
      b. Unit shall have an internal divider to separate utility types
      c. Unit shall be pre-wired and pre-piped from factory including electrical boxes, receptacles, cover plates, gas turrets and quick-connect twist-lock fittings.
      d. Top of Unit shall have quick disconnect for gas service and electrical cords shall be hard-wired into Unit.

2.03 CABINET HARDWARE

A. Manufacturer's standard styles.

B. Comply with BHMA A156.9 requirements.
   1. Acceptable base materials for plated finishes include brass, bronze, and steel.

C. Finish of exposed stainless steel components: No.4 finish.

D. Locks: On casework drawers and doors, where indicated. Lock with 5 pin cylinder and 2 keys per lock.
   1. Hinged Doors: Cam type lock, bright chromium plated over nickel on base material.
   2. Tall Hinged Doors: Three-point latching system.
   3. Keying: Key locks alike within a space; key each room separately.
   4. Master Key System: All locks operable by master key.

E. Shelves in Cabinets:
   1. Shelf Standards and Rests: Vertical standards with rubber button fitted rests, satin chromium plated over nickel on base material.

F. Swinging Doors:
   1. Hinges: Butt, number as required by referenced standards for width, height, and weight of door.

a. Butt Hinges for Inset Doors: five-knuckle, projecting barrel, minimum 2-1/2 inches long (five-knuckle, projecting barrel, minimum 64 mm long). Stainless steel with No.4 finish.

2. Catches: Magnetic.
3. Pulls: Chrome-plated brass wire pulls, 4 inches (102 mm) wide.

G. Drawers:

1. Pulls: Stainless steel wire pulls, 4 inches wide (102 mm wide).
2. Slides: Steel, full extension arms, ball bearings; self-closing; capacity as recommended by manufacturer for drawer height and width.

2.04 COUNTERTOPS

A. Countertops:

1. Epoxy Resin Countertops: Filled epoxy resin molded into homogenous, non-porous sheets; no surface coating and color and pattern consistent throughout thickness; with integral or adhesively seamed components.
   a. Flat Surface Thickness: 1 inch (25 mm), nominal.
   b. Surface Finish: Smooth, non-glare.
   c. Color: Black.
   d. Exposed Edge Shape: 3/16 inch (5 mm) radius corner.
   e. Drip Edge: Drip groove 1/8 inch (3 mm) wide and deep, located 1/2 inch (12 mm) back from edge on underside of each exposed edge.
   f. Back and End Splashes: Same material, same thickness; separate for field attachment.
   g. Fabricate in accordance with manufacturer's standard requirements.

2.05 SINKS

A. Laboratory sinks.

1. General: Molded in 1-piece with smooth surfaces, coved corners and bottom sloped to outlet.
2. Sink types and sizes are indicated on drawings.
3. Sink : Single-bowl.
   a. Material: Epoxy, min. 1/2" thick.
   b. Mounting: Undermount.
   c. Standard Sink Size: 18" wide by 15" front-to-back by 11" deep.
   d. ADA Sink Size (Provide (1) ADA type sink at each room): 25" wide by 15" front-to-back x 5" deep.

e. Outlet: polypropylene strainer and 1-1/2 inch NPS (40 mm DN) outlet with tailpiece.

1) Placement: Center.

2.06 PEGBOARDS **(EQ04)**

A. Epoxy pegboards with pre-drilled or punched holes in a staggered pattern, designed to accept removable white polypropylene pegs, included. With each pegboard include a stainless steel drip-trough with drain outlet and matching diameter 36 inch (914 mm) long PVC drain hose.

1. Pegboard Size: 30 inches wide by 30 inches high (762 mm wide by 762 mm high).
2. Peg Size: 1/2" diameter
3. Accessories: Screen insert.

2.07 GOGGLE CABINET **(EQ06)**

A. Product Basis of Design: Sellstrom Model 2000 monitor cabinet

B. Size: 24 1/2" x 32" x 9 1/2"

C. Characteristics: Painted metal cabinet for the storage and cleaning of goggles. Electrified, UV light cleaning process.

2.08 LABORATORY EMERGENCY EQUIPMENT PLUMBING FIXTURES

A. General: Provide emergency equipment products complying with requirements of ANSI Z358.1.

B. Eyewash/Safety Shower Combination Units **(EQ09)**: Floor-mounted and Overhead braced.

1. Cover/Eyewash Drain Pan: Combination fixture, with projecting activation handle requiring grasping and pulling down into operating position for activation.
   a. Plug-type valve designed to open orifice and activate water flow only when unit is swung down into operational position
   b. Twin eyewash heads mounted on supply arms, with internal flow control, and filter.
   c. Operation: Push lever with sign reading: "Push to Operate", single motion activation, stays active hands-free once activated
2. Shower Head: 10 inch (254 mm) diameter made of ABS plastic, with 20 gallons per minute (4.15 L/s) flow control.
   a. Mounting: Below finished ceiling. Include vertical supply pipe and ceiling escutcheon.
   b. Operation: 1" ball valve operated by rigid pull-rod and easy to grip handle

3. Product Basis-of-Design:
    a. WaterSaver Model SS902 or equal as determined by Architect

2.09 SERVICE FITTINGS

A. General: Comply with requirements of SEFA 7.

B. Gas Service Fittings and Fixtures.
    1. Laboratory Gas Fitting :
        a. Valve: Forged or cast brass body, 90 degree inlet - outlet configuration, with polished chrome with clear epoxy coating finish.
        b. Control: Ball valve.
        c. Mounting: Panel (vertical surface).
        d. Supply Gas: Propane.
        e. Inlet: 3/8 inch NPS (10 mm DN) NPT.
        f. Outlet: Manufacturer's standard, with removable seven-serration hose end.
            1) Number: One.
        g. Handle: Manufacturer's standard four-arm handle with color-coded index disc.

C. Water Service Fittings and Fixtures.
    1. Water, Mixing Faucet :
        a. Valve: Forged or cast brass body, 180 degree inlet - outlet configuration, with polished chrome finish.
        b. Mounting: Panel (vertical surface).
        c. Inlet: 1 3/16 inch (30 mm) male shank with two 3/8 inch (9.5 mm) outside diameter flexible copper tubes.
        d. Provide vacuum breaker integrated into gooseneck.
        e. Gooseneck: Rigid gooseneck, with 6 inch (153 mm) spread, anti-splash serrated hose end.
        f. Handles: Manufacturer's standard wrist-blade handle with color-coded index disc.
    2. Escutcheons: Stainless steel.

D. Electrical Fittings and Fixtures:
    1. Electrical Fittings, General: Types indicated, for mounting on laboratory casework, including, as appropriate, grounding screws, and mounting accessories and fasteners.
    2. Recessed Boxes: Plated steel.
    3. Electrical Power Fitting :

a. General: 3-wire polarized receptacles meeting requirements of NFPA 70.
b. Mounting: Flush, recessed.
c. Receptacles: Duplex, 5-20R, GFCI.
d. Twist-Lock Receptacles: Single, L6-20R, GFCI.
e. Orientation: Single face.
f. Voltage: 120 V.
g. Service: Normal power.
h. Receptacle Color: White.
i. See electrical drawings for circuiting.

4. Electrical Switch Fitting :
   a. Switch: Single pole.
   b. Orientation: Single face.
   c. Switch Color: White.
   d. Special Function: Pilot-light, with LED handle, illuminated when the switch is off.
   e. Pedestal Color: Select from laboratory casework manufacturer's standards.
5. Electrical Outlet Covers: Stainless steel.

2.10 MATERIALS

A. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, CS or FS Type B, with G90/Z275 coating; stretcher leveled.
B. Stainless Steel Sheet: ASTM A666, Type 304.
C. Solid Epoxy Resin: Modified epoxy resin and non-asbestos inert fillers cast into sheets.
D. Glass: Fully tempered float; ASTM C1036, Type 1, Quality Q3; ASTM C1048, tempered using horizontal tempering and complying with ANSI Z97.1; 3/16 inch (4.5 mm) thick minimum; exposed edges ground, and cut or drilled to receive hardware; clear.
E. Sealant For Use in Casework Construction: Manufacturer's recommended type.
F. Sealant For Use in Casework Installation:
   1. Manufacturer's recommended type.

2.11 FINISHES

A. Sheet Steel Finish: Having chemical resistance equal to Level 0 (no change) or Level 1 (slight change of gloss or slight discoloration) according to SEFA 8M. Test applied finishes using procedures specified in ASTM D522/D522M.

1. Coating Type, New Casework: Baked on epoxy; minimum two coats.
2. Coating Type, Refinishing of Existing Casework: Electrostatically applied enamel; minimum two coats.
3. Color: As selected from manufacturer's standard selection.
4. Preparation: Degrease and phosphate etch, and prime.

B. Stainless Steel Finish: No.4, brushed finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of support framing and anchors.

B. Verify that service connections are correctly located and of proper characteristics.

3.02 INSTALLATION

A. Perform installation in accordance with manufacturer's instructions and with SEFA 2.

B. Large Components: Ensure that large components can be moved into final position without damage to other construction.

C. Use anchoring devices to suit conditions and substrate materials encountered. Use concealed fasteners to the greatest degree possible. Use exposed fasteners only where allowed by approved shop drawings, or where concealed fasteners are impracticable.

D. Set casework items plumb and square, securely anchored to building structure, with no distortion.

1. Base Cabinets: Examine floor levelness and flatness of installation space. Do not proceed with installation if encountered floor conditions required more than 3/4 inch (19 mm) leveling adjustment. When installation conditions are acceptable, for each space, establish the high point of the floor. Set and make level and plumb first cabinet in relation to this high point.
2. Wall Cabinets: Examine wall surfaces in installation space. Do not proceed with installation if the following conditions are encountered:
    a. Maximum variation from plane of masonry wall exceeds 1/4 inch in 10 feet (6 mm/3 m) and 1/2 inch in 20 feet (13 mm/6 m) or more, and/or maximum variation from plumb exceeds 1/4 inch (6 mm) per story.
    b. Maximum variation of finished gypsum board surface from true flatness exceeds 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

E. Align cabinets to adjoining components, install filler and/or scribe panels where necessary to close gaps.

F. Fasten together cabinets in continuous runs, with joints flush, uniform and tight. Misalignment of adjacent units not to exceed 1/16 inch (1.6 mm). In addition, do not exceed the following tolerances:
   1. Variation of Tops of Base Cabinets from Level: 1/16 inch (1.6 mm) in 10 feet (3 m).
   2. Variation of Bottoms of Upper Cabinets from Level: 1/8 inch (3 mm) in 10 feet (3 m) .
   3. Variation of Faces of Cabinets from a True Plane: 1/8 inch (3 mm) in 10 feet (3 m).
   4. Variation of Adjacent Surfaces from a True Plane (Lippage): 1/32 inch (0.8 mm).
   5. Variation in Alignment of Adjacent Door and Drawer Edges: 1/16 inch (1.6 mm).

G. Secure upper and floor cabinets to concealed reinforcement at gypsum board assemblies.

H. Separate dissimilar metals to prevent galvanic action.

I. Service Space Framing: Anchor to floor with two fasteners at each frame. Fasten to wall substrates.

J. Base Cabinets: Fasten cabinets to service space framing and/or wall substrates, with fasteners spaced not more than 16 inches (407 mm) on center. Bolt adjacent cabinets together with joints flush, tight, and uniform.
   1. Where base cabinets are installed away from walls or service space framing, anchor to floor at toe space at not more than 24 inches (610 mm) on center, and at sides of cabinets with not less than two fasteners per side.

K. Wall Cabinets: Fasten to hanging strips, and/or wall substrates. Fasten each cabinet through back, near top, at not less than 16 inches (407 mm) on center.

L. Install hardware uniformly and precisely. Set hinges snug and flat in mortises.

M. Vented Cabinets: Install in strict compliance with manufacturer's written installation instructions.
   1. Install vent kits and connect to exhaust system.
   2. Use only rigid materials for venting. No flexible materials permitted.
   3. Plug vent openings in unvented cabinets with manufacturer's standard closure.

N. Replace units that are damaged, including those that have damaged finishes.

O. Coordinate installation of work of this section with installation of fume hoods and laboratory equipment.

P. Countertops: Install countertops in one true plane, with ends abutting at hairline joints, and no raised edges.

Q. Deliver sinks, cup sinks, and service fittings in properly marked boxes, accompanied with written instructions, for supervised installation by appropriate trade contractor(s).

3.03 ADJUSTING

A. Adjust operating parts, including doors, drawers, hardware, and fixtures to function smoothly.

3.04 CLEANING

A. Clean casework and other installed surfaces thoroughly.

3.05 PROTECTION

A. Do not permit finished casework to be exposed to continued construction activity.

B. Protect casework and countertops from ongoing construction activities. Prevent installers from standing on or storing tools and materials on casework or countertops.

C. Repair damage that occurs prior to Date of Substantial Completion, including finishes, using methods prescribed by manufacturer; replace units that cannot be repaired to like-new condition.

END OF SECTION

SECTION 123600
COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Countertops for architectural cabinet work.

B. Wall-hung counters and vanity tops.

C. Solid surface window sills.

1.02 RELATED REQUIREMENTS

A. Section 061053 - Miscellanesous Rough Carpentry: Blocking.

B. Section 064100 - Architectural Wood Casework.

C. Section 092116 - Gypsum Board Assemblies: Wall mounted countertop support framing.

D. Section 123553.13 - Metal Laboratory Casework: Laboratory countertops.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

B. AWI (QCP) - Quality Certification Program; Current Edition.

C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

D. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

E. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

F. PS 1 - Structural Plywood; 2023.

G. SEFA 3 - Laboratory Work Surfaces; 2020.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.

D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

F. Sustainable Design Submittal: Documentation for sustainably harvested wood-based components.
G. Test Reports: Chemical resistance testing, showing compliance with specified requirements.
H. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
I. Installer's qualification statement.
J. Installation Instructions: Manufacturer's installation instructions and recommendations.
K. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Natural Stone Institute (NSI) Accredited Natural Stone Fabricator; www.naturalstoneinstitute.org/#sle.
B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.
C. Quality Certification:
    1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
    2. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) requirements for grade or grades specified.
    3. Provide designated labels on shop drawings as required by certification program.
    4. Provide designated labels on installed products as required by certification program.
    5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.
B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.07 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOPS AND WINDOW

A. Quality Standard: Premium Grade, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.

B. Quality Standard: SEFA 3 for laboratory worksurfaces.

C. Wood Countertops: One-piece, glued-laminated under pressure.

1. Thickness: 1-1/4 inch (32 mm), minimum, unless indicated otherwise.
2. Construction (Butcher Block): Maximum 1/2 inch (12 mm) thick strips glued perpendicular to surface.
3. Species: Maple; clear grade.
4. Exposed Edges: Rounded to approximately 3/8 inch (9 mm) radius.
5. Back and End Splashes: Same material, same construction; 3/4 inch (19 mm) thick, square edges.
6. Finish: Sanded smooth; two coat boiled linseed oil rubbed in with 48 hours between coats.
7. Fabricate in accordance with AWI/AWMAC/WI (AWS), Section 11 - Countertops, Premium Grade.

D. Solid Surfacing Countertops and Window Sills: Solid surfacing sheet or plastic resin casting over continuous substrate.

1. Flat Sheet Thickness: 1/2 inch (12 mm), minimum.
2. Total Sheet Thickness:
    a. Countertops: 1 inch (25 mm).
    b. Window Sills: 1/2 inch (13 mm).
3. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
    a. Manufacturers: Subject to compliance with requirements, provide countertops by one of the following manufacturers;
        1) Avonite Surfaces: www.avonitesurfaces.com/#sle.
        2) Dupont: www.corian.com/#sle.
        3) Formica Corporation: www.formica.com/#sle.
        4) Wilsonart: www.wilsonart.com/#sle.
        5) Substitutions: See Section 016000 - Product Requirements.

b. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
c. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
d. Color and Pattern: As selected by Architect from manufacturer's full line.

4. Other Components Thickness: 1/2 inch (12 mm), minimum.
5. Exposed Edge Treatment: Built up to minimum 1-1/4 inch (32 mm) thick; square edge; use marine edge at sinks, unless indicated otherwise.
6. Back and End Splashes: Same sheet material, square top; minimum 4 inches (102 mm) high.
7. Skirts: As indicated on drawings.
8. Fabricate in accordance with AWI/AWMAC/WI (AWS), Section 11 - Countertops, Premium Grade.

2.02 MATERIALS

A. Wood-Based Components:
1. Wood fabricated from old growth timber is not permitted.

B. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch (19 mm) thick; join lengths using metal splines.

C. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

D. Joint Sealant: Mildew-resistant silicone sealant, clear.

2.03 ACCESSORIES

A. Fixed Floating Wall Mount Countertop Support Brackets:
1. Material: Steel.
2. Finish: Manufacturer's standard, factory-applied, textured powder coat.
3. Color: Black.
4. Products: Subject to compliance with requirements, provide the following or comparable product.
a. Centerline Brackets; Floating Wall Mount: www.countertopbracket.com/#sle.
b. Substitutions: See Section 016000 - Product Requirements.

2.04 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
1. Join lengths of tops using best method recommended by manufacturer.

2. Fabricate to overhang fronts and ends of cabinets 1 inch (25 mm) except where top butts against cabinet or wall.
    a. Rout a 1/8 inch (3 mm) drip groove at underside of exposed overlapping edges, set back 1/2 inch (13 mm) from face of edge.
3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
2. Height: 4 inches (102 mm), unless otherwise indicated.

C. Solid Surfacing: Fabricate tops and wall panels up to 144 inches (3657 mm) long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

D. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings, finished to match. Anchor to wall framing in accordance with manufacturer's installation recommendations.

E. Solid Surface Window Sills: Fabricate sills up to 144 inches (375 mm) long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Attach wood countertops using screws with minimum penetration into substrate board of 5/8 inch (16 mm), minimum unless otherwise indicated.
C. Securely attach window sills using concealed fasteners. Make flat surfaces level; shim where required.
D. Seal joint between window sill and adjacent construction.
E. Seal joint between back/end splashes and vertical surfaces.

3.04 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet (3 mm in 3 m), maximum.
B. Offset From Wall, Countertops and Window Sills: 1/8 inch (3 mm) maximum; 1/16 inch (1.5 mm) minimum.
C. Field Joints: 1/16 inch (1.5 mm) wide, maximum.

3.05 CLEANING

A. Clean countertops surfaces thoroughly.

3.06 PROTECTION

A. Protect installed products until completion of project.
B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 142400
HYDRAULIC ELEVATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Complete machine room-less hydraulic elevator systems.
   1. Passenger type.

1.02 RELATED REQUIREMENTS

A. Section 042000 - Unit Masonry, Mortar and Grout: Masonry hoistway enclosure; building-in and grouting hoistway door frames.
B. Section 211300 - Fire-Suppression Sprinkler Systems: Sprinkler heads in hoistway.
C. Section 220513 - Common Motor Requirements for Plumbing Equipment: Motor for sump pump in pit.
D. Section 260533.13 - Conduit for Electrical Systems:
E. Section 260583 - Wiring Connections:

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
B. AISC 360 - Specification for Structural Steel Buildings; 2022.
C. ASME A17.1 - Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices; 2022.
D. ASME A17.2 - Guide for Inspection of Elevators, Escalators, and Moving Walks Includes Inspection Procedures for Electric Traction and Winding Drum Elevators, Hydraulic Elevators, Inclined Elevators, Limited-Use/Limited-Application Elevators, Private Residence Elevators, Escalators, Moving Walks, Dumbwaiters, and Material Lifts; 2023.
E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
F. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2024.
G. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.
H. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.
I. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

J. NEMA MG 1 - Motors and Generators; 2021.
K. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
M. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate work with other installers to provide conduits necessary for installation of wiring including but not limited to:
a. Elevator equipment devices.
b. Remote group automatic panel in lobby from controller cabinet.
c. Telephone service.
d. Elevator pit for lighting, sump pump, and convenience outlets.
e. Automatic transfer switch from controller cabinet.
f. Fire alarm panel from controller cabinet.
2. Coordinate work with other installers for equipment provisions necessary for proper elevator operation, including but not limited to, the following:
a. Overcurrent protection devices selected to achieve required selective coordination.

B. Preinstallation Meeting: Convene meeting at least one week prior to start of this work.
1. Review schedule of installation, proper procedures and conditions, and coordination with related work.

C. Construction Use of Elevator: Not permitted.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.
B. Product Data: Submit data on following items:
1. Signal and operating fixtures, operating panels, and indicators.
2. Car design, dimensions, layout, and components.
3. Car and hoistway door and frame details.
4. Electrical characteristics and connection requirements.

C. Shop Drawings: Include appropriate plans, elevations, sections, diagrams, and details on following items:

1. Elevator Equipment and Machines: Size and location of driving machines, power units, controllers, governors, and other components.
2. Hoistway Components: Size and location of car guide rails, buffers, jack unit and other components.
3. Rail bracket spacing; maximum loads imposed on guide rails requiring load transfer to building structural framing.
4. Clearances and over-travel of car.
5. Locations in hoistway of traveling cables and connections for car lighting and telephone.
6. Location and sizes of hoistway and car doors and frames.
7. Electrical characteristics and connection requirements.
8. Indicate arrangement of elevator equipment and allow for clear passage of equipment through access openings.

D. Samples: Submit samples illustrating car interior finishes, car and hoistway door and frame finishes, and handrail material and finish in the form of cut sheets or finish color selection brochures.

E. Designer's Qualification Statement.

F. Installer's Qualification Statement.

G. Testing Agency's Qualification Statement.

H. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

I. Initial Maintenance Contract.

J. Operation and Maintenance Data:
1. Parts catalog with complete list of equipment replacement parts; identify each entry with equipment description and identifying code.
2. Operation and maintenance manual.
3. Schematic drawings of equipment and hydraulic piping, and wiring diagrams of installed electrical equipment with list of corresponding symbols to identify markings on machine room and hoistway apparatus.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Design guide rails, brackets, anchors, and machine anchors under direct supervision of a licensed Professional Structural Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

B. Installer Qualifications: Company specializing in performing the work of this section and approved by elevator equipment manufacturer.

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of type specified in this section.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Provide manufacturer's warranty for elevator operating equipment and devices for 5 years from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Machine Room-Less Hydraulic Elevator Manufacturers:

1. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide TK Elevator, EOX-H 3500, or an approved comparable product from one of the following:
2. Otis Elevator Company: www.otis.com/#sle.
3. Schindler Elevator Corporation: www.schindler.com/#sle.

B. Substitutions: See Section 016000 - Product Requirements.

C. Source Limitations: Provide elevator and associated equipment and components produced by the same manufacturer as the other elevator equipment used for this project and obtained from a single supplier.

2.02 HYDRAULIC ELEVATORS

A. Hydraulic Passenger Elevator, No. 1 and 2:

1. Hydraulic Elevator Equipment:
   a. MachineHoleless hydraulic with jack unit mounted within hoistway.
2. Drive System:
   a. Variable voltage variable frequency (VVVF) to modulate motor speed.
3. Operation Control Type:
   a. Two-Car Selective Collective Automatic (Duplex Collective Automatic) Operation Control.
4. Service Control Type:
   a. Standard service control only.
5. Interior Car Height: 96 inch (2438 mm).
6. Electrical Power: 480 volts; alternating current (AC); three phase; 60 Hz.
7. Rated Net Capacity: 3500 pounds (1590 kgs).
8. Rated Speed: 100 feet per minute (0.5 m per second).
9. Hoistway Size: As indicated on drawings.
10. Interior Car Platform Size: As indicated on drawings.

11. Elevator Pit Depth: 48 inch (1219 mm).
12. Overhead Clearance at Top Floor: As indicated on drawings.
13. Travel Distance: As indicated on drawings.
14. Number of Stops: Two.
15. Number of Openings: One Front.
16. Hydraulic Equipment Location: As indicated on drawings

2.03 COMPONENTS

A. Elevator Equipment:
   1. Motors, Hydraulic Equipment, Controllers, Controls, Buttons, Wiring, Devices, and Indicators: Comply with NFPA 70; see Section 260583.
   2. Guide Rails, Cables, Buffers, Attachment Brackets and Anchors: Design criteria for components includes safety factors in accordance with applicable requirements of Elevator Code, ASME A17.1.
   3. Buffers:
      a. Spring type for elevators with speed less than or equal to 200 fpm (1 m/sec).
   4. Lubrication Equipment:
      a. Provide grease fittings for periodic lubrication of bearings.
      b. Grease Cups: Automatic feed type.
      c. Lubrication Points: Visible and easily accessible.

B. Electrical Equipment:
   1. Motors: NEMA MG 1.
   2. Boxes, Conduit, Wiring, and Devices: As required by NFPA 70; see Sections 260533.13 and 260583.
   3. Sump Pump in Pit: See Section 220513.
   4. Spare Conductors: Provide ten percent in extra conductors and two pairs of shielded audio cables in traveling cables.

2.04 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with ASME A17.1, applicable local codes, and authorities having jurisdiction (AHJ).
B. Accessibility Requirements: Comply with ADA Standards.
C. Perform structural steel design, fabrication, and installation in accordance with AISC 360.
D. Perform welding of steel in accordance with AWS D1.1/D1.1M.

E. Fabricate and install door and frame assemblies in accordance with NFPA 80 and in compliance with requirements of authorities having jurisdiction.

F. Perform electrical work in accordance with NFPA 70.

G. Comply with fire protection sprinkler system of hoistway design in accordance with NFPA 13 requirements and authorities having jurisdiction (AHJ). See Section 211300.

2.05 OPERATION CONTROLS

A. Elevator Controls: Provide landing operating panels and landing indicator panels.

1. Landing Operating Panels: Metallic type, one for originating "Up" and one for originating "Down" calls, one button only at terminating landings; with illuminating indicators.
2. Landing Indicator Panels: Illuminating.
3. Comply with ADA Standards for elevator controls.

B. Interconnect elevator control system with building security, fire alarm, card access, smoke alarm, and building management control systems.

C. Door Operation Controls:

1. Program door control to open doors automatically when car arrives at floor landing.
2. Render "Door Close" button inoperative when car is standing at dispatch landing with doors open.
3. Door Safety Devices: Moveable, retractable safety edges, quiet in operation; equipped with photo-electric light rays.

D. Lobby Monitoring Panel:

1. Locate status indicator and control panel for each individual elevator and group of elevators as indicated on drawings.
2. Etch face plate markings in panel, and fill with paint of contrasting color.
3. Include direction indicator displaying landing "Up" and "Down" calls registered at each landing floor.
4. Include position and motion display for direction of travel of each elevator. Display appropriate graphic characters on non-glare screen. Indicate position of cars at rest and in motion.
5. Include a "Remove From In Service" switch for each elevator that then calls car to ground floor and parks car with doors open.
6. Include "Firefighter's Service Switch" that manually recalls each elevator to main floor.

E. Provide "Firefighter's Emergency Operation" in accordance with ASME A17.1, applicable building codes, and authorities having jurisdiction (AHJ).
   1. Designated Landing: Main Lobby.

2.06 OPERATION CONTROL TYPE

A. Two-Car Selective Collective Automatic (Duplex Collective Automatic) Operation Control: Applies to cars in two elevator shafts .
   1. Park one car at main floor and designate other as free car, at landing last served or at a predetermined upper floor landing.
   2. Arrange free car to answer landing calls either above or below landing where car is standing except main floor landing calls.
   3. When free car is answering calls, automatically start an alternate car to answer landing calls under any of the following conditions:
      a. Registration of up calls from landings below the free car while it is traveling up by alternate car below.
      b. Registration of up or down calls from landings above the free car while it is traveling down by alternate car.
      c. Free car fails to clear registered landing calls within 40 seconds, or to move alternate car in response to registered landing calls within this time frame.
   4. Register and answer calls by momentary pressure on one or more car buttons; cause car to respond.
   5. Once started, either in response to car button calls, or to landing button calls, respond to calls registered for the direction of the traveling car in the order that landings are reached, regardless of sequence that calls were registered.
   6. Allow only one car to stop in response to any one landing call.
   7. Return first free car to main floor after answering landing calls.
   8. Should both cars finish their calls at main floor, designate one car as the free car.
   9. If no car buttons are pressed and car starts up in response to several landing down calls, proceed first to the highest landing down call, then reverse to collect other landing down calls. Collect up calls similarly when car starts down in response to such calls.
   10. If a car stops for a landing call, and car button matching direction the car was traveling is pressed within a predetermined time interval after a landing stop, proceed in the same direction regardless of other landing calls that are registered.

11. If down landing buttons are pressed while car is traveling up, do not stop at those landings but allow those calls to remain registered for answering by the next down traveling car.
12. After the highest car has responded to up landing calls, reverse car automatically and respond to down landing calls.
13. When traveling down, a car will not respond to up calls. Allow those up calls to remain registered to be answered by next available car on an up trip.
14. Include a time delay to hold car for an adjustable time interval at landings where stops are made to enable passengers to enter or leave the car. Cancel the time interval upon registration of a car call or pressure on the car door close button.
15. Permit a registered car call to establish the direction of travel when a car has answered the farthest car call, even if other landing calls are registered.
16. Answer calls to the basement landing with the car that is normally parked at the main floor unless the free car is at the basement.
17. If a car is removed from service, the other car shall answer landing calls.

2.07 SERVICE CONTROL TYPE

A. Independent Service Control:
   1. Provide key operated "Independent Service" on car operating panel. Key activation will remove that car from normal operation and cancel pre-registered car calls.
   2. Car will respond to selected floor. Car will not respond to any calls from landing call buttons. Car will only respond to calls placed on the car operating panel. Doors will remain open at last landing requested. Doors will close with a constant pressure on "Door Close" button.
   3. Key activation to normal operation will return car to normal operation.

2.08 MATERIALS

A. Rolled Steel Sections, Shapes, Rods: ASTM A36/A36M.
B. Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel), with matte finish.
C. Stainless Steel Sheet: ASTM A666, Type 304; No. 4 Brushed finish unless otherwise indicated.
D. Stainless Steel Bars, Shapes and Moldings: ASTM A276/A276M, Type 304.

2.09 CAR AND HOISTWAY ENTRANCES

A. Elevator, No. 1 and 2:
   1. Car and Hoistway Entrances, Each Elevator Floor Lobby:

a. Hoistway Fire Rating: 2 Hours.
b. Elevator Door Fire Rating: 1-1/2 Hours.
c. Framed Opening Finish and Material: Brushed stainless steel.
d. Car Door Material: Stainless steel, with rigid sandwich panel construction.
e. Hoistway Door Material: Stainless steel, with rigid sandwich panel construction.
f. Door Type: Double leaf.
g. Door Operation: Side opening, two speed. See floor plan for handing of doors.
h. Door Width: 36 inches (0.914 m).
i. Door Height: 84 inches (2.134 m).
j. Sills: Manufacturer's standard.

2.10 CAR EQUIPMENT AND MATERIALS

A. Elevator Car, No. 1 and 2:
1. Car Operating Panel: Provide main and auxiliary; flush-mounted applied face plate, with illuminated call buttons corresponding to floors served with "Door Open/Door Close" buttons, "Door Open" button, "Door Close" button, and alarm button.
a. Panel Material: Stainless steel; one per car.
b. Car Floor Position Indicator: Above door with illuminating position indicators.
c. Locate alarm button where it is unlikely to be accidentally actuated; not more than 54 inch (1.372 m) above car finished floor.
2. Flooring: Textile composite flooring.
3. Front Return Panel: Stainless steel.
4. Door Wall: Stainless steel.
5. Side Walls: Stainless steel.
6. Rear Wall: Stainless steel.
7. Hand Rail: Stainless steel, at all three sides. Provide open clearance space 1-1/2 inch (38 mm) wide to face of wall.
a. Stainless Steel Finish: No. 4 Brushed.
8. Ceiling:
a. Canopy Ceiling: Stainless steel.
b. Panel Finish: No. 4 Brushed stainless steel.
c. Lighting: As selected from manufacturer's standard line.

9. Provide emergency access panel for egress from car at ceiling.

B. Car Accessories:

1. Protective Pads: Canvas cover, padded with impact-resistant fill material, sewn with piping edges; fire resistant in compliance with ASME A17.1; brass grommets for supports, covering side and rear walls and front return, with cut-out for control panel; provide one set for each elevator.
   a. Color: Grey.
   b. Provide at least 4 inch (102 mm) clearance from bottom of pad to finished floor.
   c. Pad Supports: Stainless steel studs, and mounted from top of wall panels.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting this work.
B. Verify that hoistway and pit are ready for work of this section.
C. Verify hoistway shaft and openings are of correct size and within tolerance.
D. Verify location and size of machine foundation and position of machine foundation bolts.
E. Verify that electrical power is available and of correct characteristics.

3.02 PREPARATION

A. Arrange for temporary electrical power for installation work and testing of elevator components; see Section 015000 - Temporary Facilities and Controls for additional requirements.
B. Maintain elevator pit excavation free of water.

3.03 INSTALLATION

A. Coordinate this work with installation of hoistway wall construction.
B. Install system components, and connect equipment to building utilities.
C. Provide conduit, electrical boxes, wiring, and accessories; see Sections 260533.13 and 260583.
D. Install hydraulic piping between cylinder and pump unit.
E. Mount machines, motors, and pumps on vibration and acoustic isolators.
   1. Place on structural supports and bearing plates.
   2. Securely fasten to building supports.
   3. Prevent lateral displacement.
F. Install hoistway, elevator equipment, and components in accordance with approved shop drawings.

G. Install guide rails to allow for thermal expansion and contraction movement of guide rails.
H. Accurately machine and align guide rails, forming smooth joints with machined splice plates.
I. Bolt brackets to self drilling expansion shell anchors.
J. Field Welds: Chip and clean away oxidation and residue with wire brush; spot prime surface with two coats.
K. Install hoistway door sills, frames, and headers in hoistway walls; grout sills in place, set hoistway floor entrances in alignment with car openings, and align plumb with hoistway.
L. Fill hoistway door frames solid with grout; see Section 042000.
M. Structural Metal Surfaces: Clean surfaces of rust, oil or grease; wipe clean with solvent; prime two coats.
N. Adjust equipment for smooth and quiet operation.

3.04 TOLERANCES

A. Guide Rail Alignment: Plumb and parallel to each other in accordance with ASME A17.1 and ASME A17.2.
B. Car Movement on Aligned Guide Rails: Smooth movement, without any objectionable lateral or oscillating movement or vibration.

3.05 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.
B. Testing and inspection by regulatory agencies certified in accordance with ASME QEI 1 will be performed at their discretion.
    1. Schedule tests with agencies and notify Owner and Architect.
    2. Obtain permits as required to perform tests.
    3. Document regulatory agency tests and inspections in accordance with requirements.
    4. Perform tests required by regulatory agencies.
    5. Furnish test and approval certificates issued by authorities having jurisdiction.
C. Operational Tests:
    1. Perform operational tests in the presence of Owner and Architect.
    2. Test multiple elevator system by transporting at least ____ persons up from main floor during a five minute period with maximum average time interval of ____ seconds between cars, with ____ cars leaving main floor during same five minute period.

3. At an agreed time, and the building occupied with normal building traffic, conduct tests to verify performance.
    a. Furnish event recording of each landing call registrations, time initiated, and response time throughout entire working day.
4. Set period of time elevator takes to travel between typical floor landings at not more than ____ seconds.
    a. Measure time from moment doors start to close until car has stopped level at next floor landing and doors are opening.

END OF SECTION

SECTION 210500

COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Above ground piping.

B. Buried piping.

C. Escutcheons.

D. Fire rated enclosures.

E. Mechanical couplings.

F. Pipe hangers and supports.

G. Pipe sleeves.

H. Pipe sleeve-seal systems.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 078400 - Firestopping.

C. Section 210523 - General-Duty Valves for Water-Based Fire-Suppression Piping.

D. Section 210553 - Identification for Fire Suppression Piping and Equipment: Piping identification.

E. Section 210716 - Fire Suppression Equipment Insulation: Insulation of fire suppression equipment piping, fittings, valves, mechanical couplings, connections, hangers, insulation inserts, shields, etc.

F. Section 211300 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.

1.03 REFERENCE STANDARDS

A. Publications listed here are part of this specification to the extent they are referenced. Where no specific edition of the standard or publication is identified, the current edition shall apply.

B. ASME A112.18.1 - Plumbing Supply Fittings; 2018, with Errata.

C. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.

D. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.

E. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.

F. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2011.
G. ASME B16.9 - Factory-Made Wrought Buttwelding Fittings; 2012.
H. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999 (Reapproved 2014).
I. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
J. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984, with Editorial Revision (2019).
K. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use; 2021.
L. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2022a.
M. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.
N. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2021.
O. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2023.
P. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2023.
Q. AWWA C606 - Grooved and Shouldered Joints; 2022.
R. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
S. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
T. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances; 2025.
U. NFPA 25 - Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems; 2023.
V. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 DEFINITIONS

A. The "General Conditions" and "Supplementary General Conditions" are part of the specifications. Work under this section of the specifications shall be governed by the requirements thereunder.
B. The use of the word "PROVIDE" in the specifications and on drawings shall mean: Furnish and install a complete system, supplying all necessary labor and materials.

C. Specialist: The term "Specialist" as used in the specification shall mean an individual or firm of established reputation (or, if newly organized, whose personnel have previously established a reputation in the same field,) which is regularly engaged in, and which maintains a regular force of workers skilled in either (as applicable) manufacturing or fabricating items required by the contract, installing items required by the contract, or otherwise performing work required by the contract. Where the specification requires installation by a specialist, the term shall also be deemed to mean the manufacturer of the item, an individual or firm licensed by the manufacturer, or an individual or firm who will perform the work under the manufacturer's direct supervision.

1.05 GENERAL REQUIREMENTS

A. Furnish all necessary labor, material, plant, and equipment, including materials not specifically mentioned, but necessary to complete the job in a neat, correct, and workmanlike manner.

B. The drawings and specifications shall be considered as supplementary, one to the other, so that materials and labor indicated, called for, or implied by the one and not by the other, shall be supplied and installed as though specifically called for by both.

C. The contractor shall be responsible for obtaining a current hydrant flow test prior to producing shop drawings or hydraulic calculations. This flow test shall be in addition to the test provided for permit or bid purposes and shall have been taken less than one year prior to the anticipated submittal date to the AHJ. The contractor shall report to the engineer before the start of design or construction any unsatisfactory conditions resulting from the flow test. In no case shall the Contractor proceed in uncertainty.

1.06 SCOPE OF WORK

A. The intent of this specification, together with accompanying Fire Protection Drawings is to provide a complete and operating installation, including, but not limited to the following principal items:

1. Furnish necessary labor and materials to provide a completely sprinkled building system as outlined on Fire Protection drawings and the applicable NFPA and ICC (IBC) codes, including but not limited to all sprinkler piping and standpipes, pumps, pipe hangers, sprinkler heads, valves, controls, drains, hose valves and cabinets, fittings, local and remote control panels, and switches, spare sprinklers and cabinet, backflow preventers, etc. as required for the hazard occupancies as indicated on the Fire Sprinkler Specification Sheet

and the plans. Sprinkler head spacing shall be as required by NFPA 13 and the AHJ. Coordinate sprinkler head locations with the architectural reflective ceiling plan.

2. Fire Protection system shall comply with the editions of NFPA 13 and NFPA 24 currently being recognized by the Authority Having Jurisdiction as well as NCBC and NCFC as well as local jurisdictional requirements.
3. Fire Protection Contractor shall obtain a flow test for all system calculations as specified elsewhere in this specification.
4. Fire Protection contractor shall begin work approximately 12” above the finished floor with a flange provided by Site Utility Contractor. Coordinate all connection locations with Site Utility Contractor. The fire sprinkler contractor shall provide a single-piece stainless steel Ames Fire and Waterworks IBR in-building riser to the site utility contractor for installation.
5. The fire protection system shall be hydraulically calculated to provide a wet pipe sprinkler system for the areas of the buildings as indicated on the plans and specifications. The buildings are to be calculated for light hazard and ordinary hazard based on the building areas as necessary to comply with NFPA 13.
6. Perform the testing of all piping work and necessary cleaning of the fire protection work.
7. Furnish the shop drawings and certificates of inspection.
8. Periodically remove from the job site all rubbish or debris resulting from the fire protection work.
9. Hub drains shall be provided by the Plumbing Contractor for all sprinkler drains as required by Sprinkler Contractor Design. The Sprinkler Contractor shall verify all drain locations and coordinate all drain requirements with the Plumbing Contractor prior to the slab being poured. Special attention shall be paid to drain size and location for the number of sprinkler drains in any hub drain along with potential issues for maintenance or trip hazards. Hub drain locations shall be finalized after approval of shop drawings. All inspector’s test and drain locations shall be coordinated with and approved by the owner prior to installation.
10. Sprinkler Contractor shall be responsible for the submission of hydraulically calculated piping and sprinkler head drawings as well as the hydraulic calculations to the Engineer through the Architect and to the AHJ for approval as soon as possible after the award of the contract. The Contractor is

responsible for any resubmission to the Engineer and the AHJ and will comply with all requirements of the AHJ at no additional cost to the project

1.07 BIDDING

A. Bidders shall thoroughly familiarize themselves with all conditions affecting this work, visiting the job site if necessary prior to submitting a bid.

B. Drawings are diagrammatic and do not indicate all offsets, fittings, and specialties. Examine other drawings, investigate conditions to be encountered, and arrange work accordingly, furnishing all fittings, offsets, etc., required without extra charge.

C. Before the construction of the project starts, check the location of existing and proposed equipment, ductwork, conduit, etc. Review other drawings for the project, checking grades, elevations, locations of structural elements, locations and sizes of chases, and type, and method of construction of floors, walls, and partitions. Report to the engineer before the start of construction any conflicts or unsatisfactory conditions. In no case shall the Contractor proceed in uncertainty. No extra charge will be approved after the start of construction for work resulting from failure to follow these instructions.

1.08 PERMITS, LICENSES, AND FEES

A. Fire Protection Contractor shall obtain and pay for all licenses, fees, and service charges required for the execution of this work.

B. Fire Protection Contractor shall obtain and pay for a second water flow test as specified herein. The second water flow test shall comply with all of the requirements of the municipality or water provider.

1.09 ADMINISTRATIVE REQUIREMENTS

A. Progress meetings shall be held as specified in Division 01, and also when and if the Contractor or Architect finds them necessary or advantageous to progress of work.

B. Contractor, those subcontractors and those material suppliers concerned with current progress or with the scheduling of future progress, Architect and Owner shall each be represented at these meetings by persons familiar with the details of work and authorized to conclude matters relating to work progress.

1.10 CONSTRUCTION SUBMITTALS

A. Refer to Division 01 requirements.

B. The Engineer will review and take appropriate action on product data, shop drawings, samples, mock-ups, and other submittals required by the Contract Documents. Such review shall be for general compliance with the design and with the information given in the Contract Documents.

1. It shall not include review of quantities, dimensions, weights, fabrication processes, construction methods, coordination with the work of other trades, or construction safety precautions, all of which are the sole responsibility of the Contractor.
2. Engineer's review shall be conducted with reasonable promptness consistent with sound professional practice. Review of a specific item shall not indicate acceptance of an assembly of which the item is a component.
3. The Engineer shall not be required to review and shall not be responsible for any deviation from the Contract Documents not clearly noted by the Contractor, nor shall the Engineer be required to review partial submissions or those for which submissions for correlated items have not been made.

C. Product Data: Provide manufacturer's catalog information. Indicate valve data and ratings.
1. Materials List: Accompanying the Shop Drawings, submit a complete list of all materials proposed to be furnished and installed under this section, giving manufacturer's name and catalog number for each item; this shall in no way be construed as permitting substitution except as specifically provided elsewhere in these specifications

D. Shop Drawings: Indicate pipe materials used, joining methods, supports, and floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.
1. Prior to the submittal of shop drawings to the Engineer, the General Contractor, and the Fire Protection Contractor shall review and approve shop drawings. Shop drawings that have not been reviewed and approved in writing by the Fire Protection Subcontractor will not be reviewed by the Engineer. Fire Protection Contractor shall state in writing on shop drawings any proposed deviations from contract documents. Such deviations, if not stated in shop drawing submittals, shall be the sole responsibility of the Fire Protection Subcontractor. NOTE: In addition to the General Contractor's approval and stamp, the first page of each shop drawing submittal must contain the words "APPROVED" or "APPROVED AS NOTED" and must be signed and dated by the Fire Protection Subcontractor before the Engineer will review them.
2. After the award of the Contract, and before any materials of this Section are delivered to the job site, submit shop drawings on all items of equipment, fixtures, materials, and accessories furnished under this Section to the

engineer.

3. Shop Drawings for automatic sprinkler system shall be hydraulically calculated and shall show the arrangement of all automatic sprinkler piping, densities, zones, discharge constants, Hazen-Williams C values and equipment, spacing of sprinkler heads, elevation of lines and details necessary for the conduct of work. Shop Drawings shall bear the approval of the authority having jurisdiction and the insurance underwriter.

1.11 CLOSEOUT SUBMITTALS

A. Submit documents as specified in Division 01.

B. Project Record Documents: Record actual locations of components and tag numbering.

1. Fire Protection Contractor shall maintain on the job site one complete set of the Fire Protection drawings for this project. Any changes to the system shall be authorized by the engineer and the AHJ and shall require the submittal of new plans and hydraulic calculations for approval as necessary. No field changes shall be made without the approval of the AHJ. Any changes shall be made at no additional cost to the project.
2. As-Built drawings: Maintain record documents separate from documents used for construction. Record information concurrent with construction progress.
    a. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the work.
    b. Field changes of dimension and detail.
    c. Details not on original Contract Drawings.
3. Specifications: Legibly mark and record in each section a description of actual products installed, including the following:
    a. Manufacturer's name and product model and number.
    b. Product options, substitutions, or alternates utilized.
    c. Changes made by addenda and modifications.
4. Addenda.
5. Change orders and other modifications to the Contract.
6. Reviewed shop drawings, product data, and samples.
7. The Contractor shall deliver a complete set of "As-Built" Fire Protection drawings to the Architect and an “AutoCad or Revit” electronic copy, disc (CD), or USB drive set to the Engineer.

C. Operation and Maintenance Data: Include installation instructions and spare parts lists.

1. Submit sets prior to final inspection as specified in Division 01. Unless otherwise specified in Division 01, submit no fewer than three sets. In addition to the requirements specified in Division 01, submit operating and maintenance manuals for the work of this division as specified below.
2. Hard Copy Binders: Three-ring binders with vinyl-covered hardcovers. Provide large enough binders, and sufficient quantity, that the required contents can be easily turned, removed, and reinserted.
    a. Prepare binder covers with the printed title "OPERATION AND MAINTENANCE INSTRUCTIONS," and title of project. Print on the spine of the binder "O & M INSTRUCTIONS." If more than one binder is required, print covers and spines with volume numbers. Include in the front of every binder an index to all binders.
    b. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
3. Electronic Copy Binders: Provide organized pdfs that the required contents can be easily turned, removed, and reinserted.
    a. Prepare binder covers page with the printed title "OPERATION AND MAINTENANCE INSTRUCTIONS," and title of project. If more than one binder is required, label file names with volume numbers.
    b. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
4. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, typed on white paper.
5. Part 1: Directory, listing names, addresses, and telephone numbers of engineers; Contractor; subcontractors; and major equipment suppliers.
6. Part 2: Operation and maintenance instructions, arranged by specification section. For each category, identify names, addresses, and telephone numbers of subcontractors and suppliers. Identify the following:
    a. Significant design criteria, including pump curves and similar performance charts.
    b. List of equipment, including operating weight of each piece.

c. Parts list for each component, including recommended spare parts list.
d. Operating instructions.
e. Maintenance instructions for equipment and systems.
f. Maintenance instructions for special finishes, including recommended cleaning methods and materials and special precautions identifying detrimental agents.
g. Valve charts, including locations of flow fittings.

7. Part 3: Project documents and certificates, including the following:
a. Shop drawings and product data.
b. Photocopies of certificates.
c. Photocopies of warranties and guarantees.
d. Test reports: Copies of the results of all tests required under all sections of specifications.

8. Submit one copy of completed volumes in final form 15 days prior to final inspection. This copy will be returned after the final inspection, with Engineer's comments. Revise the content of documents as required prior to final submittal.
9. Submit final volumes revised, within ten days after final inspection.
10. Submit copy, disc (CD), or USB drive storage media specified for Division 21.

D. Lubrication Table: Prepare a lubrication table for each piece of equipment that requires grease or oil. Include the following:
1. Types of lubricants required.
2. Locations of lubrication points.
3. Frequency of lubrication.
4. Provide one extra set of lubrication tables mounted in framed plastic covers in each mechanical and/or utility room.

E. Provide copies of the manufacturer's product warranties as required for the Operation and Maintenance Manual and by Division 01.

F. Provide copies of the installer's workmanship warranties as required for the Operation and Maintenance Manual and by Division 01.

1.12 QUALITY ASSURANCE

A. Designer/Specialist shall submit a list of at least three projects similar to this project in type, size, and quality, which have been in place and operating satisfactorily for at least five years.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified in this section.

D. Comply with UL (DIR) requirements.

E. Valves: Bear UL (DIR) product listing label or marking. Provide manufacturer's name and pressure rating marked on valve body.

F. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

G. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.13 REGULATORY REQUIREMENTS

A. When these specifications call for materials or construction of a better quality or larger sizes than required by the following codes and standards, the provisions of the specifications shall take precedence.

B. Provide, without extra charge, any additional materials and labor that may be required for compliance with these codes and standards even though the work is not mentioned in these specifications or shown on the contract drawings.

C. Perform the work of this division in strict accordance with the following authorities. The latest revision of these codes accepted by the authority having jurisdiction as of the date of the contract documents shall apply.

1. The plumbing, mechanical, electrical, building, fire, and safety codes of the Federal, State and County or city in which the work is being performed.
2. The National Electric Code, NFPA 70 (NEC).
3. The National Fire Protection Association Code. (NFPA).
    a. Including but not limited to NFPA 13, NFPA 24, NFPA 25.
4. International Energy Conservation, Fire, Fuel Gas, Mechanical, and Plumbing Codes (ICC).

1.14 MATERIALS AND WORKMANSHIP

A. All materials and equipment shall be new and free from flaws and defects of any nature. Materials called for are to be considered as standards of quality which, however, implies no right on the part of the Contractor to substitute other materials and methods without written authority. All materials and equipment furnished shall be approved by UL, F/M, and/or AWWA where applicable. Materials and equipment manufactured outside of the United States will not be acceptable unless specifically

approved by the engineer.

B. All work shall be performed by skilled mechanics under competent supervision, employing the latest and best practices of the trade. Work shall be installed in accordance with the recommendations of the NFPA, ASTM, ASA, and equipment manufacturer. In the event there is any conflict or doubt, consult Engineer for clarification and approval.

C. All equipment and materials provided under this section of the specifications shall be new and of the best grade and quality.

1.15 BUILDING INFORMATION MODELING

A. The project will utilize a digital Building Information Model (BIM) for coordination, scheduling, and conflict resolution.

B. Development of a computerized model pertaining to all systems specified under Division 21 is required for the project.

C. Model shall be used as the basis of the detailed design for shop drawings, and will be used for fabrication, coordination, and installation.

D. The BIM model shall be constructed utilizing Revit Architecture, AutoCAD MEP, Revit MEP, or other 3-D software compatible with Navisworks Manage.

E. Refer to Division 01 for additional project BIM requirements.

1.16 COORDINATION

A. Mechanical/Electrical Coordination: Before equipment is ordered and after all motors, loads, controls, and other characteristics of equipment are known, the Contractor shall review the data shown on the Electrical drawings. Special attention shall be given to motor size, starters, means of disconnect, control wiring, etc. that are being furnished under the electrical section of the specifications. At the time of shop drawing submittal, the contractor shall by letter to the Engineer point out any discrepancies and describe the proposed corrective action.

B. Sprinkler/Fire Alarm Coordination: Before equipment, flow switches, tamper switches, or other devices are ordered; the Fire Sprinkler Contractor shall review the data shown on the Electrical and Fire Alarm drawings. The Contractor shall provide the Fire Alarm (or Electrical Contractor) with the locations of all flow switches, tamper switches, pressure switches, control panels, or other devices that are to be monitored by the fire alarm system. At the time of shop drawing submittal, the contractor shall by letter to the Engineer point out any discrepancies and describe the proposed corrective action.

C. Drawings showing utilities in concealed locations are based on the best information available but are not represented as being precisely correct. Work of the contract includes digging, cutting, drilling, using nondestructive methods, and other methods of locating concealed utilities in the field, as well as patching and repairing as specified in "Cutting and Patching" below.

D. If, in the course of the work, workers encounter a material they suspect to present some hazard:

1. Promptly notify the Architect in writing.
2. Do not perform any work that would disturb the suspected material until written instructions have been received.

1.17 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers, with labeling in place.

B. Use of sidewalk or roadway areas outside of the property lines shall be with permission and approval of the local authorities having jurisdiction.

C. Temporary Storage:

1. Maintain upon premises, where directed, a storage area, and be responsible for all contents within these areas. Provide all security measures necessary for this area.
2. The area shall be maintained and shall be returned to its original condition at the completion of the project.

D. Protect work stored in place and supplies stored in the building.

1. Store materials and products, subject to damage from moisture, in dry locations. If necessary, provide in protective wraps or covers.
2. Store plastics, other materials, and products subject to damage from heat or cool at the manufacturer's recommended temperatures.

E. Control dust resulting from construction work to prevent its spread beyond the immediate work area, and to avoid creation of a nuisance.

1. Do not use water to control dust. Use drop cloths or other suitable barriers.
2. In areas where dirt or dust is produced as a result of the work, sweep daily, or more often as required.
3. Provide walk-off mats at entries and replace them at regular intervals.
4. Construct dust partitions, where indicated on the drawings or as required.

F. Each trade and subcontractor is responsible for preventing damage and soiling of work performed by other trades or subcontractors. Each trade and subcontractor is responsible for providing temporary protection of its own work.

1. Protect work from spills, splatters, drippings, adhesives, bitumens, mortars, paints, plasters, and damage from welding or burning.
2. Protect finished work from damage, defacement, staining, or scratching.
3. Protect finishes from cleaning agents, or grinding and finishing equipment.
4. Protect adjacent and finished work from damage, using tape, masking, covers or coatings and protective enclosures.
5. Coordinate installations and temporarily remove items to avoid damage from finishing work.
6. Provide temporary protective coating on cast iron and steel valves.
7. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

G. Repair all damage or soiling to the complete satisfaction of the Architect/Engineer; replace any materials or work damaged to such an extent that they cannot be restored to their original condition, all at no addition to the Contract Sum.

1.18 WARRANTY

A. Refer to Division 01 requirements.

B. Correct defective Work in workmanship, materials, equipment and operation of the system within a one year period after Date of Substantial Completion.

C. Equipment and materials, repaired or replaced are guaranteed for one year following date of correction.

D. Special warranties are warranties required by individual specification sections, incidental product warranties, manufacturers' standard warranties, installer or subcontractor service agreements, and other individual warranties in addition to the general project warranty.

E. When use of the permanent equipment has been permitted for temporary use or occupancy of the building, the warranty and correction periods shall nevertheless begin at the time of substantial completion, unless another date of acceptance has been agreed to by the Owner.

F. During the correction period, the Contractor shall begin correcting any work found to be not in accordance with the requirements of the Contract Documents within 4 hours of receiving written notice from the Owner. Provide a detailed schedule for completion of work within 24 hours of receiving written notice from the Owner and revise the schedule based on any Owner comments generated. Except as otherwise required in General Conditions and Division 01, the correction period is one years after the date of substantial completion of the work. Work requiring correction shall promptly be

repaired or completely replaced at no addition to the Contract Sum.

1. Provide a service log on all equipment repairs to the Owner at the end of the warranty period.

G. To remove any item not specified or given approval and replace it with a specified item.

H. Any item submitted for approval that does not conform to these specifications shall have an accompanying note of exception.

I. To repair any damage to building and equipment resulting from defects in workmanship, new materials, new equipment, and system operation.

J. That the system as installed shall comply with all applicable code requirements.

K. For items of work delayed beyond date of substantial completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Sprinkler-based System:

1. Comply with NFPA 13.
2. See Section 211300.

B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

C. Provide system pipes, fittings, sleeves, escutcheons, seals, and other related accessories.

2.02 BURIED PIPING

A. Ductile Iron Pipe: AWWA C151/A21.51.

1. Fittings: AWWA C110/A21.10, standard thickness.
2. Joints: AWWA C111/A21.11, styrene-butadiene rubber (SBR) or vulcanized SBR gasket.
3. Mechanical Couplings: Shaped composition sealing gasket, steel bolts, nuts, and washers.

2.03 ABOVE GROUND PIPING

A. Steel Pipe: ASTM A795 Schedule 10 or ASTM A53 Schedule 40, black.

1. Steel Fittings: ASME B16.9 wrought steel, buttwelded.
2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings and ASME B16.4, threaded fittings.
3. Malleable Iron Fittings: ASME B16.3, threaded fittings and ASTM A47/A47M.

4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
5. Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocked and O-ring, uniformly compressed into permanent mechanical engagement onto pipe.

2.04 PIPE SLEEVES

A. Vertical Piping:
1. Sleeve Length: 1 inch above finished floor.
2. Provide sealant for watertight joint.
3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.
4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

B. Plastic, Sheet Metal, or Moisture-Resistant Fiber: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

C. Pipe Passing Through Below Grade Exterior Walls:
1. Zinc-coated or cast-iron pipe.
2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

D. Pipe Passing Through Quarry Tile, Terrazzo, or Ceramic Tile Floors:
1. Brass pipe.
2. Connect sleeve with floor plate.

E. Clearances:
1. Provide allowance for insulated piping.
2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
3. Rated Openings: Caulked tight with firestopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

2.05 PIPE SLEEVE-SEAL SYSTEMS

A. Modular Mechanical Seals:
1. Elastomer-based interlocking links to continuously fill annular space between pipe and wall-sleeve, wall or casing opening.
2. Watertight seal between pipe and wall-sleeve, wall or casing opening.

3. Size and select seal component materials in accordance with service requirements.
4. Service Requirements:
    a. Underground, buried, and wet conditions.
    b. Fire Resistance: 1 hour, UL (DIR) approved.
    c. Low temperature, down to minus 67 deg F.
5. Glass-reinforced plastic pressure end plates.

B. Wall Sleeve: PVC material with waterstop collar, and nailer end caps.

C. Sleeve-Forming Disk: Nonconductive plastic-based material, 3 inch thick.

2.06 FIRE-RATED ENCLOSURES

A. Provide as required to preserve fire resistance rating of building elements.

2.07 ESCUTCHEONS

A. Material:
1. Metals and Finish: Comply with ASME A112.18.1.

B. Construction:
1. One-piece for mounting on chrome-plated tubing or pipe and one-piece or split-pattern type elsewhere.
2. Internal spring tension devices or setscrews to maintain a fixed position against a surface.

2.08 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable Iron or Carbon Steel, adjustable swivel, split ring.

B. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.

C. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

D. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.

E. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.

F. Vertical Support: Steel riser clamp.

G. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

H. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.09 MECHANICAL COUPLINGS

A. Rigid Mechanical Couplings for Grooved Joints:
1. Dimensions and Testing: Comply with AWWA C606.
2. Minimum Working Pressure: 300 psig.

3. Housing Material: Fabricate of ductile iron complying with ASTM A536.
4. Housing Coating: Factory applied orange enamel.
5. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
6. Bolts and Nuts: Hot-dipped-galvanized or zinc-electroplated steel.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
B. Remove scale and foreign material, from inside and outside, before assembly.
C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.
B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
C. Install piping to conserve building space, to not interfere with use of space and other work.
D. Space Conditions: All materials and equipment shall conform to the space limitations. Maintain maximum headroom and space clearances at all points.
E. Group piping whenever practical at common elevations.
F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
G. Inserts:
    1. Provide inserts for placement in concrete formwork.
    2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
    3. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
H. Pipe Hangers and Supports:
    1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
    2. Place hangers within 12 inches of each horizontal elbow.
    3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
6. Field review of placement and hangers and supports.

I. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

J. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.

K. Excavating and Backfilling
1. Contractor shall do all excavating and backfilling for the installation of work included under this contract and he shall promptly remove from the premises all excess earth, debris, and trash for which he is responsible. For all piping below grade and upon completion of tests and inspections, backfill with approved material, tamped to 95% relative compaction and as required by NFPA 13.

L. Cutting and Patching
1. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
2. Fire Protection Contractor will do all cutting, patching, and setting of sleeves. Fire Protection Contractor shall advise General Contractor well in advance of sizes and locations of all chases required for this installation. Failure to do so will result in Fire Protection Contractor bearing costs for this phase of the work.
3. No cutting of any structure or finish shall be done until the condition requiring such cutting has been examined and approved by the Architect/Engineer.
4. D. New or existing surfaces disturbed as a result of such cutting or otherwise damaged shall be restored to match original work and all materials used for any patching or mending shall conform to the class of materials originally installed.
5. Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

M. Structural Considerations:
1. Do not penetrate building structural members unless indicated.

N. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.

1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.
2. Aboveground Piping:
    a. Pack solid using mineral fiber complying with ASTM C592.
    b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.

O. Manufactured Sleeve-Seal Systems:
1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a watertight seal.
6. Install in accordance with manufacturer's recommendations.

P. Escutcheons:
1. Install and firmly attach escutcheons at piping penetrations into finished spaces.
2. Provide escutcheons on both sides of partitions separating finished areas through which piping passes.
3. Use chrome plated escutcheons in occupied spaces and to conceal openings in construction.

Q. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, unions, and couplings for servicing are consistently provided.

3.03 TESTING AND INSPECTION

A. The Contractor shall conduct and bear the cost of all necessary tests of the fire protection work, furnishing all labor, power, and equipment. All piping shall be tested with water.

B. All piping tested shall be witnessed by the engineer. The contractor shall notify the engineer and the authority having jurisdiction at least one week prior to all testing. Any test conducted without the Engineer present shall be considered as having not been performed, and such systems shall be retested in the presence of the Engineer

at the expense of the contractor.

C. Acceptance of the automatic sprinkler work shall be based upon the inspection and tests of the completed installation by representatives of the authority having jurisdiction, the local Fire Department, and the Engineer. The Contractor shall provide all certificates of testing as required and in accordance with NFPA.

D. Any delays or additional cost to the project that result from the failure of the contractor to properly test all systems shall be the sole responsibility of the contractor.

3.04 CLEANING

A. The Contractor shall be responsible for any damage to the work of others, to building and property/materials of others caused by leaks in automatic sprinkler equipment, unplugged or disconnected pipes of fittings, and shall pay for necessary replacement or repair of work or items so damaged during the installation and testing periods of the automatic sprinkler work.

B. Upon completion of work, clean all parts of the installation.

C. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION 210500

SECTION 210523

GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Two-piece ball valves with indicators.

B. Iron butterfly valves with indicators.

C. Check valves.

D. Iron OS&Y gate valves.

E. Trim and drain valves.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 078400 - Firestopping.

C. Section 210500 - Common Work Results for Fire Suppression

D. Section 210548 - Vibration and Seismic Controls for Fire Suppression Piping and Equipment.

E. Section 210553 - Identification for Fire Suppression Piping and Equipment.

F. Section 211100 - Facility Fire-Suppression Water-Service Piping.

G. Section 211300 - Fire-Suppression Sprinkler Systems.

H. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

I. Section 284600 - Fire Detection and Alarm.

1.03 ABBREVIATIONS AND ACRONYMS

A. EPDM: Ethylene-propylene diene monomer.

B. NRS: Non-rising stem.

C. OS&Y: Outside screw and yoke.

D. PTFE: Polytetrafluoroethylene.

1.04 REFERENCE STANDARDS

A. Publications listed here are part of this specification to the extent they are referenced. Where no specific edition of the standard or publication is identified, the current edition shall apply.

B. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).

C. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.

D. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300; 2021.
E. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.
F. AWWA C606 - Grooved and Shouldered Joints; 2022.
G. FM (AG) - FM Approval Guide; Current Edition.
H. FM 1112 - Examination Standard for Indicating Valves (Butterfly or Ball Type); 2020.
I. FM 1120/1130 - Approval Standard for Fire Service Water Control Valves (OS&Y and NRS Gate Valves); 1997.
J. FM 1140 - Approval Standard for Quick Opening Valves 1/4 Inch through 2 Inch Nominal Size; 1998.
K. FM 1210 - Approval Standard for Swing Check Valves; 2004.
L. ISO 9001 - Quality Management Systems-Requirements; 2008.
M. UL (DIR) - Online Certifications Directory; Current Edition.
N. UL 258 - Shutoff Valves for Trim and Drain Purposes for Fire Protection Service; Current Edition, Including All Revisions.
O. UL 262 - Gate Valves for Fire-Protection Service; Current Edition, Including All Revisions.
P. UL 312 - Check Valves for Fire-Protection Service; Current Edition, Including All Revisions.
Q. UL 789 - Indicator Posts for Fire-Protection Service; Current Edition, Including All Revisions.
R. UL 1091 - Standard for Butterfly Valves for Fire-Protection Service; Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.06 CONSTRUCTION SUBMITTALS

A. Refer to Division 01 requirements.
B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

1.07 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

1.08 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Obtain valves for each valve type from single manufacturer.
   2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.
   3. The manufacturer shall be fully certified by the International Standards Organization per ISO 9001.

B. Where listed products are specified, provide products listed, certified, and labeled by FM (AG), UL (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for purpose indicated.

C. Welding Materials and Procedures: Comply with ASME BPVC-IX.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect valve ends and flange faces.
   3. Set valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:
   1. Maintain valve end protection and protect flanges and specialties from dirt.
      a. Provide temporary inlet and outlet caps.
      b. Maintain caps in place until installation.
   2. Store valves in shipping containers and maintain in place until installation.
      a. Store valves indoors and maintain at higher than ambient dew point temperature.
      b. If outdoor storage is unavoidable, store valves off the ground in watertight enclosures.

C. Use the following precautions for handling:
   1. Use sling to handle large valves, rig to avoid damage to exposed parts.
   2. Do not use operating handles or stems as lifting or rigging points.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Source Limitations: Furnish valves of same kind by same manufacturer.

B. Valve-End Connections:

1. Flanges on Iron Valves: ASME B16.1 or ASME B16.42.
2. Threaded Ends: ASME B1.20.1.
3. Grooved Ends: AWWA C606.

C. Comply with NFPA 13 for valves.

D. Valve Pressure Ratings: Not less than minimum pressure rating indicated or higher as required.

E. Valve Sizes: Same as upstream piping unless otherwise indicated.

F. Valve Actuator Types:

1. Worm-gear actuator with handwheel for quarter-turn valves 2-1/2 NPS and larger, except trim and drain valves.
2. Handwheel: For other than quarter-turn trim and drain valves.
3. Hand-lever: For quarter-turn trim and drain valves 2 NPS and smaller.

2.02 TWO PIECE BALL VALVES WITH INDICATORS

A. UL 1091 and FM 1112 listed.

B. Description:

1. Minimum Pressure Rating: 300 psig.
2. Body Design: Two piece.
3. Body Material: Forged brass or bronze.
4. Port Size: Full.
5. Seat: PTFE.
6. Stem: Bronze or stainless steel.
7. Ball: Chrome-plated brass.
8. Actuator: Worm gear or traveling nut.
9. Supervisory Switch: Internal or external.
10. End Connections: Threaded or grooved.

2.03 IRON BUTTERFLY VALVES WITH INDICATORS

A. UL 1091 and FM 1112 listed.

B. Minimum Pressure Rating: 300 psig.

C. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.

D. Seat: EPDM.

E. Stem: Stainless steel.

F. Disc: Ductile iron with EPDM coating.

G. Actuator: Worm gear or traveling nut.

H. Supervisory Switch: Internal or external.

I. Body Design: Grooved-end or wafer style.

2.04 SWING CHECK VALVES

A. UL 312 and FM 1210 listed.

B. Minimum Pressure Rating: 175 psig.

C. Body Material: Cast or ductile iron.

D. Clapper: Bronze, EPDM-coated ductile iron, or stainless steel.

E. Seat: Bronze or EPDM-coated bronze.

F. End Connections: Flanged or Grooved.

2.05 IRON OS&Y GATE VALVES

A. UL 262 and FM 1120/1130 listed.

B. End Connections: Flanged or Grooved.

C. Maximum Working Pressure: 300 psi.

D. Body and Bonnet Material: Cast or ductile iron.

E. Wedge: Cast or ductile iron, or bronze with elastomeric coating.

F. Stem: Brass, bronze, or stainless steel.

G. Packing: Non-asbestos PTFE.

H. Supervisory Switch: External.

2.06 TRIM AND DRAIN VALVES

A. Ball Valves:

1. Description:

a. UL 258 or FM 1140 listed.

b. Pressure Rating: 300 psig.

c. Body Design: Two piece.

d. Body Material: Forged brass or bronze.

e. Port Size: Full or standard.

f. Seat: PTFE.

g. Stem: Bronze or stainless steel.

h. Ball: Chrome-plated brass.

i. Actuator: Hand-lever.

j. End Connections: Threaded or grooved.

PART 3 EXECUTION

3.01 EXAMINATION

A. Confirm valve interior to be free of foreign matter and corrosion.

B. Remove packing materials.

C. Examine guides and seats by operating valves from the fully open position to the fully closed position.

D. Examine valve threads and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage.

1. Check bolting for proper size, length, and material.
2. Verify gasket for size, defects, damage, and suitable material composition for service.
3. Replace defective valves with new valves.

3.02 INSTALLATION

A. Install valves in accessible locations to allow for operation, inspections, tests, and maintenance.

B. Install listed valves in accordance with their listing.

C. Install valves in accordance with manufacturer's instructions.

D. Support valves independently of adjacent piping.

E. Install valves in horizontal piping with stem at or above pipe center.

F. Position valves to allow full actuator movement.

G. Install OS&Y valves with full clearance for rising stem. Install surrounding components so they do not interfere with nor are they impacted by full extension of rising stem.

H. Install supervised shutoff valves in supervised-open position.

1. Install permanent identification signs indicating portion of system controlled by each shutoff valve.
2. Install threaded-end valves with unions upstream and downstream.

I. Install valve tags. See Section 210553. Label valves in accordance with NFPA standard applying to the piping system in which valves are installed.

END OF SECTION 210523

SECTION 210548

VIBRATION AND SEISMIC CONTROLS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vibration isolation requirements.

B. Vibration isolators.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 033000 - Cast-in-Place Concrete.

1.03 REFERENCE STANDARDS

A. Publications listed here are part of this specification to the extent they are referenced. Where no specific edition of the standard or publication is identified, the current edition shall apply.

B. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
2. Coordinate the work with other trades to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Notify Architect/Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 033000.

1.05 CONSTRUCTION SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.

1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.

1.06 CLOSEOUT SUBMITTALS

A. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.07 QUALITY ASSURANCE

A. Comply with applicable building code.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing fire suppression equipment.

B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:

C. General Requirements:

1. Select vibration isolators to provide required static deflection.
2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.

D. Piping Isolation:

1. Use flexible piping connections to vibration-isolated equipment.

2.02 VIBRATION ISOLATORS

A. General Requirements:

1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Secure fasteners according to manufacturer's recommended torque settings.

D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

E. Vibration Isolation Systems:

1. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
2. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
3. Adjust isolators to be free of isolation short circuits during normal operation.
4. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect vibration isolation and/or seismic control components for damage and defects.

C. Vibration Isolation Systems:

1. Verify isolator static deflections.
2. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.

D. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

END OF SECTION 210548

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SECTION 210553

IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe markers.

D. Ceiling tacks.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.03 REFERENCE STANDARDS

A. Publications listed here are part of this specification to the extent they are referenced. Where no specific edition of the standard or publication is identified, the current edition shall apply.

B. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

C. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

1.04 CONSTRUCTION SUBMITTALS

A. Refer to Division 01 requirements.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Product Data: Provide manufacturers catalog literature for each product required.

1.05 CLOSEOUT SUBMITTALS

A. Manufacturer's Installation Instructions: Indicate special procedures, and installation instructions.

B. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Automatic Controls: Tags.

B. Control Panels: Nameplates.

C. Instrumentation: Tags.

D. Major Control Components: Nameplates.

E. Piping: Pipe markers.
   1. Exposed in Finished Spaces: None.
F. Pumps: Nameplates.
G. Relays: Tags.
H. Small-sized Equipment: Tags.
I. Thermostats: Nameplates.
J. Valves: Nameplates and ceiling tacks where above lay-in ceilings.

2.02 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: 1/4 inch.
   3. Background Color: Black.
   4. Thickness: 1/8 inch.
   5. Plastic: Comply with ASTM D709.

2.03 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.
B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 PIPE MARKERS

A. Color: Comply with ASME A13.1.
B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
C. Color code as follows:
   1. Fire Quenching Fluids: Red with white letters.

2.05 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.
B. Mounting: Screw fasteners to the grid frame.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Use tags on piping 3/4 inch diameter and smaller.

1. Identify service, flow direction, and pressure.
2. Install in clear view and align with axis of piping.
3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

F. Locate ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 210553

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SECTION 211300

FIRE-SUPPRESSION SPRINKLER SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wet-pipe sprinkler system.

B. Preaction sprinkler system.

C. System design, installation, and certification.

D. Fire department connections.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 210500 - Common Work Results for Fire Suppression: Pipe and fittings.

C. Section 210523 - General-Duty Valves for Water-Based Fire-Suppression Piping.

D. Section 210548 - Vibration and Seismic Controls for Fire Suppression Piping and Equipment.

E. Section 210553 - Identification for Fire Suppression Piping and Equipment.

F. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

G. Section 284600 - Fire Detection and Alarm.

1.03 REFERENCE STANDARDS

A. Publications listed here are part of this specification to the extent they are referenced. Where no specific edition of the standard or publication is identified, the current edition shall apply.

B. FM (AG) - FM Approval Guide; Current Edition.

C. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2018, with Editorial Revision (2020).

D. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry; 2018, with Editorial Revision (2020).

E. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2017, with Editorial Revision (2020).

F. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements; 2023.

G. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and

Supplements.

H. NFPA 1963 - Standard for Fire Hose Connections; 2019.

I. UL (DIR) - Online Certifications Directory; Current Edition.

J. UL 405 - Standard for Safety Fire Department Connection Devices; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 CONSTRUCTION SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Shop Drawings:

1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components, and accessories. Indicate system controls.
3. Submit shop drawings, product data, and hydraulic calculations to Authorities Having Jurisdiction for approval. Submit proof of approval to Architect/Engineer.

D. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.

E. Designer's qualification statement.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

B. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Sprinklers: Type and size matching those installed in quantity required by referenced NFPA design and installation standard.
2. Sprinkler Wrenches: For each sprinkler type.

C. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

1.07 QUALITY ASSURANCE

A. Comply with FM (AG) requirements.

B. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years of documented experience.

D. Installer Qualifications: Company specializing in performing the work of this section documented experience and approved by manufacturer.

E. Equipment and Components: Provide products that bear FM (AG) label or marking.

F. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

1.08 MOCK-UP

A. Provide components for installation in mock-up.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

PART 2 PRODUCTS

2.01 SPRINKLER SYSTEM

A. Sprinkler System: Provide coverage for entire building.

B. Occupancy: As indicated on plans.

C. Water Supply: Determine volume and pressure from water flow test data.

D. Interface system with building fire and smoke alarm system.

E. Provide fire department connections where indicated.

F. Storage Cabinet for Spare Sprinklers and Tools: Steel, located at entering service location.

G. Pipe Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:

1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.

6. Other Types: As required.

H. All sprinkler heads shall be ordinary temperature rated except in areas where normal temperatures require higher temperature sprinklers and shall be tested and listed by UL or FM.

2.02 SPRINKLERS

A. Suspended Ceiling Type: Concealed pendant type with matching push on cover plate.
   1. Response Type: Quick.
   2. Coverage Type: Standard.
   3. Finish: Enamel, color as determined by architect .
   4. Escutcheon Plate Finish: Enamel, color as determined by architect.
   5. Fusible Link: Glass bulb type temperature rated for specific area hazard.

B. Exposed Area Type: Upright type with guard in mechanical, electrical and storage rooms.
   1. Response Type: Quick.
   2. Coverage Type: Standard.
   3. Finish: Brass.
   4. Fusible Link: Glass bulb type temperature rated for specific area hazard.

C. Sidewall Type: Semi-recessed horizontal sidewall type with matching push on escutcheon plate.
   1. Response Type: Quick.
   2. Coverage Type: Standard.
   3. Finish: Enamel, color as selected by architect .
   4. Escutcheon Plate Finish: Enamel, color as selected by architect .
   5. Fusible Link: Glass bulb type temperature rated for specific area hazard.

D. Guards: Finish to match sprinkler finish.

E. Flexible Drop System: Flexible Drop Systems are not acceptable.

F. Refer to drawings for sprinkler types in specific areas.

2.03 PIPING SPECIALTIES

A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber-faced clapper to automatically actuate water motor alarm and electric alarm, pressure retard chamber and variable pressure trim with the following additional capabilities and features:
   1. Activate electric alarm.
   2. Test and drain valve.

3. Replaceable internal components without removing valve from installed position.

B. Preaction Valve:
   1. Operated by detection system listed for releasing service and independent of building fire alarm system with provisions for local, manual, and indicated remote releases.
   2. Incorporate mechanical latching mechanism incorporating valve clappers independent of system water pressure fluctuations.
   3. Provide test detection device for each actuation circuit adjacent to each controlled valve in accordance with NFPA 13.

C. Backflow Preventer: Double check valve detector assembly backflow preventer with drain and supervised OS & Y gate valve on each end.

D. Test Connections:
   1. Inspector's Test Connection for Preaction Systems:
      a. Provide test connections approximately 6 ft above floor for each or portion of each sprinkler system equipped with an alarm device, located at the most remote part of each system.
      b. Route test connection to an open-site drain location, excluding janitor sinks, accepting full flow without negative consequences.
      c. Supply discharge orifice with same size as corresponding sprinkler orifice.
   2. Backflow Preventer Test Connection:
      a. Provide downstream of the backflow prevention assembly, listed hose valves with 2.5 inch National Standard male hose threads with cap and chain.
      b. Furnish one valve for each 250 gpm of system demand or fraction thereof.
      c. Provide permanent sign reading "Test Valve" in accordance with Section 210553.

E. Electric Alarm: Electrically operated red enameled gong with pressure alarm switch.
   1. Switch shall be sized to activate based on flow of a sprinkler of the smallest oriffice size installed downstream.

F. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.
   1. Switch shall be sized to activate based on flow of a sprinkler of the smallest oriffice size installed downstream.

G. Fire Department Connections:
1. Type: Free standing made of corrosion resistant metal complying with UL 405.
a. Inlets: Two way, 2-1/2 inch swivel fittings, internal threaded. Thread size and inlets according to NFPA 1963 or Authority Having Jurisdiction. Brass caps with gaskets, chains, and lugs.
b. Configuration: Horizontal.
c. Outlet: Bottom with pipe threads, 4 NPS.
d. Rated Working Pressure: 175 psi.
e. Finish: Chrome.
f. Sleeve: Brass, 18 inches height.
g. Signage: Raised or engraved lettering 1 inch minimum indicating system type.

2.04 PREACTION VALVE CONTROL PANEL

A. Provide a modular type control panel for electrically operated detection and extinguishing systems for each preaction valve.
1. Factory mount in surface mounted, steel cabinet with hinged doors, and cylinder lock.
2. Provide factory wired assembly containing components and equipment as required to perform specified system operating and supervisory functions.
3. Include isolation switch to allow system testing without activation of the preaction valve.
4. Include trouble lights and trouble alarm.
5. Provide 120 volt AC service transformed through a two-winding, isolation type transformer and rectified to low voltage DC for operation of all system actuating, signal sounding, trouble signal, and fire alarm tripping circuits.
6. Provide UL (DIR) listed as an extinguishing system releasing panel and separate from the building's fire alarm control panel.

B. Secondary Power Supply:
1. Storage Batteries:
a. Provide with sufficient ampere-hour rating to operate under supervisory and trouble conditions, including audible trouble signal devices under alarm conditions for an additional 10 minutes and as required in accordance with the equipment listing.
b. Prevent contact between terminals of adjacent cells, battery terminals, and other metal parts with separate cell construction.

2. Battery Charger:
    a. Provide solid-state automatic two rate type, capable of recharging completely discharged batteries to fully charged condition in 24 hours or less.
    b. Locate charger within control panel or battery cabinet.

2.05 AIR COMPRESSOR

A. Compressor: Single-unit, electric motor driven, motor, motor starter, safety valves, check valves, air maintenance device incorporating electric pressure switch and unloader valve.

2.06 ZONE CONTROL VALVE ASSEMBLY

A. Integral test and drain valve, customizable test orifice, flow switch, and pressure gauge.
B. Material: Carbon Steel.
C. Maximum Working Pressure: 365 psi.
D. Body:
    1. Housing: Ductile iron conforming to ASTM A536.
E. Shut-off and Test/Drain Valve: Chrome plated brass ball, brass clapper, stainless steel shafts, Delrin orifice, virgin Teflon, enhanced Teflon and EPDM rubber seals.
F. Water Flow Detector: Vane type with sealed retard, visual switch activation, and mechanical delay adjustment. Cover includes tamper resistant security screws and tool.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with referenced NFPA design and installation standard.
B. Install equipment in accordance with manufacturer's instructions.
C. Provide approved backflow preventer assembly at sprinkler system water source connection.
D. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.
E. Locate outside alarm gong on building wall .
F. Place pipe runs to minimize obstruction to other work.
G. Place piping in concealed spaces above finished ceilings.
H. Center sprinklers in two directions in ceiling tile and provide piping offsets as required.

I. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting.

J. Install air compressor on vibration isolators. Refer to Section 210548.

K. Flush entire piping system of foreign matter.

L. Install guards on sprinklers where indicated.

M. Hydrostatically test entire system.

N. Require test be witnessed by Fire Marshal.

O. Sprinklers shall be centered in 2' x 2' acoustical tile and white escutcheon plates shall be installed in all areas with finished ceilings.

P. Bronze upright heads shall be installed in areas with no finished ceiling or as shown on drawings.

Q. Where required by the architect sprinkler and escutcheon plate colors other than white may be required, but no special colors are required.

R. Where required by the architect or where indicated on the Drawings, concealed type sprinklers are to be installed.

S. All sprinkler heads for any shell space shall be spaced at a maximum of 120 square feet per head and shall be installed on an approximate 12’x10’ grid to accommodate future upfits. For upfitted or completed areas of the building the sprinkler head spacing shall be properly sized for area coverage as specified and required by NFPA 13 and as designated on drawings and shall be installed in strict accordance with their listings.

3.02 INTERFACE WITH OTHER PRODUCTS

A. Ensure required devices are installed and connected as required to fire alarm system.

END OF SECTION 211300

SECTION 212200

CLEAN-AGENT FIRE-EXTINGUISHING SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire suppression system control panel.

B. Space or area signage.

C. System piping and specialties.

D. Clean-agent containers.

E. Agent discharge nozzles.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 078400 - Firestopping.

C. Section 099123 - Interior Painting.

D. Section 210548 - Vibration and Seismic Controls for Fire Suppression Piping and Equipment.

E. Section 210553 - Identification for Fire Suppression Piping and Equipment.

F. Section 211300 - Fire-Suppression Sprinkler Systems.

G. Section 233300 - Air Duct Accessories: Fire and smoke dampers.

H. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

I. Section 284600 - Fire Detection and Alarm: Building fire alarm system and devices.

1.03 REFERENCE STANDARDS

A. Publications listed here are part of this specification to the extent they are referenced. Where no specific edition of the standard or publication is identified, the current edition shall apply.

B. ASHRAE Std 135 - BACnet - A Data Communication Protocol for Building Automation and Control Networks; 2012.

C. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.

D. ASME B31.1 - Power Piping; 2022.

E. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2022.

F. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.

G. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
H. ASTM A106/A106M - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service; 2019a.
I. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe; 2021.
J. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2023a.
K. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).
L. FM (AG) - FM Approval Guide; Current Edition.
M. NEMA ICS 6 - Industrial Control and Systems: Enclosures; 1993 (Reaffirmed 2016).
N. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
O. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.
P. NFPA 2001 - Standard on Clean Agent Fire Extinguishing Systems; 2022, with Errata.
Q. UL (DIR) - Online Certifications Directory; Current Edition.
R. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.
S. UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service; Current Edition, Including All Revisions.

1.04 CONSTRUCTION SUBMITTALS

A. Refer to Division 01 requirements.
B. Product Data: Provide system and component data bearing approval stamp from Authority Having Jurisdiction. Include detectors, release devices, discharge nozzles, manual controls, alarm devices, annunciators, extinguishing agent containers, manifolds, and control panel.
C. Shop Drawings:
    1. Provide stamp of approval from Authority Having Jurisdiction.
    2. Floor Plan(s): System layout with proposed raceway, piping, and component locations with a minimum drawing scale of 1/8 inch to 1 foot, use larger scale for details.
    3. Schematics: System riser, control and wiring diagrams with written sequence of operation.

D. Design Data: Submit design calculations stamp of approval from Authority Having Jurisdiction. Include calculated system pressures, nozzle flow rate, orifice code numbers, piping pressure losses, component flow data, and pipe sizes.

E. Certificates: Certify that products meet or exceed specified requirements.

1. Manufacturer: Certify that system meets or exceeds specified requirements.

F. Manufacturer's Instructions: Include recommended equipment installation and system components.

G. Test Reports: Indicate successful completion of tests; include certification of extinguishing agent container pressure and extinguishing agent quantity.

H. Code Authority Approval: Submit copy of inspection approval of fire protection system by Authority Having Jurisdiction.

I. Manufacturer's qualification statement.

J. Installer's qualification statement.

1.05 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of components and equipment, equipment identification markings, conduit and piping routing details, and agent container positions.

B. Operation and Maintenance Data:

1. Include electrical schematic written description of system design, drawings illustrating control logic and equipment locations, and technical brochures describing equipment.
2. Include manufacturer recommended spare parts list.
3. Include checklists and procedures for emergencies, troubleshooting techniques, abort functions, system control panel operation, trouble procedures, and safety requirements.

C. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

C. Welding Materials and Procedures: Comply with ASME BPVC-IX.

D. Installer Qualifications: Company specializing in performing work of the type specified and with at least five years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store equipment in shipping containers with labeling in place. Deliver fire extinguishing agent in approved containers.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Provide two year system warranty for complete replacement fire extinguishing agent.

C. Provide manufacturer's standard twenty year system warranty for complete replacement of fire extinguishing agent due to regulatory changes.

D. Provide manufacturer's standard twenty year system warranty for complete replacement of fire extinguishing agent due to system discharge, regardless of cause.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Data Center Room 004: Location of devices:

1. Smoke Detector: One at ceiling.
2. Heat Detector: Two at ceiling.
3. Abort Switch: Next to main entrance, left side.
4. Manual Release: Next to main entrance, right side.
5. Alarm Bell: Any suitable location.
6. Alarm Horn: Not required.

2.02 CLEAN-AGENT FIRE SUPPRESSION SYSTEM REQUIREMENTS

A. Engineered fire detection and suppression system that totally floods protected area with clean-agent fire extinguishing agent to extinguish fire.

1. Comply with NFPA 2001 and NFPA 72.
2. Fire Extinguishing Agent: Inergen.
   a. Inergen Compound: 52% Nitrogen, 40% Argon, and 8% Carbon Dioxide mixture.
   b. No ozone-depleting potential.
   c. Non-toxic associated.
   d. Specific gravity: 0.085 lb/ft3
   e. Vapor Density: 1.1 (Air = 1)
   f. Molecuilar weight: 34.
3. Locate extinguishing agent supply near each protected area.
4. Locate manual release stations at each exit from protected area.

5. Locate abort stations at each exit from protected area.
6. Provide all manufactured system components from a single source and by a single manufacturer.
7. Provide components listed and labeled by UL (DIR) for the type of system required and for use with the other components of the system.
8. System and Component Listings: FM (AG) and UL (DIR) for intended purpose.
9. Products Requiring Electrical Connection: Listed and classified by UL (DIR) or testing firm acceptable to authorities having jurisdiction as suitable for the purpose specified and indicated.

B. Engineered System Design Criteria:
1. Provide total flooding of fire extinguishing agent at manufacturer's recommended concentration by volume and initiated within 10 seconds of automated fire detection or immediately upon manual station operation, supplied continuously for 10 minutes with 10 percent allowance for room leakage.
2. Direct discharge parallel to ceiling; use 360 degree pattern nozzles except where obstructions would make 360 distribution inefficient.
3. Use UL-listed flow calculation software.
4. Provide sufficient amount of fire extinguishing agent. Consider the following when computing volume:
a. Volume of protected area.
b. Specific volume of fire extinguishing agent.
c. Additional quantities of fire extinguishing agent required to compensate for openings, pipe losses.
d. Other special conditions affecting extinguishing agent concentration.

2.03 FIRE SUPPRESSION SYSTEM CONTROL PANEL

A. Provide system controller in the form of fire alarm system monitored, self-contained control panel or module.

B. Type: Combination type approved as both alarm and releasing device, with solid state internal circuitry enclosed in NEMA ICS 6, Type 1 cabinet.

C. Provide NFPA 72, Class A circuit supervision for wire break or ground faults of:
1. Zone detection loops.
2. Suppression system solenoid valves.
3. Power supply and circuit wiring and fuse.
4. Battery interconnecting wires and fuse.

5. Alarm in abort mode.

D. Conceal control switches and indicators, with exception of Power On, Master Trouble, Supervisory Trouble, Circuit 1 Alarm, Circuit 2 Alarm and Release Indicators.

E. Equip panel with following standard features:
   1. Visual and audible annunciation of trouble or alarm signals.
   2. Panel reset switch.
   3. Trouble alarm silence switch with ring back feature.
   4. Battery test meter and switch.
   5. Manual discharge switch.
   6. Deadman abort switch.
   7. Programmable timers for pre-discharge and discharge, 0 to 60 second cycle.
   8. Isolated relay contactors for external alarm or equipment and ventilation shutdown.
   9. Relay contactors for general trouble signal.
   10. Relay contactor activated by detector zone board in alarm or trouble mode.

F. Annunciation: Provide the following annunciation:
   1. Power On: Green.
   2. System Trouble: Amber.
   3. Battery Trouble: Amber.
   4. Ground Fault: Amber.
   5. Release trouble: Amber.
   6. Agent Release: Red.
   7. Alarm Output Trouble: Amber.
   8. Supervisory Trouble: Amber.

G. Batteries: Provide nickel cadmium batteries and charger for continuous operation of detection, alarm, actuation and supervision functions for 24 hours. Provide automatic battery switch-over upon failure of primary power supply.

H. BAS, BMS, SCADA, or other Integrated Automation Link: ASHRAE Std 135 BACnet IP.

I. Initiating Devices:
   1. Manual Pull Stations:
      a. Surface housing fitted with double action control fitted with "push in" tab and "pull down" lever that locks in position after releasing spring-loaded contact switch, for mounting on electrical outlet box; addressable using manufacturer's standard monitor module.

1) Activate all audible and visual alarms.
2) Override any abort station or time delay function.
3) Activate all release and shutdown functions normally triggered by detectors or alarm system.
4) Engraved Sign or Label: Provide adjacent to each manual release station indicating area protected and that actuation will cause discharge of fire extinguishing agent.

2. Manual System Abort Switch:
   a. Stainless steel plate with momentary contact push button, countdown timer, magnetic door holders manual release, for mounting on electrical outlet box; addressable using manufacturer's standard monitor module.
   b. Engraved Sign or Label: Provide adjacent to each manual abort station, indicating area protected and that actuation will prevent discharge of fire extinguishing agent after automatic system is activated.
3. Ionization Smoke Detectors:
   a. UL (DIR) listed, NFPA 72, adjustable sensitivity, operating on ionization principle, activated by combustion products, plug-in, twist-lock unit easily removed from base.
   b. Ionization chambers: Dual, one for fire detection and second for reference, stabilizing detector for changes in temperature, humidity, and pressure.
   c. Amplifier-Switching Circuit and Indicator Lamp: Solid state, two-wire, 24 volts. On alarm, unit shall lock and be reset at control panel.
   d. Adjustment: Manual for normal or high sensitivity, with sensitivity setting visible and requiring no special tools.
   e. Base Assembly: Twist-lock type with screw terminals, lamp to indicate alarm, security base lock, and relay contactor.
4. Heat Detectors:
   a. UL (DIR) listed, NFPA 72, micro-processor based, thermistor type, that responds to a fixed temperature with minimal thermal lag.
   b. Electronically Addressable and Field Programmable: Resettable alert and alarm thresholds provide real-time value of current and local temperature when requested by operator.
   c. Configuration Option: Prevention of inadvertent or spurious fire signatures from accidental discharge of agent via programmable alarm

threshold.

J. Notification and Control Devices:

1. Alarm Bells: 24 VDC with supervision of circuit wiring, of modular design, red baked enamel finish, with minimum sound level of 84 dba at 10 feet, for mounting on 4 inch electrical outlet box.
2. Alarm Horns: 24 VDC with supervision of circuit wiring, with minimum sound level of 90 dba at 10 feet, for mounting on 4 inch electrical outlet box.
3. Strobe Beacon: 24 VDC with system identification on strobe lens.
4. Dampers: Electrically Actuated Fire-Smoke Control Dampers; see Section 233300.

K. Fire-Suppression Operating Sequence:

1. Actuation of one detector in either zone circuit:
   a. Illuminate zone indicator.
   b. Energize alarm bell.
   c. Shut down air-conditioning system and close dampers.
   d. Close doors to area.
   e. Signal building fire alarm system.
2. Actuation of second detector on second zone circuit:
   a. Illuminate zone indicator.
   b. Energize alarm horn.
   c. Shut down power to protected equipment.
   d. Actuate time delay for up to 30 seconds.
   e. Release extinguishing agent into protected area.
   f. If abort switch is engaged, delay release.
   g. Upon abort switch disengagement release extinguishing agent unless system cleared and reset.
3. Discharge of Extinguishing Agent:
   a. Sounds alarm bells and horns.
   b. Operates strobes.
   c. Close circuit to sprinkler pre-action valve.

2.04 SPACE OR AREA SIGNAGE

A. Entrance Warning Sign: One warning sign at each entrance to protected area.

B. Exit Warning Signs: One lighted, flashing warning sign at each exit from protected area.

2.05 SYSTEM PIPING AND SPECIALTIES

A. Steel Pipe: ASTM A53/A53M or ASTM A106/A106M Schedule 40, or ASTM A135/A135M Schedule 10, galvanized as specified in ASTM A53/A53M.
   1. Fittings: ASME B16.3 malleable iron class 300 for sizes 2 inch and smaller, or ASTM A234/A234M, wrought steel welding type fittings.
   2. Joints: Threaded, AWS D1.1/D1.1M welded, or grooved and shouldered pipe end couplings.

B. Pipe Hangers: ASME B31.1, UL (DIR) approved listing for sprinkler systems, split clamp up to 2-1/2 inch size, riser clamps over 2-1/2 inch size, adequate to offset discharge thrust.

C. Escutcheons: Chrome plated pressed or stamped brass, one-piece or split pattern, minimum 2 inches larger than opening.

D. Gauges: ASME B40.100, UL 393, or UL 404; 3-1/2 inch in diameter cast aluminum case, phosphor bronze bourdon tube, rotary brass movement, brass socket, front re-calibration adjustment, black figures on white background, 1 percent mid-scale accuracy, scale calibrated in psi.

2.06 CLEAN-AGENT CONTAINERS

A. Containers:
   1. Containers: Constructed, tested, and marked in accordance with applicable Department of Transportation (DOT) specifications. As a minimum, the containers must meet the requirements of DOT 3AA3000 or ISO 9089-1.
   2. Steel, red enamel finish; standard model and size for ease of replacement and addition.
      a. Each cylinder shall be equipped with a pressure seat-type valve and gauge. The system shall utilize manufacturer approved (ANSUL CV-98 or equal) valve assemblies.
      b. For 150 bar cylinders, each valve shall also include a safety pressure relief device, which provides relief at 3000 to 3360 psi per CGA test methods. Cylinder charging pressure is 2175 psi at 70 °F.
      c. For 200 bar cylinders, each valve shall also include a safety pressure relief device, which provides relief at 4000 to 4480 psi per CGA test methods. Cylinder charging pressure is 2900 psi at 70 °F.

3. Where multiple, replaceable containers are used, provide only containers of the same size and holding the same amount of extinguishing agent.
    a. When the system’s capacity exceeds 40 cylinders, a second pilot valve shall be provided and used for cylinder activation.
    b. Each valve shall be constructed of forged brass and shall attach to the cylinder providing a leak-tight seal.

B. Contents: Fill with required fire extinguishing agent.

C. Identification: Permanent plate or marking, specifying agent, tare and gross weight, pounds of fire extinguishing agent, and pressurization level; installed so plate or marking is visible and readable.

D. Safety Release: Equip with frangible disc safety device that operates when internal pressure exceeds 730 pounds per square inch.

E. Safety Release: Equip with frangible disc safety device.

F. Valves: Heavy duty forged brass, with safety pressure relief device, manual control, discharge valve, and pressure gauge.
    1. Pressure Reducer: The pressure reducer is required in the distribution piping to restrict the flow of clean agent, thus reducing the agent pressure down stream of the reducer. The pressure reducer contains a stainless steel orifice plate which is drilled to the specific size hole required based on the hydrau-liccalculation. The orifice plate provides readily visible orifice identification. Coordinate the pressure reducer sizes with the manufactuer.

G. Actuator: Resettable electric with pressurized nitrogen cartridge. Explosive devices are NOT permitted.
    1. Electric actuation of an agent container is accomplished by an electric actuator interfaced through a Control System. This actuator can be used in hazardous environments where the ambient temperature range is between 32 °F and 130 °F. In auxiliary or override applications, a manual lever actuator can be installed on top of the actuator.

H. Pressure Gauge: Visual indicator of internal pressure.

I. Low Pressure Switch: Electronic sensor; reports to control panel and provides audible and visual alarms when container pressure drops below 230 psi.

J. Manifold: Provide for systems with more than one container, with rack to secure each and check valves between each discharge and manifold.

K. Wall Bracket: Manufacturer's standard; UL (DIR) listed, welded steel construction, modular design with saddle bottom and front bracket.

2.07 AGENT DISCHARGE NOZZLES

A. Nozzles: UL (DIR) listed; orifice size providing required rates of discharge and coverage and to distribute extinguishing agent uniformly throughout protected area.
   1. The system design specifies the nozzle and orifice size to be used for proper flow rate and distribution pattern.
   2. The nozzle selection depends on the hazard and location to be protected.

B. Construction: Two-piece chrome plated brass or aluminum nozzle with textured finish with female pipe thread integral on body; one-piece deflector plate.
   1. Nozzles are available in either 360° or 180° discharge patterns.

C. Orifice Union Nipple Assemblies:
   1. Construction: Manufacturer's standard, UL (DIR) listed.
   2. Identification: Permanently marked with manufacturer's part number and UL (DIR) listing or FM (AG) approval.
   3. Rating: 2,000 lb.

D. Identification: Permanently mark nozzles with manufacturer's part number, UL listing and equivalent single orifice diameter.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that enclosing walls are continuous above ceilings to enable required concentration to be built up and maintained for required time to ensure fire is extinguished.

3.02 INSTALLATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe. Remove scale and dirt on inside and outside before assembly. Blow out pipe before nozzles or discharge devices are installed.

B. Route piping in orderly manner, concealed, plumb and parallel to building structure, and maintain gradient. Install piping to conserve building space, and not interfere with use of space and other work.

C. Securely support piping in accordance with ASME B31.1 with allowance for fire extinguishing agent thrust forces, and thermal expansion and contraction.

D. Use grooved mechanical couplings and fasteners only in accessible locations. Roll groove piping only.

E. Install unions downstream of valves and at equipment or apparatus connections.

F. Prepare pipe, fittings, supports, and accessories for finish painting, see Section 099123.

G. Identify in accordance with requirements of referenced standard.
   1. Place directional arrows and system labels wherever piping changes direction and minimum 20 feet on straight runs.
H. In rooms with suspended ceiling tiles, clip or retain tiles within 4 foot radius of the nozzles to prevent lifting during discharge.
I. Install wiring in compliance with NFPA 70, see Section 260583.
J. Make final connections between equipment and system wiring under direct supervision of factory trained representative of manufacturer.
K. Install engraved plastic instruction plate, detailing emergency procedures, at control panel and at each manual discharge and abort switch location. At control panel identify control logic units, contacts, and major circuits with permanent nameplates.
L. At hazard area walls pack space between pipe, pipe sleeve, or surface penetration with mineral fiber with elastomer caulk to a depth of 1/2 inch. Provide escutcheons where exposed piping passes through walls, floors, and ceilings. Seal pipe penetrations of fire separations. See Section 078400.
M. Locate discharge nozzle approximately 6 inches above or below ceiling. Avoid interference with other piping and equipment.
N. Locate remote manual releases at one or more doors to protect area where indicated. Locate deadman abort switch adjacent.
O. Mounting Height of Notification Devices: Between 72 to 80 inches above finished floor.
P. Locate extinguishing agent supply and backup pre-action cabinet near each protected area.
Q. Locate manual release at each exit from protected area.
R. Locate strobe units at points of entrance to each protected area.
S. Locate abort station at points of exit from each protected area.

3.03 INTERFACE WITH OTHER PRODUCTS

A. Integrate the system with pre-action sprinkler system, see Section 211300.
B. Provide auxiliary alarm and trouble/fault signals to fire alarm system for supervisory monitoring, see Section 284600.

3.04 FIELD QUALITY CONTROL

A. Manufacturer Services: Provide experienced manufacturer's field engineer to supervise installation and performance testing of the system.
B. Perform field inspection and testing in accordance with Section 014000 - Quality Requirements.

C. Test distribution piping and valving, prior to nozzle installation, to 50 psi air pressure test. Inspect joints using soap water solution or halide torch or lamp. Repair leaks and retest. Maintain test pressure for four hours.

D. Upon completion of installation provide final checkout inspection by factory trained representative of manufacturer to ascertain proper system operation. Leave system in a fully commissioned and automatic readiness state with circuitry energized and supervised.

E. Test circuits including automatic discharge, manual discharge, equipment shut-down, alarm devices, and storage container pressure. Test supervision of each circuit.

F. Check each ionization detector with a sensitivity meter, adjust. Record sensitivity, and include record in test report.

G. Submit original copies of tests, indicating that factory trained technical representatives of the manufacturer have inspected and tested systems and are satisfied with methods of installation, connections and operation.

H. Pressure test entire enclosure with test fan, pressurizing protected area both under positive and negative conditions. Confirm that leakage is within system design allowance.

3.05 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate that components, except discharge assemblies, are functioning properly and in conjunction with the controls system.

3.06 MAINTENANCE

A. See Section 017000 - Execution and Closeout Requirements for additional requirements relating to maintenance service.

B. Provide inspections and maintenance performed by competent personnel in the employ of the system installer.

C. Conduct inspections at 6 months and 12 months from Date of Substantial Completion to verify proper operation of system, check agent container weight and pressure, and a thorough check of controls, detection and alarm systems.

D. Remedy of all deficiencies shall be included at no extra cost to Owner except for replacement of agent due to discharge under normal use or damage due to abuse.

E. Submit documents certifying satisfactory system conditions. Include manufacturer's certificate of acceptance of inspector's qualifications.

END OF SECTION 212200

SECTION 220000

PLUMBING COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the requirements for Enhanced Commissioning to be used on this project.

B. Systems to be commissioned include:

1 Domestic water heating system and equipment.
2. Laboratory plumbing systems.

C. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Sections 230000, 260000 and other Division 01 Specification Sections, apply to this Section.

D. Specification 001700a and 001700b contains the Commissioning Plan and Building Envelope Commissioning Plan.

1.2 WORK INCLUDED

A. A third party Commissioning Agent has been engaged by the Owner to administer the commissioning of the building systems.

B. The Contractor shall provide all commissioning services as outlined in this Section; perform all testing, measurements, and inspection outlined in the ‘Commissioning Plan”; and coordinate with the Commissioning Agent.

C. The Commissioning Agent will review all submittals related to the systems to be commissioned after approval and in conjunction with the Engineer of Record.

D. Post Occupancy commissioning is included to be conducted prior to the 10 months after substantial completion.

E. The Contractor shall provide the Commissioning Agent the Operations and Maintenance (O&M) for review and comment.

F. The Contractor shall provide the Commissioning Agent Owner Training Plan for review and comment.

1.3 COMMISSIONING OBJECTIVES

A. To ensure that all building Domestic Hot Water; laboratory plumbing; and interfaces of these systems with other building systems are installed, tested, and are operating in compliance with Contract Documents and within the scope of design requirements.

B. To ensure that all system operation and maintenance personnel are properly instructed to effectively and efficiently operate and maintain the building systems, subsystems, domestic hot water, and laboratory plumbing. To further ensure that they will receive all required manuals and documentation.

C. To ensure the Systems, Operation and Maintenance Manuals accurately reflect the installed equipment and systems.

D. The Commissioning Agent shall provide the following to the Contractor for implementation and execution.

1. Commissioning Plan: The Commissioning Agent shall prepare the Commissioning Plan in accordance with contents as specified herein.

2. Checklists: The Commissioning Agent shall prepare the Pre-Functional and Functional Performance Test Forms, specifically for this project, and edited to suit the equipment and systems installed.

E. The Commissioning Agent shall prepare a Final Commissioning Report containing a compilation of the completed checklists, Issues and Benefits Log, Vendor Equipment Startup Reports, and TAB Reports.

1.4 REFERENCED STANDARDS

A. ASHRAE Guideline 0-2019, “The HVAC Commissioning Process.”

B. NEBB, “Procedural Standards for Building Systems Commissioning.”

C. SMACNA, “HVAC Systems Commissioning Manual.”

1.5 COMMISSIONING TEAM

A. The Contractor shall designate team members from each of the following to participate in the Commissioning Process:

1. General Contractor
2. Plumbing Subcontractor
3. Equipment Startup Technicians

B. The Owner may designate a representative to participate in the Commissioning Process.

C. Each of the team member’s names shall be submitted in writing to the Commissioning Agent for inclusion in the Commissioning Plan. Members of the team cannot be replaced or substituted without the Commissioning Agent and Owners concurrence.

PART 2 - PRODUCTS

(NOT APPLICABLE)

PART 3 - EXECUTION

3.1 IMPLEMENTATION OF THE COMMISSIONING PLAN

A. Sequence of Events

1. The Commissioning Agent shall provide the Commissioning Plan to the Contractor for execution.

2. A kick off meeting attended by all parties will be conducted by the Commissioning Agent.

2. The Commissioning Agent will periodically visit to the job site to observe installation activities. Observations will be documented on site visit reports and the Issues and Benefits log.

3. The Contractor shall maintain the Prefunctional Checklists on the job site. The installing trade Foreman shall sign off on each item as it is completed.

4. Prior to any equipment startup, the Contractor shall request the Commissioning Agent backcheck the Prefunctional Checklist and verify all items are complete and the building condition is ready for startup.

4. All equipment shall be started by qualified technicians and documented on standardized startup forms typically provided by the equipment manufacturer. The startup documentation shall be submitted to the Commissioning Agent for review and inclusion in the final commissioning report.

5. The Contractor shall submit the approved duct air leakage (DALT) and testing, adjusting, and balancing (TAB) reports to the Commissioning Agent.

6. The Contractor shall provide notice that the entire control system (both building automation and equipment controllers) is complete; the point-to-point connectivity has been confirmed, instruments have been calibrated, sequence of operation checked, and the computer graphics interface is finished.

7. The systems, operation and maintenance manuals shall be submitted to the Commissioning Agent for review.

8. Functional Testing will begin only after all of the items above are complete. Functional commissioning may occur on second shift, if needed to support the building occupancy.

9. The Contractor shall submit the Owner Training plan to the Commissioning Agent for review. Once training is completed, the attendance sign in sheet shall be forwarded to the Commissioning Agent. Individuals with direct experience with the equipment startup and operation shall participate in the training, including the project startup technicians.

10. Post occupancy commissioning will be performed prior to the warranty expiration.

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11. When all of the above items are complete, and all of the items on the Issues and Benefits Log have been resolved, the Commissioning Agent will prepare the Final Commissioning Report. The report will contain the Commissioning Agent's recommendations on final acceptance of the Project.

B. Equipment and Systems Startup:

1. Pre-startup Verification: Prior to startup of equipment and systems, the Contractor shall indicate on the pre-start checklists and Commissioning Agent shall observe and verify that all items have been substantially installed in accordance with the project Contract Documents, including all change orders. Verification of the basic installation testing of systems shall be performed by the Contractor and shall include:

   a. Hydrostatic testing of piping systems.

b. Cleaning, flushing, and venting of piping systems, including removal and cleaning of all strainers.

c. Cleaning of equipment and systems of construction dirt and debris, including replacement of filters.

d. Alignment of all rotating machinery.

e. All items on the Prefunctional Checklists.

2. Startup Verification: The Contractor shall indicate on the startup checklists, and Commissioning Agent shall verify that all equipment, systems, and subsystems have been activated and operate substantially in accordance with Contract Documents, with all equipment, system, and electrical operating and safety devices checked and functional. The Contractor's work also includes but is not limited to:

a. Calibration and testing of all automatic temperature control devices and building automation systems

b. Testing and verification of all interlocks and interfacing between equipment, systems, subsystems, and other building systems

c. Adjust the hot water system balance valves.

3. Startup Documentation: Completed startup checklists shall be filled out by the Contractor, and provided to the Commissioning Agent after startup verification of each system, subsystem or each item of equipment. Where available the equipment manufacturer’s startup form shall be used for documentation. Startup of each piece of equipment shall be documented in a professional manner on a separate document. The documentation shall contain the company name, address, and signature of the technician.

3.2 FUNCTIONAL PERFORMANCE TESTING

A. Every item of equipment, all systems and subsystems, controls, and all related equipment shall be tested and evaluated for conformance to performance data in the Contract Documents. Included is conformance to:

1. Domestic hot water equipment output temperatures.

2. Plumbing systems and subsystems flow and distribution performance.

3. Adherence to Sequences of Operation.

4. Interface with other equipment and/or systems.

B. Functional performance testing shall not begin until all equipment and systems have had startup verification by the Contractor and notification of completion has been given to the Commissioning Agent by the Contractor.

1. Functional performance test checklists developed by the Commissioning Agent shall be used to document the equipment functional performance tests.

2. Each item of system equipment will be functional performance tested by the Contractor and the results documented by the Contractor at full load (and under part load conditions where required by the Contract Documents).

3. Operation under “abnormal and/or emergency conditions” shall be simulated by the Contractor for equipment and systems, and all safety equipment and control operations verified.

4. Test methods shall be documented and approved by the Commissioning Agent prior to implementation and shall be covered during the Owner’s training as well.

5. No equipment test functions or procedures shall be eliminated from the functional performance test unless approved by the Commissioning Agent and the Owner.

6. The startup technicians shall be present during Functional Commissioning of equipment as applicable.

D. Test Documentation: Functional performance test checklists developed by the Commissioning Agent shall be used by the Contractor to document the results of the functional performance testing process.

E. Test Failures: No system or subsystem shall be accepted until all items of equipment in the system have approved and verified functional performance test checklists.

1. When a functional performance test is not approved, the Contractor shall provide a written report to the Commissioning Agent listing the deficiencies causing the test failure, and remedy.

2. After all deficiencies have been corrected; the entire functional performance test for the equipment, system, or subsystem shall be repeated at the discretion of the Commissioning Agent.

3. The Commissioning Agent will continue to monitor the actions to correct the equipment or system deficiencies until an acceptable functional performance test has been accomplished.

F. Deferred Tests: If any checklist or functional performance test cannot be completed for seasonal reasons, lack of occupancy, or for other reasons, a written report shall be sent by the Contractor to the Commissioning Agent indicating when the test will be scheduled.

1. If any checklist or functional performance test cannot be accomplished due to deficiencies outside the scope of work, the deficiencies shall be resolved and corrected by the appropriate parties before completion of the commissioning process.

3.3 OWNER TRAINING

A. The Contractor shall provide Owner Training as indicated in the Contract Documents. (See section 017823)

3.4 POST OCCUPANY FUNCTIONAL TESTING

A. Post Occupancy functional testing will be performed on the major equipment and building systems to verify system performance under design conditions.

1. The same commissioning team must be assembled for this work.

2. The testing will be reduced scope and focus on performance and identification of issues that have arisen since the construction period.

3.5 COMMISSIONING REPORT

A. The Final Commissioning Report will be prepared by the Commissioning Agent with the following information provided by the Contractor.

1. Site Visit Reports

2. Issues and Benefits Logs

3. Pre-functional Checklists

4. Functional Checklists

5. Startup Reports

3.6 ONGOING COMMISSIONING

A. The Commissioning Agent shall provide an Ongoing Commissioning Plan with the Final Commissioning Report. Ongoing Commissioning Plan shall detail the following:

1. Ongoing Commissioning Definitions

2. Systems to be Commissioned

3. Project Planning and Budget

4. Systems Testing & Performance Verification

5. Corrective Action Response

3.7 ACCEPTANCE

A. The Commissioning Agent shall make a recommendation of final acceptance of the project to the Owner.

END OF SECTION 220800

SECTION 220500

COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. This Section applies to all Plumbing specification Sections.

1.02 JOB CONDITIONS

A. The drawings show the general scope and arrangement of the plumbing systems and shall be followed as closely as actual conditions allow.

B. Give consideration to all other trades. Make arrangements to avoid conflicts and interference with other work. Fully coordinate all components of plumbing systems with minor adjustments as required, including provision of offsets, transitions, fittings, and accessories to meet actual conditions.

1.03 ELECTRICAL WORK

A. Electrical equipment and electrical motor-driven equipment specified herein shall be provided complete with motors, integral motor starters where indicated, and controls.

B. Electrical equipment and wiring shall conform to the requirements of Division 26 - Electrical. Manual or automatic control and protective or signal devices required for the operation specified herein, and any control wiring required for control devices but not shown on the electrical plans shall be provided under this Section.

1.04 CONFORMANCE TO REGULATIONS

A. All work shall conform to the regulations of the applicable federal, state, and local laws, ordinances and codes, including but not limited to the 2018 Virginia Uniform Statewide Building Code (VUSBC), the 2018 IPC, the 2018 IFGC, and the 2018 IECC.

1.05 REGULATORY REQUIREMENTS

A. All products shall be listed by the Underwriters Laboratories, Inc. (UL), and shall bear the UL label. Where UL labels are not provided from the factory, the contractor shall be responsible for having the equipment or materials tested by a UL testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

1.06 QUALITY ASSURANCE

A. Work shall meet or exceed minimum recommendations of:

1. AGA - American Gas Association
2. ANSI - American National Standards Institute
3. ASME American Society of Mechanical Engineers
4. ASPE - American Society of Plumbing Engineers
5. ASTM - American Society for Testing and Materials
6. AWS - American Welding Society
7. AWWA - American Water Works Association
8. USDOE - United States Department of Energy
9. EPA - Environmental Protection Agency
10. GAMMA - Gas Appliance Manufacturer's Association
11. IBC - International Building Code (current adopted edition)
12. IECC - International Energy Conservation Code (current adopted edition)
13. IFGC - International Fuel Gas Code (current adopted edition)
14. IPC - International Plumbing Code (current adopted edition)
15. ISA - Instrument Society of America
16. NEMA - National Electrical Manufacturers Association
17. NIOSH - National Institute for Occupational Safety and Health
18. NSF - National Sanitation Foundation
19. OSHA - Occupational Safety and Health Act
20. TIMA - Thermal Insulation Manufacturers Association
21. UL - Underwriters' Laboratories
22. VUSBC - Virginia Uniform Statewide Building Code (current adopted edition)

B. Reference to the standards of any technical society, organization, or association, or to the laws, ordinances, or codes of governmental authorities shall mean the latest standard, code, or specification adopted, published, and effective at the date of taking bids.

C. The specifications, codes, and standards referenced in these specifications (including addenda, amendments, and errata) shall govern in all cases where references thereto are made. In case of conflict between the referenced specifications, the more stringent requirement shall govern unless otherwise permitted by the Architect/Engineer. Major conflicts shall be referred to the Engineer for resolution.

1.07 MATERIALS AND EQUIPMENT

A. Unless specifically provided otherwise, all materials and equipment furnished for permanent installation in the Work shall conform to applicable standards and be new, current design, unused, and undamaged.

B. Individual parts shall be manufactured to standard sizes and gauges so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate equipment shall be interchangeable.

1.08 UTILITIES AND CONNECTIONS

A. Verify location of all existing utilities before laying out and making connections. Report any inconsistencies to Engineer before commencing work. Contractor shall be responsible for any error resulting from failure to exercise these precautions.

1.09 WIRING DIAGRAMS

A. All plumbing equipment shall be provided with complete wiring diagrams showing all power and control connections. The diagrams shall be placed in a clear plastic pouch that is permanently affixed to the equipment.

1.10 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Refer to Division 01 requirements.

B. Protect products from damage, marring, and soiling.

C. Any marring of factory finishes shall be touched up to match the original factory finish.

1.11 SUBMITTALS

A. Refer to Division 01 requirements.

B. General: The Contractor shall submit information, for Architect/Engineer's review, to demonstrate compliance of proposed Products and/or installations with the Contract Documents. This information shall include, but not be limited to: catalog data; performance data; noise levels; etc. Proposed Products that are not in compliance with the Contract Documents may be rejected. Information must be submitted on all required Products, including proposed Products that appear to be in compliance with the Contract Documents.

1.12 SUBSTITUTIONS

A. Refer to Division 01 requirements.

1.13 OPERATING AND MAINTENANCE MANUAL

A. Refer to Division 01 requirements.

1.14 INSTRUCTION AND TRAINING SESSIONS

A. Refer to Division 01 requirements.

1.15 RECORD DRAWINGS

A. Refer to Division 01 requirements.

1.16 PROJECT/SITE CONDITIONS

A. Install work in locations shown on Drawings, unless prevented by Project conditions.

B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Architect/Engineer before proceeding.

1.17 WARRANTIES

A. Refer to Division 01 requirements.

B. Warranty periods shall begin from Date of Substantial Completion.

1.18 CONTRACTOR COORDINATION

A. Nomenclature for final room names and numbers may vary from the construction documents. Final names and numbers used in the shop drawings shall be coordinated with final room names and numbers assigned by the Owner and Architect.

B. Plumbing contractor(s) shall coordinate their work with all other trades prior to fabrication of systems and commencement of installation. It shall be the responsibility of each contractor to review the work of other trades (including, but not limited to civil, structural, architectural, food service, fire alarm, fire suppression, HVAC, and electrical) as it affects their work, and as their work affects other trades, to insure that the construction documents are closely followed. Where discrepancies arise, they shall be referred to the Architect/Engineer for resolution before proceeding with the Work.

PART 2 - PRODUCTS

2.01 NOT USED.

PART 3 - EXECUTION

3.01 GENERAL

A. Unless otherwise noted, install equipment in accordance with manufacturer's printed instructions for application indicated.

B. Install, operate, and adjust systems in accordance with the plans and specifications.

C. All work for this division shall conform to the regulations of the applicable federal, state, and local laws, ordinances, and codes.

D. A Request For Information (RFI) shall be submitted to the Architect/Engineer for any portion of the Work that the Contractor determines a clarification is required. Prior to submitting a RFI the Contractor shall thoroughly research the Contract Documents to ensure information has not been overlooked. The RFI shall include references to the portion of the Contract Documents that requires a clarification. The Contractor shall allow a minimum of three business days for the Architect/Engineer to respond to the RFI. The Contractor shall not proceed with that portion of the Work until a response

has been returned.

E. All Products delivered to the site(s) shall be stored in accordance with the manufacturer's printed instructions. If a manufacturer does not have printed instructions then the Product shall be adequately housed and otherwise protected against damage or corrosion. If any Product stored at the site(s) is not protected as specified herein, the Contractor shall not receive payment for that Product. Any Product damaged as a result of failure to comply with this requirement shall be replaced by the Contractor at no additional cost to the Owner.

3.02 ACCESSIBILITY

A. Locate all equipment, which must be serviced, operated, or maintained in fully accessible positions in accordance with manufacturer's recommendations and subject to approval of Architect. Provide a minimum of two feet of clearance in front of equipment access doors and components requiring service.

3.03 FIRESTOPPING

A. Refer to Division 07 requirements.

B. For all penetrations or openings in or through fire-rated assemblies including, but not limited to, walls, floors, ceilings, shafts, etc. the Contractor shall provide approved UL listed "through penetration firestop" systems to ensure integrity of rated assembly. Refer to details for approved options and confirm final selection with Architect/Engineer before proceeding with this portion of the Work.

3.04 PROTECTION OF OPENINGS

A. Openings in partially installed systems, including equipment and piping, shall be plugged, capped, or otherwise closed with approved methods and materials or devices until connections are made.

3.05 PROTECTION FROM MOVING PARTS

A. Belts, shafts, couplings, and other rotating or moving parts, located so that any person may come in proximity thereto, shall be fully enclosed or properly guarded.

3.06 COORDINATION WITH FOOD SERVICE CONTRACTOR (FSC)

A. Coordinate work with the requirements of the Food Service drawings and specifications.

B. All final connections to equipment will be by Plumbing Contractor, except indirect waste lines that will be provided and made by the FSC.

C. Cold water lines shall be insulated to prevent condensation formation.

D. Provide service valves on all rough-ins. Each connection to each piece of equipment shall have its own individual valve.

E. The Plumbing Contractor shall run all vent piping or waste lines concealed. Any required exposed vents shall be submitted to the Architect/Engineer for approval for furring-in stainless steel sleeve, or chase provision as an alternate.

F. All horizontal piping lines extended and connected to equipment shall run as high as practical and not less than 6" above floor.

G. Coordinate exact location of all floor drains in food service areas with Architect/Engineer and FSC prior to installation.

H. Safe-wastes (floor sinks) shall not be located in passages and aisles. Where adjacent to walls, safe-wastes shall be located as close to the wall as possible.

END OF SECTION 220500

SECTION 220517

SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe sleeves.

B. Pipe sleeve-seals.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 220719 - Plumbing Piping Insulation.

1.03 REFERENCE STANDARDS

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2022a.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.

1.04 SUBMITTALS

A. Refer to Division 01 requirements.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

PART 2 PRODUCTS

2.01 PIPE SLEEVES

A. Vertical Piping - Pipe passing through interior floor slabs, above at-grade level:

1. Zinc coated or cast iron pipe, secured to floor slab.
2. Sleeve Length: 2 inch above finished floor.
3. Provide sealant for watertight joint.

B. Vertictal Piping - Pipe passing through at-grade floor slabs:

1. Zinc coated or cast iron pipe, secured to floor slab.
2. Sleeve Length: 2 inch above finished floor.
3. Provide Pipe Sleeve Seal (see below).

C. Horizontal Piping - Pipe passing through interior walls and partitions, above at-grade level:

1. Galvinized sheet metal with no sharp edges.
2. Sleeve Length: extend minimum 1" inch beyond finished wall/partition.

D. Horizontal Pipe - Pipe passing through below grade exterior walls:

1. Zinc coated or cast iron pipe sleeve.
2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both exterior and interior sides of penetration.

E. Pipe Passing Through Mechanical Room:
1. Galvanized steel pipe or black iron pipe with asphalt coating.
2. Connect sleeve with floor plate except in mechanical rooms.

F. Clearances:
1. Provide allowance for insulated piping.
2. Wall, Floor, and Partitions: 1 inch greater than external pipe diameter, including pipe insulation, where required.
3. All Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

2.02 PIPE-SLEEVE SEALS

A. Modular Mechanical Seal:
1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
2. Provide watertight seal between pipe and wall/casing opening.
3. Elastomer element size and material in accordance with manufacturer's recommendations.
4. Glass reinforced plastic pressure end plates.

B. Sealing Compounds:
1. Provide packing and sealing compound to fill pipe to sleeve thickness.
2. Combined packing and sealing compounding to match partition fire-resistance hourly rating.

PART 3 EXECUTION

3.01 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. Install piping to conserve building space, to not interfere with use of space and other work.

C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation

required.

E. Underground Piping: Caulk pipe sleeve watertight with mechanically expandable chloroprene inserts with bitumen sealed metal components.

F. Aboveground Piping:

1. Pack solid using mineral fiber complying with ASTM C592.
2. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.

G. All Rated Openings: Caulk tight with fire stopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.

H. Manufactured Sleeve-Seal Systems:

1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a water-tight seal.
6. Install in accordance with manufacturer's recommendations.

END OF SECTION 220517

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SECTION 220519

METERS AND GAUGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pressure gauges and pressure gauge taps.

B. Thermometers and thermometer wells.

1.02 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2022.

B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014.

C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014 (Reapproved 2021).

1.03 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

1.04 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 - PRODUCTS

2.01 PRESSURE GAUGES

A. Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.

1. Case: Steel with brass bourdon tube.
2. Size: 4-1/2 inch diameter.
3. Mid-Scale Accuracy: One percent.
4. Scale: Psi.

2.02 PRESSURE GAUGE TAPPINGS

A. Gauge Cock: Tee or lever handle, brass for maximum 150 psi.

B. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections.

C. Syphon: Steel, Schedule 40, 1/4 inch angle or straight pattern.

2.03 SELF POWERED THERMOMETERS

A. Solar-powered digital thermometer with a ten Lux (one foot-candle) rating and a 10-second display update. The unit shall swivel and pivot to meet custom installation requirements. Capable of handling humidity up to 95% RH non-condensing.

1. Size: 0.375 inch LCD display.
2. Window: Clear glass.
3. Hi-Impact plastic case and protective plastic digital display cover.
4. Accuracy: 2 percent, per ASTM E 77.
5. Calibration: Degrees F and Degrees C.

2.04 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide one pressure gauge per pump, installing taps before strainers and on suction and discharge of pump.

C. Install pressure gauges with pulsation dampers. Provide gage cock to isolate each gauge. Extend nipples and siphons to allow clearance from insulation.

D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

E. Provide instruments with scale ranges selected according to service with largest appropriate scale.

F. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

G. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

END OF SECTION 220519

SECTION 220523

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Ball valves.

B. Butterfly valves.

C. Check valves.

D. Plug valves.

1.02 RELATED REQUIREMENTS

A. Section 220553 - Identification for Plumbing Piping and Equipment.

B. Section 220719 - Plumbing Piping Insulation.

C. Section 221005 - Plumbing Piping.

1.03 ABBREVIATIONS AND ACRONYMS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Non-rising stem.

E. OS&Y: Outside screw and yoke.

F. PTFE: Polytetrafluoroethylene.

G. TFE: Tetrafluoroethylene.

1.04 REFERENCE STANDARDS

A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch; 2013 (Reaffirmed 2018).

B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2020.

C. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard; 2013.

D. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves; 2009.

E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.

F. ASME B16.34 - Valves - Flanged, Threaded and Welding End; 2013.

G. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2022.

H. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2023).

I. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017.

J. AWWA C606 - Grooved and Shouldered Joints; 2022.

K. MSS SP-67 - Butterfly Valves; 2011.
L. MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends; 2011.
M. MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends; 2011.
N. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; 2013.
O. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.
P. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).
Q. NSF 372 - Drinking Water System Components - Lead Content; 2011.

1.05 SUBMITTALS

A. Refer to Division 01 requirements.

1.06 QUALITY ASSURANCE

A. Manufacturer:
1. Obtain valves for each valve type from single manufacturer.
2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
1. Minimize exposure of operable surfaces by setting ball valves to open position.
2. Protect valve parts exposed to piped medium against rust and corrosion.
3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
4. Adjust gate valves to the closed position to avoid clattering.
5. Secure check valves in either the closed position or open position.

B. Use the following precautions during storage:
1. Maintain valve end protection and protect flanges and specialties from dirt.
2. Store valves in shipping containers and maintain in place until installation.
a. Store valves indoors in dry environment.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. Provide the following valves for the applications if not indicated on drawings:
1. Shutoff: Ball.
2. Throttling: Butterfly.
3. Swing Check (Pump Outlet):
a. 2 NPS and Smaller: Bronze swing check valves with bronze or nonmetallic disc.

b. 2-1/2 NPS and Larger for Domestic Water: Iron swing check valves with closure control, metal or resilient seat check valves.

B. Substitutions of valves with higher CWP classes or SWP ratings for same valve types are permitted when specified CWP ratings or SWP classes are not available.

2.02 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: Not less than rating indicated; as required for system pressures and temperatures.

B. Valve Sizes: Match upstream piping unless otherwise indicated.

C. Valve Actuator Types:

1. Handwheel: Valves other than quarter-turn types.
2. Hand Lever: Quarter-turn valves 6 NPS and smaller.

D. Valves in Insulated Piping: With 2 NPS stem extensions and the following features:

1. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
2. Butterfly Valves: Extended neck.
3. Memory Stops: Fully adjustable after insulation is installed.

E. Valve-End Connections:

1. Threaded End Valves: ASME B1.20.1.
2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
3. Pipe Flanges and Flanged Fittings 1/2 NPS through 24 NPS: ASME B16.5.
4. Solder Joint Connections: ASME B16.18.
5. Grooved End Connections: AWWA C606.

2.03 BRONZE BALL VALVES

A. Two Piece, Full Port with Bronze Trim:

1. Comply with MSS SP-110.
2. SWP Rating: 150 psig.
3. CWP Rating: 600 psig.
4. Body: Bronze.
5. Ends: Threaded.
6. Seats: PTFE.
7. Stem: Bronze.
8. Ball: Chrome plated brass.

2.04 IRON, GROOVED-END BUTTERFLY VALVES

A. CWP Rating: 175 psig (1200 kPa).

1. Comply with MSS SP-67, Type I.
2. Body: Coated ductile iron.
3. Stem: Two-piece stainless steel.
4. Disc: Coated ductile iron.
5. Disc Seal: EPDM.

2.05 BRONZE SWING CHECK VALVES

A. Class 125: CWP Rating: 200 psig (1380 kPa)
   1. Comply with MSS SP-80, Type 3.
   2. Design: Horizontal flow.
   3. Body: Bronze, ASTM B62.
   4. Ends: Threaded as indicated.
   5. Disc: Bronze.

2.06 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125 with Lever and Spring-Closure Control.
   1. Comply with MSS SP-71, Type I.
   2. Description:
      a. CWP Rating: 200 psig.
      b. Design: Clear or full waterway.
      c. Body: ASTM A126, gray iron with bolted bonnet.
      d. Ends: Flanged as indicated.
      e. Trim: Bronze.
      f. Gasket: Asbestos free.
      g. Closer Control: Factory installed, exterior lever, and weight.

2.07 LUBRICATED PLUG VALVES

A. Regular Gland with Threaded Ends:
   1. Comply with MSS SP-78, Type II.
   2. Class 125: CWP Rating: 200 psig.
   3. Body: ASTM A48/A48M or ASTM A126, cast iron with lubrication sealing system.
   4. Pattern: Regular or short.
   5. Plug: Cast iron or bronze with sealant groove.

PART 3 EXECUTION

3.01 EXAMINATION

A. Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result

in leakage.

B. Verify valve parts to be fully operational in all positions from closed to fully open.

C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.

D. If valve is determined to be defective, replace with new valve.

3.02 INSTALLATION

A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.

B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

C. Install check valves where necessary to maintain direction of flow as follows:

1. Swing Check: Install horizontal maintaining hinge pin level.

END OF SECTION 220523

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SECTION 220529

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components for equipment, piping, and other plumbing work.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General - Purpose Piping; 2014.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999 (Reapproved 2014).

F. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

I. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
2. Coordinate the work with other trades to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.

4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
5. Notify Architect/Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 033000.

1.05 SUBMITTALS

A. Refer to Division 01 requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

1. Comply with MSS SP-58.
2. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
3. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
    a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
    b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Metal Channel (Strut) Framing Systems:

1. Provide factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
2. Comply with MFMA-4.

C. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

D. Thermal Insulated Pipe Supports:

1. General Construction and Requirements:
    a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
    b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
    c. Pipe supports to be provided for nominally sized, 1/2 inch to 30 inch iron pipes.
    d. Insulation inserts to consist of rigid phenolic foam insulation surrounded by a 360 degree, PVC jacketing.
2. PVC Jacket:
    a. Pipe insulation protection shields to be provided with a ball bearing hinge and locking seam.
    b. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
    c. Thickness: 60 mil.
3. Pipe insulation protection shields to be provided at the hanger points and guide locations on pipes requiring insulation as indicated on drawings.

E. Pipe Supports:

1. Liquid Temperatures Up To 122 degrees F:
    a. Overhead Support: MSS SP-58 Types 1, 3 through 12.
    b. Support From Below: MSS SP-58 Types 35 through 38.
2. Operating Temperatures from 122 to 446 degrees F:
    a. Overhead Support: MSS SP-58 Type 1 or 3 through 12, with appropriate saddle of MSS SP-58 Type 40 for insulated pipe.

F. Pipe Stanchions: For pipe runs, use stanchions of same type and material where vertical adjustment is required for stationary pipe.

1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
2. Provide coated or plated saddles to isolate steel hangers from dissimilar metal tube or pipe.

G. Beam Clamps: MSS SP-58 Types 19 through 23, 25 or 27 through 30 based on required load.

1. Material: ASTM A36/A36M carbon steel or ASTM A181/A181M forged steel.

2. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.

H. Riser Clamps:
   1. Provide copper plated clamps for copper tubing support.
   2. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.

I. Strut Clamps: Two-piece pipe clamp.

J. Insulation Clamps: Two bolt-type clamps designed for installation under insulation.

K. Pipe Hangers: For a given pipe run, use hangers of the same type and material.
   1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
   2. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

L. Pipe Shields for Insulated Piping:
   1. General Construction and Requirements:
      a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
      b. Shields Material: UV-resistant polypropylene with glass fill.
      c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.
      d. Minimum Service Temperature: Minus 40 degrees F.
      e. Maximum Service Temperature: 178 degrees F.
      f. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

M. Anchors and Fasteners:
   1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
   2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
   3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
   4. Steel: Use beam clamps.
   5. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
      a. Comply with MFMA-4.
      b. Channel Material: Use galvanized steel.
      c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

C. Unless specifically indicated or approved by Architect/Engineer, do not provide support from suspended ceiling support system or ceiling grid.

D. Unless specifically indicated or approved by Architect/Engineer, do not provide support from roof deck.

E. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

F. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.

G. Equipment Support and Attachment:

1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 4 inch high concrete pad constructed in accordance with Section 033000.
5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.

I. Secure fasteners according to manufacturer's recommended torque settings.

J. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. Inspect support and attachment components for damage and defects.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 220529

SECTION 220553

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe markers.

E. Ceiling tacks.

1.02 RELATED REQUIREMENTS

A. Refer to Division 09 Identification Painting requirements.

1.03 REFERENCE STANDARDS

A. ANSI/ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2023.

B. ANSI Z53.1 - Safety Code Color for Marking Physical Hazards; 2022.

1.04 SUBMITTALS

A. Refer to Division 01 requirements.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

E. Project Record Documents: Record actual locations of tagged valves.

PART 2 - PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Piping: Pipe markers.

B. Pumps: Nameplates.

C. Small-sized Equipment: Tags.

D. Equipment: Plastic Laminate Nameplates.

E. Valves:Tagsand ceiling tacks where located above lay-in ceiling.

2.02 NAMEPLATES

A. Description: Laminated two-layer plastic with engraved letters.

1. Letter Color: White.
2. Letter Height: 1/4 inch.
3. Background Color: Black.

2.03 TAGS

A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

B. Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 PIPE MARKERS

A. Comply with ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, traceable, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.05 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

B. Color code as follows:

1. Plumbing Valves: Green.

PART 3 - EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Division 09 for stencil painting.

3.02 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. All piping and equipment in mechanical equipment rooms shall be completely painted according to the “Scheme for the Identification of Piping Systems,” ANSI A13.1 and the “Safety Code Color for Marking Physical Hazards,” ANSI Z53.1, latest revisions.

D. Install plastic pipe markers in accordance with manufacturer's instructions.

E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

F. Use tags on piping 3/4 inch diameter and smaller.

G. Pipe markers:

1. Identify service, flow direction, and pressure.

2. Install in clear view and align with axis of piping.

3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

H. Provide ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION 220553

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SECTION 220719
PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Flexible removable and reusable blanket insulation.

C. Jackets and accessories.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 221005 - Plumbing Piping: Placement of hangers and hanger inserts.

1.03 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.

B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2013).

C. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.

D. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2014.

E. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2015.

F. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.

G. ASTM C1695 - Standard Specification for Fabrication of Flexible Removable and Reusable Blanket Insulation for Hot Service; 2010 (Reapproved 2015).

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

I. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

J. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with documented experience.

B. Applicator Qualifications: Company specializing in manufacturing the Products specified in this section with documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 - PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or ASTM E84.

2.02 GLASS FIBER

A. Insulation: ASTM C547and ASTM C795; rigid molded, noncombustible.

1. K Value: ASTM C177, 0.24 at 75 degrees F.
2. Maximum Service Temperature: 850 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.

B. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E 96/E 96M of 0.02 perm-inches. Factory prepared to receive paint.

C. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

D. Vapor Barrier Lap Adhesive: Compatible with insulation.

1. Compatible with insulation.

E. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

1. ASTM C195; hydraulic setting on mineral wool.

2.03 FLEXIBLE REMOVABLE AND REUSABLE BLANKET INSULATION

A. Insulation: ASTM C553 Type V; flexible, noncombustible.

1. Comply with ASTM C1695.
2. K Value: 0.37 at 100 degrees F, when tested in accordance with ASTM C177 or ASTM C518.

3. Minimum Service Temperature: 32 degrees F.
4. Maximum Service Temperature: 250 degrees F.
5. Maximum Water Vapor Absorption: Less than 5.0 percent by weight.

2.04 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
   1. Minimum Service Temperature: Minus 40 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.
B. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.05 JACKETS

A. PVC Plastic.
   1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum Service Temperature: 0 degrees F.
      b. Maximum Service Temperature: 150 degrees F.
      c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
      d. Thickness: 10 mil.
      e. Connections: Brush on welding adhesive.
      f. Factory prepared to receive paint.

2.06 ELECTRIC HEAT TRACE

A. UL Listed system of heating cables, components, and controls to prevent pipes from freezing or temperature maintenance (as indicated on Drawings).
B. The self-regulating heating cable shall consist of two (2) 16 AWG nickel-copper bus wires embedded in parallel in a self-regulating polymer core that varies its power output to respond to temperature all along its length, allowing the heating cable to be cut to length in the field. The heating cable shall be covered by a radiation cross-linked, modified polyolefin dielectric jacket. To provide a ground path and to enhance the heating cable's ruggedness, the heating cable shall have a braid of tinned copper and an outer jacket of modified polyolefin or fluoropolymer.
C. In order to conserve energy and to prevent overheating, the heating cable shall have a self-regulating factor of at least 90 percent. The self-regulation factor is defined as the percentage reduction, without thermostatic control, of the heating cable output going from 40 degree F pipe temperature operation to 150 degree F pipe temperature

operation.

D. The heating cable shall operate on the voltages indicated without the use of transformers.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass fiber insulated pipes conveying fluids below ambient temperature:

1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

F. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

G. Glass fiber insulated pipes conveying fluids above ambient temperature:

1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

H. Inserts and Shields:

1. Application: Piping 1-1/2 inches diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert Location: Between support shield and piping and under the finish jacket.

4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Division 07.

J. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with canvas jacket sized for finish painting.

K. Buried Piping: Provide factory fabricated assembly with inner all-purpose service jacket with self-sealing lap, and asphalt impregnated open mesh glass fabric, with one mil thick aluminum foil sandwiched between three layers of bituminous compound; outer surface faced with a polyester film.

L. Heat Traced Piping: Insulate fittings, joints, and valves with insulation of like material, thickness, and finish as adjoining pipe. Size large enough to enclose pipe and heat tracer. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

3.03 ELECTRIC HEAT TRACE

A. System shall be installed per manufacturer's recommendations.

B. Apply the heating cable linearly on the pipe after piping has been successfully tested. Secure the heating cable to piping with cable ties or fiberglass tape.

C. Apply "Electric Traced" labels to the outside of the thermal insulation.

D. After installation and before and after installing the thermal insulation, subject heating cable to testing using a 2500-Vdc Megger, Minimum insulation resistance shall be 20 megohms or greater.

3.04 SCHEDULES

A. Refer to drawings.

END OF SECTION 220719

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SECTION 220719.11

UNDER-LAVATORY PIPE AND SUPPLY COVERS - PLUMBEREX

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Under-lavatory pipe and supply covers.

1.02 RELATED REQUIREMENTS

A. Section 221005 - Plumbing Piping.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping; 2015.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

D. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Provide catalog illustrations of covers, sizes, and finishes.

C. Manufacturer's Instructions: Indicate installation methods and procedures.

D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

PART 2 PRODUCTS

2.01 UNDER-LAVATORY PIPE AND SUPPLY COVERS

A. General:

1. Insulate exposed drainage piping under lavatories and sinks per ADA Standards.
2. Insulate hot, cold, and tempered water supplies under sinks per ADA Standards; not required under lavatories.
3. Adhesives, sewing threads, and two-ply laminated materials are prohibited.
4. Exterior Surfaces: Smooth nonabsorbent with no finger recessed indentations for easy cleaning.

B. Under-Lavatory Covers with Snap-Lock Fasteners:

1. Construction: PVC with antimicrobial, antifungal, and UV-resistant properties, one piece injected molded design with internal bridge at top of J-bend to prevent separating.

2. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces. No cable ties allowed.
3. Maintenance: Valve and supply cover shall be accessible for maintenance without removal and with removable, reusable access cap.
4. Provide with weep hole for condensation drainage and ventilation.
5. Vandal Resistance: Internal line grooves for trimming not easily torn by hand. All trim line grooves shall require tool cutting only.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that walls, floor finishes, lavatories, and piping are prepared and ready for installation of under-lavatory guards.

B. Confirm location and size of fixtures and piping before installation.

3.02 INSTALLATION

A. Install under-lavatory guards according to manufacturer's written instructions.

3.03 CLEANING

A. Clean installed under-lavatory guards.

3.04 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 220719.11

SECTION 221005
PLUMBING PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, specialties, and connections for piping systems.
   1. Sanitary sewer.
   2. Grease sanitary sewer.
   3. Domestic water.
   4. Storm water.
   5. Gas.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.
B. Section 22 0523 - Meters and Gauges for Plumbing Piping.
C. Section 220553 - Identification for Plumbing Piping and Equipment.
D. Section 220719 - Plumbing Piping Insulation.

1.03 REFERENCE STANDARDS

A. ANSI Z223.1 - National Fuel Gas Code; 2024.
B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.
C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.
D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.
E. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; 2018.
F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
G. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2016.
H. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2023a.
I. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).
J. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2015a.
K. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.
L. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2010.
M. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2002 (Reapproved 2010).

N. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2014.

O. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2012.

P. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2014.

Q. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets; 2020.

R. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; 2009 (Revised 2012).

S. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2011 (Revised 2012).

T. NFPA 58 - Liquefied Petroleum Gas Code; National Fire Protection Association; 2014, with 2015 interim Amendments.

U. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).

V. NSF 372 - Drinking Water System Components - Lead Content; 2011.

1.04 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.07 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 - PRODUCTS

2.01 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 service weight.
   1. Fittings: Cast iron.
   2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets.

B. PVC Pipe: ASTM D 2665. Schedule 40 PVC. Installed per ASTM D 2321.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D 2564 low-VOC solvent cement. LEED compliant.

2.02 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.03 GREASE SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 service weight.
   1. Fittings: Cast iron.
   2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets.

2.04 GREASE SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.05 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Copper Pipe, 1/2" diameter: ASTM B 42, Type K, annealed.
   1. Fittings: ASME B16.26, cast bronze.
   2. Joints: ASTM B 32, alloy Sn95 solder.

B. Ductile Iron Pipe: AWWA C151/A21.51. Class 52 asphalt coated, cement lined with flexible restratined joints. The entry to buildings shall be made with a factory flanged Class 53 or higher ductile iron pipe.
   1. Fittings: Ductile or gray iron, standard thickness.
   2. Joints: AWWA C111/A21.11, styrene butadiene rubber (SBR) or vulcanized SBR gasket with 3/4 inch diameter rods.

2.06 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.

a. Fittings installed in hot water piping shall clearly state that they are rated for 140 degrees F.

2. Joints: ASTM B32, alloy Sn95 solder.

3. Mechanical Press Sealed Fittings: Double pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, non toxic synthetic rubber sealing elements.

2.07 STORM WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 service weight.

1. Fittings: Cast iron.

2. Joint Seals: ASTM C564 neoprene gaskets.

B. PVC Pipe: ASTM D 2665. Schedule 40 PVC. Installed per ASTM D 2321.

1. Fittings: PVC.

2. Joints: Solvent welded, with ASTM D 2564 low-VOC solvent cement. LEED compliant.

2.08 STORM WATER PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight.

1. Fittings: Cast iron.

2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.09 PROPANE GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Steel Pipe: Schedule 40 black.

1. Fittings: wrought steel welding type, with polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

2. Joints: ASME B31.1, welded.

2.10 PROPANE GAS PIPING, ABOVE GRADE

A. Steel Pipe: Schedule 40 black.

1. Fittings: malleable iron, or wrought steel welding type.

2. Joints: threaded or welded to ASME B31.1.

2.11 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:

1. Ferrous pipe: Class 150 malleable iron threaded unions.

2. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Size Over 2 Inch:
   1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
   2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Dielectric Connections: Brass nipple, with at least 6" of length between threads.

PART 3 - EXECUTION

3.01 EXAMINATION

A. All copper domestic water piping systems shall be hydrostatically tested after installation. Test pressure shall be 150 psi or 1 1/2 times the working pressure, whichever is greater. Components not suitable for a 150 psig test may be tested at a lower pressure, then valved off for the 150 psig test. Test duration shall be at least 2 hours for soldered joints; if mechanical joints are used, the duration shall be at least 24 hours.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
B. Remove scale and dirt, on inside and outside, before assembly.
C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Provide brass nipples with at least 6" between threads wherever jointing dissimilar metals.
C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
E. Group piping whenever practical at common elevations.
F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
G. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.
H. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
I. Excavate in accordance with Division 31 requirements.
J. Backfill in accordance with Division 31 requirements.
K. Install hub and spigot pipe with hub end upstream.

L. Install water piping to ASME B31.9.

M. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

N. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

O. Sleeve pipes passing through partitions, walls and floors.

P. Minimize quantity of soldered joints below concrete slab.

3.04 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/8 inch per foot slope.

B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.05 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect water distribution system in accordance with IPC-610 and Virginia Department of Health regulations.

B. Prior to starting work, verify system is complete, flushed and clean.

3.06 SERVICE CONNECTIONS

A. Provide new sanitary and storm sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

B. Provide new water service complete with approved reduced pressure backflow preventer.

1. Provide sleeve in wall for service entrance. Sleeve and make watertight with modular Link-Seal system or approved equal.

END OF SECTION 221005

SECTION 221006

PLUMBING PIPING SPECIALTIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Drains.
B. Barrier-type trap seals.
C. Downspout nozzles.
D. Cleanouts.
E. Hose bibbs.
F. Hydrants.
G. Washing machine box.
H. Back water valves.
I. Backflow preventers.
J. Pressure reducing valves.
K. Water hammer arrestors.
L. Thermostatic mixing valves.
M. Thermostatic balancing valves.
N. Refrigerator / ice maker outlet boxes.
O. Air admittance valves.

1.02 RELATED REQUIREMENTS

A. Section 221005 - Plumbing Piping.
B. Section 223000 - Plumbing Equipment.
C. Section 224000 - Plumbing Fixtures.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
B. ASME A112.6.3 - Floor and Trench Drains; 2001 (R2007).
C. ASME A112.6.4 - Roof, Deck, and Balcony Drains; 2008 (Reaffirmed 2012).
D. ASSE 1011 - Hose Connection Vacuum Breakers; 2004.
E. ASSE 1013 - Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers; 2011.
F. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance; 2011.
G. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).
H. NSF 372 - Drinking Water System Components - Lead Content; 2011.
I. PDI-WH 201 - Water Hammer Arresters; 2010.

1.04 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

C. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 - PRODUCTS

2.01 DRAINS

A. Combination Roof Drains: (RD-1)

1. Assembly: ASME A112.6.4.
2. Secondary roof drains with common deck plate.
3. Secondary drain shall have 2" collar above flood elevation.
4. Body: Lacquered cast iron with sump.
5. Strainer: Removable cast iron dome with vandal proof screws.
6. Accessories: Coordinate with roofing type_____:
    a. Membrane flange and membrane clamp with integral gravel stop.
    b. Adjustable under deck clamp.
    c. Roof sump receiver.
    d. Waterproofing flange.
    e. Controlled flow weir.
    f. Leveling frame.
    g. Adjustable extension sleeve for roof insulation.

B. Gutter Drains: (RD-2)

1. Lacquered cast iron body with flashing clamp collar and nickel bronze dome strainer.

C. Downspout Nozzles (DSN):

1. Cast nickel bronze downspout nozzle with anchor flange, countersunk mounting holes.

D. Trench Drains: (TD-1)

1. 8" wide high strength polymer concrete modular trench drain with galvanized steel integral rail, drain section with bottom outlet. Galvanized steel slotted grate. Plastic closed end caps.

E. Floor Drain (FD-1):
1. ASME A112.6.3; epoxy coated cast iron floor drain with anchor flange, reversible clamping collar with primary and secondary weepholes, post-pour adjustable round heel proof nickel bronze strainer with integrated bubble level, leveling shims. Install with barrier-type trap seal device. Vandal-proof screws.

F. Floor Drain (FD-2):
1. ASME A112.6.3; epoxy coated cast iron floor drain with anchor flange, reversible clamping collar with primary and secondary weepholes, adjustable round nickel bronze extended rim strainer. Install with barrier-type trap seal device. Vandal-proof screws.

G. Floor Sink (FS-1):
1. 12" Square, 10" deep, white acid resistant porcelain enamel coated interior, loose set enamel coated cast iron half grate, polypropylene dome bottom strainer. Install with barrier-type trap seal device.

H. Floor Sink (FS-2):
1. 12" Square, 10" deep, white acid resistant porcelain enamel coated interior, loose set enamel coated cast iron full grate, polypropylene dome bottom strainer. Install with barrier-type trap seal device.

2.02 BARRIER-TYPE TRAP SEAL (BTS-1):

A. ABS rigid structure, silicone gasket and seal. Engineered to comply with the performance requirements of ASSE 1072 standard.

2.03 CLEANOUTS

A. Cleanouts at Interior Finished Floor Areas (CO-1):
1. Epoxy coated cast iron body with anchor flange, primary and secondary weepholes, adjustable round nickel bronze cover, leveling shims, vandal proof.

B. Cleanouts at Interior Finished Wall Areas (WCO):
1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

2.04 HOSE BIBBS

A. Interior Mixing Type Hose Bibbs (HB-1):
1. Hot and cold, bronze bodies, all brass interior parts, replaceable seat washers, screwdriver operated stop valves in supply, handle operated control valves,

stainless steel box and removable hinged cover with cylinder lock and "WATER" stamped on cover. ASSE 1052 approved.

2.05 HYDRANTS

A. Freeze-less Wall Hydrants:(FWH-1, FWH-2)

1. ASSE 1052; lead-free anti-siphon automatic draining wall hydrant for flush installation. Non-freeze type integral backflow preventer, bronze casing, all bronze interior parts, non-turning operating rod with free-floating compression closure valve, replaceable bronze seat and seat washer. Nickel -plated cast brass box and hinged cover with operating key lock (FWH-1) and "WATER" cast on cover.

2.06 WASHING MACHINE BOX: (WMB-1)

A. Box assembly:

1. ABS recessed box, metal brackets for anchoring to wall construction, quarter-turn valve with arrester, frame, debris cover, ASSE 1010 arrester.
2. Two 1/4-turn ball valves. Valve and stop bodies of forged brass with chrome-plated exposed parts. 1/2 inch supply inlets. 3/4 inch male hose thread outlet.

2.07 WATER VALVE AND RECESSED BOX: (IMB-1)

A. ABS recessed box, metal brackets for anchoring to wall construction, quarter-turn valve with arrester, frame, debris cover, ASSE 1010 arrester.

2.08 BACK WATER VALVES: (BWV-1)

A. Cast Iron Back Water Valves: ASME A112.6.4; lacquered cast iron body and cover, brass valve, extension sleeve, and access cover.

2.09 BACKFLOW PREVENTERS

A. Reduced Pressure Zone Backflow Preventers with Flood Protection (BFP-1A/1B):

1. ASSE 1013; The Reduced Pressure Zone Assembly shall consist of two independent torsion spring check modules, a differential pressure relief valve located between and below the two modules, two drip tight shutoff valves, and required torsion spring check modules and relief valve shall be contained with a sleeve accessible single housing constructed from 304 (Schedule 40) stainless steel pipe with groove end connections. Torsion spring checks shall have replaceable elastomer discs and in operation produce drip tight closure against the reverse flow of liquid caused by backpressure or backsiphonage.
2. The Flood Protection Shutdown Valve shall be a normally open diaphragm valve installed upstream of the reduced pressure zone (RPZ) backflow assembly, and automatically close if the RPZ relief valve begins to discharge. A

time delay supplied in the JB113 junction box shall prevent the valve from closing on intermittent discharges from the RPZ relief valve. Once closed the ACV must be manually reset. The electronics junction box (JB113) on ACV connects to SentryPlus Alert™ Wireless Node Junction Box (WN113) for wireless communication alerting the user via text, phone or email. Extra set of remote trip indication terminals allow users to get remote alarms at their building management system (BMS). The entire valve station assembly shall be provided by the same manufacturer and be covered by a single warranty policy.

2.10 PRESSURE REDUCING VALVES

A. ASSE 1003; The water pressure reducing valve shall be constructed using lead free materials. Lead free regulators shall comply with state codes and standards, where applicable, requiring reduced lead content. Provision shall be made to permit the bypass flow of water back through the valve into the main when pressures, due to thermal expansion on the outlet side of the valve, exceed the pressure in the main supply. Pressure reducing valves with built-in bypass check valves and strainer will be acceptable.

B. Wye pattern strainer by same manufacturer installed at inlet of pressure reducing valve.

2.11 WATER HAMMER ARRESTORS

A. Water Hammer Arrestors:

1. Stainless steel construction, piston type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F and maximum 250 psi working pressure.

2.12 MIXING VALVES

A. Thermostatic Mixing Valves - Main (TMV-1):

1. Valve: ASSE 1017, chrome plated cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment.
2. Consists of two thermostatic controllers with swivel action check stops, removable cartridge with strainer, stainless steel piston and liquid fill thermal motor with bellow element mounted out of water, inlet manifold piping, pressure reducing valve, two pressure gauges, two ball valves, bi-metal dial thermometer, 20 to 240 degree Fahrenheit temperature range. Rough bronze and copper finish. Factory assembled and tested.
3. Capacity: As scheduled on the drawings.

4. Cabinet: 16 gage, 0.0598 inch prime coated steel, for recessed mounting with keyed lock.

B. Thermostatic Mixing Valve - Point of Use (TMV-2):
1. Lead-free bronze body, locked temperature adjustment cap (vandal resistant), copper encapsulated thermostat assembly with polymer thermoplastic shuttle, stainless steel springs, Buna-N O-rings, integral check valves on hot and cold inlets, compression fittings on inlets and outlet.
2. Capacity: As scheduled on drawings.
3. Mounting bracket.
4. ASSE 1070 compliant.

2.13 THERMOSTATIC BALANCING VALVES (TBV):

A. Adjustable thermostatic balancing valve will regulate domestic hot water flow in the recirculation circuit based on the actual water temperature entering the valve and the desired water temperature set on the valve.
1. Valve shall maintain dynamic control of the recirculating circuit by allowing a small amount of hot water to pass through even when fully closed.
2. The valve shall be field adjustable without the need for gauges or specialized tools as project conditions require.

B. Valve will allow for increased flow over the minimum rate via a bypass once 160°F is achieved for an automatic legionella flushing period.

C. Valve shall be a DZR Brass ANSI C27453 or EN 12165 CW511L body and internal components and meet the following requirements:
1. Shall be rated to 360 PSI maximum working pressure.
2. Shall have a temperature regulation range of 105°F-140°F.
3. Shall have a working temperature range of 15°F-200°F.
4. Shall be NSF/ANSI 61 certified for domestic water system use.
5. Spring-loaded thermal actuator delivers sufficient thrust to keep orifice opening clean and free of deposits.
6. Shall have two ports for optional thermometer or test pressure plug ports.
7. Shall not use plastic as the shutter in the valve.

D. Installation technicians shall review instructions included with each valve by the manufacturer.
1. The valve shall be installed in the return piping branch of each domestic hot water system as indicated on the construction documents.
2. Provide additional components as indicated on project drawings.

E. Install in an accessible location for maintenance or provide an access panel for any non-accessible installation locations.

2.14 AIR ADMITTANCE VALVES (AAV-1):

A. Description: Screening on the inside and outside of the valve to protect the sealing membrane from insects and debris. Protective cover for the air intake and additional insulation against extreme temperatures. Ability to divert condensation away from the sealing membrane. Lifetime warranty.

B. Materials: Polystyrene valve with elastromeric membrane, PVC adaptor.

C. Performance Standards: ASSE 1051 single fixture and Branch type AAVs, ASSE 1050 Stack Type AAVs, NSF Standard 14 (plastic components).

D. Code approvals: International Plumbing Code (IPC)

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Encase exterior cleanouts in concrete flush with grade.

D. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur.

E. Pipe relief from reduced pressure zone backflow preventer to nearest drain.

F. Install water hammer arrestors complete with accessible isolation valve on cold water supply piping to water closets and ice machine outlets.

END OF SECTION 221006

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SECTION 221429
SUMP PUMPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Submersible sump pumps.

B. Sump basins and pits.

1.02 REFERENCE STANDARDS

A. ICC (IPC) - International Plumbing Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. UL (DIR) - Online Certifications Directory; Current Edition.

1.03 SUBMITTALS

A. Refer to Division 01 requirements.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with three years minimum of documented experience.

B. Certifications: UL (DIR) listed, classified, and suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.06 WARRANTY

A. Refer to Division 01 for additional warranty requirements.

B. Manufacturer Warranty: Provide 2-year manufacturer warranty for pumps and related components. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 SUBMERSIBLE SUMP PUMP - (SP-1):

A. General: Cast iron housing and base with oil-filled motor chamber, ball bearings, and mechanical seal.

B. Impeller: Bronze; open nonclog, stainless steel shaft.

C. Motor: Base mount, enclosed, lubricated oil-free, thermal-overload protected, continuous duty, permanent split capacitor with oil-resistant, three-prong connector, 10 foot power cord.

D. Controls: Integral, chemically-resistant, vertical plated-steel rod float switch. Cycle pump Off/On between 2.5 and 9 inch heights from bottom of pump.

E. Solids Handling Capacity: Pass lint and other small solids up to 1/2 inch in size.

F. Discharge Pipe Size: 2 inch, NPT, female.

G. Maximum Water-Based Effluent Temperature: 120 degrees F.

H. Accessories: Provide full flow swing-type discharge check valve.

2.02 SUMP BASINS AND PITS

A. Sump Basin:

1. Below Ground Pipe Inlet: Molded or predrilled with seal, 4 inch.
2. Basin Dimensions: 36 inch diameter, 48 inch deep.
3. Basin Material: Polyethylene structural foam, heavy duty injection molded.
4. Molded-Finish Requirements: Hard bottom, watertight, gas-tight and radon-tight molding.
5. Maximum Effluent Temperature: Match or exceed maximum pump service temperature.
6. Basin Riser Extension: Diameter matched, 6 inch with hardware.
7. Basin Cover:
   a. Material: One-piece flat lid made of polyethylene with seal gasket.
   b. Openings: 2 inch discharge, and cord grommet with hubs.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products with related fittings and accessories according to manufacturer instructions.

3.02 PROTECTION

A. Protect installed products from damage from subsequent construction operations.

END OF SECTION 221429

SECTION 223000
PLUMBING EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Water Heaters:
   1. Commercial electric.
   2. Packaged heat pump domestic water heating systems.
B. Domestic hot water storage tanks.
C. Diaphragm-type compression tanks.
D. In-line circulator pumps.
E. Sewage ejectors.
F. Elevator sump pumps.

1.02 REFERENCE STANDARDS

A. VPC - Virginia Plumbing Code; 2018
B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
D. UL 174 - Standard for Household Electric Storage Tank Water Heaters; Current Edition, Including All Revisions.
E. UL 778 - Standard for Motor-Operated Water Pumps; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. Refer to Division 01 requirements.
B. Product Data:
   1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
   2. Indicate pump type, capacity, power requirements.
   3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
   4. Provide electrical characteristics and connection requirements.
C. Shop Drawings:
   1. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

D. Project Record Documents: Record actual locations of components.

E. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Certifications:

1. Water Heaters: NSF approved.
2. Electric Water Heaters: UL listed and labeled to UL 174.
3. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with documented experience.

C. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.06 WARRANTY

A. Refer to Division 01 requirements.

B. Provide five year manufacturer warranty for domestic water heaters.

PART 2 - PRODUCTS

2.01 WATER HEATERS

A. Commercial Electric:

1. Type: Factory-assembled and wired, electric, vertical storage.
2. Tank: Cement lined, thermally insulated with minimum 2 inches glass fiber encased in corrosion-resistant steel jacket; baked-on enamel finish.
3. Controls: Automatic immersion water thermostat; externally adjustable temperature range from 60 to 180 degrees F, flanged or screw-in incoloy elements, high temperature limit thermostat.
4. Accessories:
   a. Water Connections: nonferrous, removable fittings at all tank connections.
   b. Bottom drain valve.
   c. Temperature and Pressure Relief Valve: ASME labeled.

2.02 PACKAGED HEAT PUMP DOMESTIC WATER HEATING SYSTEMS

A. Heat Pump: integral domestic water circulating pump, controls, piping and valving as indicated.
   1. Thermal Source: Ground Source (Geothermal).
   2. Refrigerant: R-513a.
   3. Unit Cabinet and Frame: Epoxy-Coated Aluminium, 304L Stainless Steel, or 316L Stainless Steel.
   4. Compressor: Hermetic scroll, suitable for high temperature operation with the intended refrigerant.
      a. Compressor Control Monitoring:
         1) High discharge pressure.
         2) Low suction pressure.
         3) Phase failure.
      b. Refrigerant Accessories:
         1) Filter-Drier.
         2) Sight Glass.
   5. Condenser: 316L Stainless steel copper brazed plate vented double wall type,
      a. UL listed and NSF 372 compliant.
      b. Operating Pressure: no less than 435 psi (30 Bar).
   6. Evaporator: 316L Stainless steel copper brazed plate single wall type,
      a. UL listed.
      b. Operating Pressure: no less than 435 psi (30 Bar).
   7. Expansion Valve: Specifically designed for heat pump use, with field adjustable superheat feature
   8. Domestic Water Circulator: Stainless steel or bronze circulator for potable water duty.
      a. NSF-61 or -372 compliant.
   9. Controls:
      a. Heat Logic Control: Unit shall utilize its own logic to analyze up to 4 factory-provided temperature sensors and run via user-specified temperature setpoints. Unit shall have the ability to trigger on via BAS or a closed contact set.
      b. Constant Leaving Water Temperature Control: Unit shall possess the ability to maintain constant outlet water temperatures via PID control logic, regardless of the inlet water temperature. Setpoint temperature

shall be field adjustable.

c. Refrigerant Cycle Control: Built-in controls shall prevent the following conditions from exceeding boundaries that cause harm or unnecessary wear to physical components: high incoming potable water temperature, compressor short-cycling, high discharge pressure, low suction pressure, and phase failure compressor protection. Alarm notifications shall alert user of extraordinary conditions via user interface.

d. Heat Pump Array: System shall have the ability to integrate modular arrays and possess the ability to assume lead or lag status within the array. System shall communicate intenally inside the array via ethernet without any external hardware required. Controls shall have the ability to report any unit status within the array to controlling BAS.

2.03 DOMESTIC HOT WATER STORAGE TANKS

A. Tank: Welded steel, ASME labeled for working pressure of 125 psig, steel support saddles, tappings for accessories, threaded connections of stainless steel, access manhole.

B. Insulation: 2 inch thick, non-cfc foam on respective top and tank sides.

1. Fiberglass: limiting heat loss to no more than 14 BTU per hour per square foot of tank surface in ambient temperature of 65 degrees F.

2. Flame spread not to exceed 25 and fuel contribution not to exceed 50 when tested in accordance with ASTM E84.

C. Lining: Corrosion-resistant Cement continued into connections.

D. Openings: Up to 3 inches, copper-silicone threaded; over 4 inches, flanged; manway fitting.

2.04 DIAPHRAGM-TYPE COMPRESSION TANKS

A. Construction: Welded steel, NSF61 certified, ASME compliant, rated for working pressure of 150 psig, with fixed FDA-approved heavy-duty butyl diaphragm sealed into tank, and steel legs or saddles.

B. Accessories: Pressure gauge and air-charging fitting, tank drain; precharge to 50 psig.

2.05 IN-LINE CIRCULATOR PUMPS

A. Casing: Stainless steel, rated for 125 psig working pressure, and 230 degrees F working temperature.

B. Impeller: Stainless steel.

C. Shaft: Stainless Steel.

D. Rotor: Permanent magnet.

E. Seal: Carbon rotating against a stationary ceramic seat.

F. Motor: Electrically commutated.

2.06 SANITARY SEWAGE PUMPS

A. Centrifugal Solids Handling:

1. General: Non-clogging centrifugal type suitable for pumping solids up to 3 inches in diameter without internal interstices that can collect stringy materials and solids resulting in clogging.
2. Casing:
   a. Capable of withstanding operating pressures 50 percent greater than the maximum operating pressure.
   b. Plugged and tapped holes for draining and venting pump.
   c. Volute to consist of smooth passages.
   d. Configuration to permit removal of impeller without disturbing discharge and suction connections.
   e. Handhole to allow cleaning and inspection of pump interior.
   f. Lifting eyes to facilitate handling of pump.
3. Impeller:
   a. Design to consist of smooth passages to prevent clogging and pass fibrous or stringy material.
   b. Securely keyed to shaft with locking arrangement preventing loosening by torque from either forward or reverse direction.
   c. Balance statically, dynamically, and hydraulically within the operating range and to the first critical speed at 150 percent of the maximum operating speed.
4. Wearing Rings:
   a. Provide renewable wearing rings on the casing and impeller with wearing surfaces normal to the axis of rotation.
   b. Construction: Cast iron.
   c. Factory designed for simple maintenance and secured to prevent rotation.
   d. In lieu of wearing rings on impeller and casing, replaceable steel wear plates fastened to casing may be used.
5. Pump Shaft:
   a. Provide with adequate size and strength to transmit full driver horsepower with liberal safety factor.

b. Fabricate from stainless steel.

6. Pump Shaft Sleeve:
   a. Fabricate from stainless steel.
   b. Seal joint between shaft and sleeve to prevent leakage.
   c. Stuffing Box:
      1) Factory designed for minimum 5 rings of packing with removable split type glands.
      2) Fabricate from same material as casing and water sealed.
7. Mechanical Seal System:
   a. Furnish single seals to seal pump shaft against leakage.
   b. Each seal to be held in place by its own spring system, supplemented by external liquid pressures.
   c. System to be readily removable from the shaft.
8. Bearings:
   a. Provide ball type designed to handle all thrust loads in either direction.
   b. Furnish with a L-10 life of minimum 50,000 hours as required by ABMA 9 or ABMA 11.
   c. Pumps depending only on hydraulic balance and thrust are not acceptable.
9. Lubrication:
   a. Bearing:
      1) Grease Lubricated:
         a) Provide grease fitting of the type that prevents over-lubrication and the building up of pressure injurious to the bearings.
         b) Provide grease tubing if fitting is not readily accessible.
10. Pump Support:
    a. Vertical Shaft Centrifugal Pumps: Separate bases for pump and support.
11. Coupling:
    a. Provide heavy duty, flexible type, locked to the shaft.
    b. Disconnection of the coupling possible without removing the driver half or the pump half of the coupling from the shaft.

2.07 ELEVATOR SUMP PUMP

A. Description: Provide pump and control systems capable of pumping water while containing oil.

B. Pumps:

1. The pump shall be a submersible type and meet performance requirements as scheduled on drawings. The pump shall be approved to UL 778 standards and shall include thermal and overload protection. The motor shall be capable of operating continuously or intermittently. The motor housing shall be constructed of 304 stainless steel and mechanical seats shall be housed in a separate oil-filled compartment.

C. Controls:

1. The system shall function automatically and shall provide for an alarm and separate LED lights in the event of:
   a. The presence of oil in the sump.
   b. High liquid in the sump.
   c. High amps or a locked rotor condition.
2. LED lights shall be provided for:
   a. Power.
   b. Pump run function.
3. An alarm that sounds only in the event of a high liquid condition or does not separately identify the above five functions shall not be acceptable.
4. The main control shall be approved to UL 508 standards and housed in a gasketed Nema 4X enclosure with a see-through window for observation of operating functions.
5. The control shall be equipped with an 8-pin twist lock receptacle, dual solid state oil-minder relays with variable sensitivity settings, an over current relay, self-cleaning stainless steel sensor probe, high decibel warning horn with alarm silencing switch, dual floats, clearly marked terminal board and remote monitoring contact.
6. A NEMA 4X junction box with 8-pin twist-lock electrical receptacle and 25-ft (additional lengths available in 25-ft increments) of mating 8 conductor cable shall be provided. All cables between the pump and junction box shall be 16-ft long and the cable and plug from the control unit shall be 8-ft long.
7. The control unit, junction box, pump, floats and sensor shall be factory assembled as a complete, ready-to-use system and shall be tested and approved as a complete system by a nationally recognized testing laboratory.
8. The system shall allow for the main control to be located outside of the elevator hoistway to be monitored for all functions without having to enter the elevator shaft.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Install water heaters level and plumb in accordance with manufacturers written instructions and referenced standards.

C. Pumps:

1. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

3.02 SCHEDULES

A. Refer to the drawings.

END OF SECTION 223000

SECTION 224000
PLUMBING FIXTURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Water closets.
B. Urinals.
C. Lavatories.
D. Sinks.
E. Mop sinks.
F. Electric water coolers.
G. Showers.

1.02 RELATED REQUIREMENTS

A. Section 221005 - Plumbing Piping.
B. Section 221006 - Plumbing Piping Specialties.
C. Section 223000 - Plumbing Equipment.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
B. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration.; 2008.
C. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2002).
D. ASME A112.18.1 - Plumbing Supply Fittings; 2018, with Errata.
E. ASME A112.19.3 - Stainless Steel Plumbing Fixtures; 2008 (R2013).
F. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks; 2011.
G. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices; 2004.
H. IAPMO Z124 - Plastic Plumbing Fixtures; 2012.
I. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).
J. NSF 372 - Drinking Water System Components - Lead Content; 2011.
K. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

A. Refer to Division 01 requirements.
B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Manufacturer's Instructions: Indicate installation methods and procedures.

D. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Refer to Division 01 requirements.
2. Extra Faucet Washers: Two sets of each type and size.
3. Extra Lavatory Supply Fittings: One set of each type and size.
4. Extra Toilet Seats: One of each type and size.
5. Flush Valve Service Kits: One for each type and size.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with documented experience.

1.06 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.07 MOCK-UP

A. Provide mock-up of typical bathroom group.

B. Mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.09 WARRANTY

A. Refer to Division 01 requirements.

B. Provide five year manufacturer warranty for electric water cooler.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

B. Water Efficiency: EPA WaterSense label is required for all water closets, urinals, lavatory faucets, and showerheads.

C. Fixtures shall be ADA compliant where scheduled on the drawings.

2.02 REGULATORY REQUIREMENTS

A. Comply with applicable codes for installation of plumbing systems.

B. Comply with UL (DIR) requirements.

2.03 FLUSH VALVE WATER CLOSETS (P-1A/B)

A. Water Closets: Vitreous china, ASME A112.19.2, elongated rim, wall mounted, siphon jet flush action, china bolt caps. ADA compliant where scheduled.

1. Color: White.

B. Flush Valves: ASME A112.18.1,diaphragm type, complete withvacuum breaker stops and accessories.

1. Sensor-Operated Type: motorized actuator, battery powered, infrared sensor and mechanical over-ride push button.
2. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop.
   a. Low-Flush type: 1.28 gallon flush volume.

C. Seats:

1. Solid white plastic, open front, extended back,self-sustaining hinge, brass bolts, without cover.

D. Water Closet Carriers:

1. ASME A112.6.1M; adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

2.04 FLOOR-MOUNTED WATER CLOSETS (P-1C)

A. Water Closets: Vitreous china, ASME A112.19.2, elongated rim, floor mounted, siphon jet flush action, china bolt caps. ADA compliant where scheduled.

1. Color: white.
2. Flush Valves: ASME A112.18.1,diaphragm type, complete withvacuum breaker stops and accessories.
   a. Sensor-Operated Type: motorized actuator, battery powered, infrared sensor and mechanical over-ride push button.
   b. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop.
      1) Low-Flush type: 1.28 gallon flush volume.
3. Seats:
   a. Solid white plastic, open front, extended back,self-sustaining hinge, brass bolts, with cover.

2.05 WALL HUNG URINALS

A. Urinals: Vitreous china, ASME A112.19.2, wall hung with side shields and concealed carrier.
   1. Flush Style: Washout.
   2. Trap: Integral.
   3. Removable stainless steel strainer.

B. Flush Valves: ASME A112.19.2, diaphragm type, complete with vacuum breaker stops and accessories.
   1. Sensor-Operated Type: battery powered, infrared sensor with over-ride push button.
   2. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop.

C. Carriers:
   1. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs.

2.06 LAVATORIES

A. Vitreous China Wall Hung Basin: ASME A112.19.2; vitreous china wall hung lavatory, rectangular basin with single faucet hole, and rear overflow.

B. Vitreous China Under Mount Basin:
   1. ASME A112.19.2; vitreous china undercounter lavatory, 13-3/4" round, seal of putty, caulking, or concealed vinyl gasket.

C. Public-Use Supply Faucet: ASME A112.18.1; chrome plated supply fitting with open grid strainer, water economy aerator with maximum flow of 0.35 GPM, battery-operated sensor operation.

D. Accessories:
   1. Chrome plated 17 gage, 0.0538 inch brass P-trap with clean-out plug and arm with escutcheon.
   2. Screwdriver stops.
   3. Flexible supplies.
   4. Carrier:
      a. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded studs for fixture hanger, bearing plate and studs.

2.07 SINKS

A. P-4A - Single Compartment Bowl: ASME A112.19.3; dimensions as scheduled, 18 gage thick, Type 304 stainless steel, under mount (as scheduled), undercoated.

1. Drain outlet: 1-1/2 inch chromed brass.
2. Drain: 3-1/2 inch crumb cup and tailpiece.
3. Drain location: Center rear.

B. P-4B - Standing double compartment sink with left and right drainboards: ASME A112.19.3; dimensions as scheduled, 16 gage thick, Type 300 series stainless steel, including legs, center drains in each bowl.
1. Drain outlet: 1-1/2 inch chromed brass drain.
2. Drain: 3-1/2 inch crumb cup and tailpiece.

C. P-4A Trim: ASME A112.18.1; chrome plated brass supply with swing spout, vandal proof water economy aerator with maximum flow as scheduled, 4-inch indexed lever handles . ADA compliant.

D. P-4B Trim: ASME A112.18.1; chrome plated brass splash-mounted body with swing nozzle and lever handles, vandal proof water economy aerator with maximum gpm flow as scheduled.

E. Accessories: Chrome plated 17 gage brass P-trapwith clean-out plug and arm with escutcheon, screwdriver stop, rigid supplies.
1. Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon.
2. Screwdriver stop, rigid supplies.
3. Removable strainer cup.

2.08 SHOWERS

A. Cabinet: IAPMO Z124 reinforced glass fiber, 39-3/8 by 39-3/8 by 72 inches with integral receptor, grab bars, fold-down seat , removable chrome plated strainer, tail piece, white color.

B. Trim: ASME A112.18.1.
1. ADA: Wall showerhead with hand shower attached to flexible metal hose and mounted on 42-inch slide bar, maximum showerhead flow rate as scheduled. Provide escutcheon at finished wall. ADA compliant. Two handle temperature/pressure balancing valve, shower only, service stops with adjustable stop limit. With on-off control and non-positive shut-off.

2.09 BI-LEVEL, ELECTRIC WATER COOLERS (P-6A)

A. Water Cooler: Bi-level, electric, mechanically refrigerated; recessed,ADA compliant; stainless steel top, stainless steel body, elevated anti-squirt bubbler with stream guard, automatic stream regulator, push button, mounting frame; integral air cooled condenserand stainless steel grille.

1. Capacity: 8 gallons per hour of 50 degrees F water with inlet at 80 degrees F and room temperature of 90 degrees F, when tested in accordance with ASHRAE Std 18.
2. Electrical: 115 V, 60 Hertz compressor, 6 foot cord and plug for connection to electric wiring system including grounding connector.

B. Bottle Filler: Materials to match fountain.

2.10 MOP SINKS

A. Material: Molded, one-piece construction.
B. Type: Rectilinear, standard height.
C. Grid strainer: Stainless steel; integral; removable.
D. Dimensions: As indicated on drawings.
E. Faucet: ASME A112.18.1 exposed wall type supply with lever handles, spout wall brace, vacuum breaker, hose end spout, check valves, eccentric adjustable inlets, integral screwdriver stops with covering caps and adjustable threaded wall flanges.
F. Accessories:
   1. 5 feet of 1/2 inch diameter plain end reinforced rubber hose.
   2. Hose clamp hanger.
   3. Mop hanger.
   4. Stainless steel rim guards.
   5. Stainless steel wall guards.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
B. Verify that electric power is available and of the correct characteristics.
C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.03 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.
B. Provide chrome plated flexible supplies to fixtures with screwdriver stops, reducers, and escutcheons. Ensure the length of flexible supplies is not grossly oversized.
C. Install components level and plumb.
D. Install and secure fixtures in place with wall carriers and bolts, where applicable.

E. Seal fixtures to wall and floor surfaces with sealant as specified in Division 07, color to match fixture.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.05 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.06 CLEANING

A. Clean plumbing fixtures and equipment.

B. Adjust flow and temperatures, clean aerators.

3.07 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Do not permit use of fixtures by construction personnel.

C. Repair or replace damaged products before Date of Substantial Completion.

3.08 SCHEDULES

A. Refer to the drawings.

END OF SECTION 224000

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SECTION 224500
EMERGENCY PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Eye/face wash equipment.

B. Safety stations (combination emergency fixture units).

C. Emergency-fixture water-tempering valves.

1.02 RELATED REQUIREMENTS

A. Section 221005 - Plumbing Piping

1.03 REFERENCE STANDARDS

A. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment; 2014.

B. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2023.

1.04 SUBMITTALS

A. Refer to Division 01 requirements.

PART 2 PRODUCTS

2.01 HAND-HELD EMERGENCY COMBINATION EYEWASH/DRENCH HOSE (P-9A):

A. ANSI Z358.1, 15 gallon drench hose with spray head assembly.

B. Eyewash: Two spray heads mounted side-by-side with flip-top dust covers, internal flow control and filter.

C. Hose:

1. 12 feet long, flexible reinforced nylon retractable coiled hose with fitted male swivel water connection.
2. Maximum Working Pressure: 180 psi.

D. Handle: Full flow, quick to open powder-coated cast alumnimum flag handle.

E. Tepid Supply Water Temperature: Set to 85 degrees F.

F. Accessories:

1. In-line dual backflow preventer fitted to hose inlet. ASSE 1024 listed.
2. Signage: ANSI Z535.2, emergency drench hose safety equipment.
3. Wall bracket - coordinate mounting height with architectual details.

2.02 SAFETY STATIONS (COMBINATION EMERGENCY FIXTURE UNIT) - (P-9B):

A. ANSI Z358.1, free-standing shower with wide area bowl-mounted dual eye wash spray head fixture assembly.

B. Tepid Supply Water Temperature: Set to 85 degrees F.

C. Water Supply Connection Size: Minimum, 1-1/4 inch.

D. Water Discharge Flow Rates:

1. Shower Head: Minimum, 20 gpm at 30 psi for 15 minutes.
2. Eye wash Spray Heads: Minimum, 0.4 gpm for 15 minutes.

E. Pipe and Fittings Material: Sched. 40 galvanized steel, with orange polyethylene covers.

F. Shower Head:

1. Self-cleaning, non-clogging, 10 inches in diameter with escutcheon.
2. Flow Pattern: Minimum, 20 inches at 60 inches above floor end.

G. Valves: Full flow, self closing, quick to open within one second using dedicated manual stainless steel pull rod operator for shower and dedicated manual flag handle for eye wash.

H. Accessories:

1. Signage: ANSI Z535.2, emergency safety station equipment.
2. Eye wash: Provide spray head filter and flip-top dust cover.

2.03 EMERGENCY-FIXTURE WATER-TEMPERING VALVES

A. Valve Assembly: ASSE 1071 certified; Thermostatic mixing (blending) type made of lead-free cast brass body with integral built-in cold water bypass (fail safe), color marked dual-scale outlet temperature gauge, integral inlet check valve, integral inlet strainer, locking-type regulator, and mounting bracket.

B. Cabinet: 16 gauge, 0.0598 inch stainless steel, surface-mounted with keyed lock.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install fixtures and fittings in accordance with the manufacturer's instructions.

B. Adjust water flow rates to comply with manufacturer's rating of the fixture.

3.02 CLEANING

A. Thoroughly clean plumbing fixtures and equipment.

3.03 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Repair or replace products damaged before Date of Substantial Completion.

END OF SECTION 224500

SECTION 226600

CHEMICAL-WASTE SYSTEMS FOR LABORATORY AND HEALTHCARE FACILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single-wall piping.

B. Traps, drains, and cleanouts.

C. Neutralization tanks.

1.02 RELATED REQUIREMENTS

A. Section 220529 - Hangers and Supports for Plumbing Piping and Equipment.

B. Section 220553 - Identification for Plumbing Piping and Equipment.

1.03 SUBMITTALS

A. Refer to Div. 1 for submittal procedures.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties with sealing plugs in ends or with end protection.

B. Do not store plastic pipe or fittings in direct sunlight.

C. Protect pipe, fittings, and seals from dirt and damage.

PART 2 PRODUCTS

2.01 SINGLE-WALL PIPE

A. PP (Polypropylene) Piping:

1. Fabrication: ASTM D4101, schedule 40 pipe and fittings.
2. Corrosive Waste Drain Service: ASTM F1412.
3. Transition Fittings: Provide combinations of clamps, couplings, adapters, and gaskets compatible with installed products and service fluids when joining different piping materials.

2.02 TRAPS, DRAINS, AND CLEANOUTS

A. Acid Dilution Traps:

1. Material: CPVC (Chlorinated Polyvinyl Chloride) with removable tank lid-base.
   a. CPVC: Solvent weld with ASTM F493 solvent cement.
2. Tank Type: 1 Gallon (3.7 L) made of polypropylene.
3. Size Connection: 1-1/2 inch, slip-union inlet and socket-union outlet.

2.03 NEUTRALIZATION TANKS: (ANT-1)

A. Tank Capacity: 1.5 Gallon.

B. Form Factor: Cylindrical shape made of acid-resistant material.

C. Material: HDPE (high-density polyethylene) cast with built-in piping connections and bolted, gasketed cover.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

END OF SECTION 226600

SECTION 230000 – MECHANICAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the requirements for Enhanced Commissioning to be used on this project.

B. Systems to be commissioned include:

1. All HVAC systems and equipment.

C. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Sections 220000, 260000 and other Division 01 Specification Sections, apply to this Section.

D. Specification 001700a and 001700b contains the Commissioning Plan and Building Envelope Commissioning Plan.

1.2 WORK INCLUDED

A. A third party Commissioning Agent has been engaged by the Owner to administer the commissioning of the building systems.

B. The Contractor shall provide all commissioning services as outlined in this Section; perform all testing, measurements, and inspection outlined in the ‘Commissioning Plan”; and coordinate with the Commissioning Agent.

C. The Commissioning Agent will review all submittals related to the systems to be commissioned after approval and in conjunction with the Engineer of Record.

D. Post Occupancy commissioning is included to be conducted prior to the 10 months after substantial completion.

E. The Contractor shall provide the Commissioning Agent the Operations and Maintenance (O&M) for review and comment.

F. The Contractor shall provide the Commissioning Agent Owner Training Plan for review and comment.

1.3 COMMISSIONING OBJECTIVES

A. To ensure that all building HVAC systems, subsystems, equipment, and controls; Domestic Hot Water; Lighting controls; and interfaces of these systems with other building systems are installed, tested, and are operating in compliance with Contract Documents and within the scope of design requirements.

B. To ensure that all system operation and maintenance personnel are properly instructed to effectively and efficiently operate and maintain the building systems, subsystems, HVAC equipment, and controls, domestic hot water, and lighting. To further ensure that they will receive all required manuals and documentation.

C. To ensure the Systems, Operation and Maintenance Manuals accurately reflect the installed equipment and systems.

D. The Commissioning Agent shall provide the following to the Contractor for implementation and execution.

1. Commissioning Plan: The Commissioning Agent shall prepare the Commissioning Plan in accordance with contents as specified herein.

2. Checklists: The Commissioning Agent shall prepare the Pre-Functional and Functional Performance Test Forms, specifically for this project, and edited to suit the equipment and systems installed.

E. The Commissioning Agent shall prepare a Final Commissioning Report containing a compilation of the completed checklists, Issues and Benefits Log, Vendor Equipment Startup Reports, and TAB Reports.

1.4 REFERENCED STANDARDS

A. ASHRAE Guideline 0-2019, “The HVAC Commissioning Process.”

B. NEBB, “Procedural Standards for Building Systems Commissioning.”

C. SMACNA, “HVAC Systems Commissioning Manual.”

1.5 COMMISSIONING TEAM

A. The Contractor shall designate team members from each of the following to participate in the Commissioning Process:

1. General Contractor
2. Mechanical Subcontractor
3. Plumbing Subcontractor
4. Electrical Subcontractor
5. Testing, Adjusting and Balancing (TAB) Subcontractor
6. Automatic Temperature Controls Subcontractor
7. Equipment Startup Technicians

B. The Owner may designate a representative to participate in the Commissioning Process.

C. Each of the team member’s names shall be submitted in writing to the Commissioning Agent for inclusion in the Commissioning Plan. Members of the team cannot be replaced or substituted without the Commissioning Agent and Owners concurrence.

PART 2 - PRODUCTS

(NOT APPLICABLE)

PART 3 - EXECUTION

3.1 IMPLEMENTATION OF THE COMMISSIONING PLAN

A. Sequence of Events

1. The Commissioning Agent shall provide the Commissioning Plan to the Contractor for execution.

2. A kick off meeting attended by all parties will be conducted by the Commissioning Agent.

2. The Commissioning Agent will periodically visit to the job site to observe installation activities. Observations will be documented on site visit reports and the Issues and Benefits log.

3. The Contractor shall maintain the Prefunctional Checklists on the job site. The installing trade Foreman shall sign off on each item as it is completed.

4. Prior to any equipment startup, the Contractor shall request the Commissioning Agent backcheck the Prefunctional Checklist and verify all items are complete and the building condition is ready for startup.

4. All equipment shall be started by qualified technicians and documented on standardized startup forms typically provided by the equipment manufacturer. The startup documentation shall be submitted to the Commissioning Agent for review and inclusion in the final commissioning report.

5. The Contractor shall submit the approved duct air leakage (DALT) and testing, adjusting, and balancing (TAB) reports to the Commissioning Agent.

6. The Contractor shall provide notice that the entire control system (both building automation and equipment controllers) is complete; the point-to-point connectivity has been confirmed, instruments have been calibrated, sequence of operation checked, and the computer graphics interface is finished.

7. The systems, operation and maintenance manuals shall be submitted to the Commissioning Agent for review.

8. Functional Testing will begin only after all of the items above are complete. Functional commissioning may occur on second shift, if needed to support the building occupancy.

9. The Contractor shall submit the Owner Training plan to the Commissioning Agent for review. Once training is completed, the attendance sign in sheet shall be forwarded to the Commissioning Agent. Individuals with direct experience with the equipment startup and operation shall participate in the training, including the project startup technicians.

10. Second season commissioning will be performed on the major equipment.

11. Post occupancy commissioning will be performed prior to the warranty expiration.

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12. When all of the above items are complete, and all of the items on the Issues and Benefits Log have been resolved, the Commissioning Agent will prepare the Final Commissioning Report. The report will contain the Commissioning Agent's recommendations on final acceptance of the Project.

B. Equipment and Systems Startup:

1. Pre-startup Verification: Prior to startup of HVAC equipment and systems, the Contractor shall indicate on the pre-start checklists and Commissioning Agent shall observe and verify that all items have been substantially installed in accordance with the project Contract Documents, including all change orders. Verification of the basic installation testing of systems shall be performed by the Contractor and shall include:

    a. Hydrostatic testing of hydronic piping systems.

    b. Cleaning, flushing, and venting of piping systems, including removal and cleaning of all strainers.

    c. Cleaning of equipment and systems of construction dirt and debris, including replacement of filters.

    d. Alignment of all rotating machinery.

    e. All items on the Prefunctional Checklists.

2. Startup Verification: The Contractor shall indicate on the startup checklists, and Commissioning Agent shall verify that all equipment, systems, and subsystems have been activated and operate substantially in accordance with Contract Documents, with all equipment, system, and electrical operating and safety devices checked and functional. The Contractor's work also includes but is not limited to:

    a. Calibration and testing of all automatic temperature control devices and building automation systems

    b. Testing and verification of all interlocks and interfacing between HVAC equipment, systems, subsystems, and other building systems

    c. Completion of testing, adjusting, and balancing (TAB) work, including the rechecking of 10% of the measurements

3. Startup Documentation: Completed startup checklists shall be filled out by the Contractor, and provided to the Commissioning Agent after startup verification of each system, subsystem or each item of equipment. Where available the equipment manufacturer’s startup form shall be used for documentation. Startup of each piece of equipment shall be documented in a professional manner on a separate document. The documentation shall contain the company name, address, and signature of the technician.

4. During the entire first year of occupancy, the Contractor shall provide DDC trend data demonstrating the HVAC equipment is operating within design parameters.

3.2 FUNCTIONAL PERFORMANCE TESTING

A. Every item of HVAC equipment, all HVAC systems and subsystems, controls, and all related equipment shall be tested and evaluated for conformance to performance data in the Contract Documents. Included is conformance to:

1. HVAC equipment input and output capacities.

2. HVAC systems and subsystems flow and distribution performance.

3. Control system performance, accuracy, and adherence to sequences of operation.

4. Minimum or part load operations and performance.

5. Interface with other equipment and/or systems.

B. Functional performance testing shall not begin until all equipment and systems have had startup verification by the Contractor and notification of completion has been given to the Owner by the Commissioning Agent.

1. Functional performance test checklists developed by the Commissioning Agent shall be used to document the equipment functional performance tests.

2. Each item of system equipment will be functional performance tested by the Contractor and the results documented by the Contractor at full load (and under part load conditions where required by the Contract Documents).

3. Operation under “abnormal and/or emergency conditions” shall be simulated by the Contractor for equipment and systems, and all safety equipment and control operations verified.

4. Test methods shall be documented and approved by the Commissioning Agent prior to implementation and shall be covered during the Owner’s training as well.

5. No equipment test functions or procedures shall be eliminated from the functional performance test unless approved by the Commissioning Agent and the Owner.

6. The startup technicians shall be present during Functional Commissioning of equipment as applicable.

D. Test Documentation: Functional performance test checklists developed by the Commissioning Agent shall be used by the Contractor to document the results of the functional performance testing process.

E. Test Failures: No system or subsystem shall be accepted until all items of equipment in the system have approved and verified functional performance test checklists.

1. When a functional performance test is not approved, the Contractor shall provide a written report to the Commissioning Agent listing the deficiencies causing the test failure, and remedy.

2. After all deficiencies have been corrected; the entire functional performance test for the equipment, system, or subsystem shall be repeated at the discretion of the Commissioning Agent.

3. The Commissioning Agent will continue to monitor the actions to correct the equipment or system deficiencies until an acceptable functional performance test has been accomplished.

F. Deferred Tests: If any checklist or functional performance test cannot be completed for seasonal reasons, lack of occupancy, or for other reasons, a written report shall be sent by the Contractor to the Commissioning Agent indicating when the test will be scheduled.

1. If any checklist or functional performance test cannot be accomplished due to deficiencies outside the scope of the HVAC systems work, the deficiencies shall be resolved and corrected by the appropriate parties before completion of the HVAC commissioning process.

G. Control System Verification: The Control Contractor shall provide a field technician on site with a portable control access computer and related test equipment. The date and time of this control system verification testing shall be scheduled in advance with the Commissioning Agent. The field technician shall demonstrate to the Commissioning Agent the accuracy of each physical input point, and the response of each physical output point during each mode of operation identified in the Sequence of Controls.

1. Where equipment is provided with controllers that perform portions of the sequence of operation, the equipment supplier is considered to share the responsibilities of the Control Contractor. The equipment manufacturers authorized startup technician shall participate in the commissioning as described above.

H. A checklist shall be provided by the Contractor for each of the physical hardware points prior to this system verification demonstration, with all identification information and the physical location of each physical input/output device. For input sensors, this checklist shall be completed during the field test to indicate what the actual measured reading was during the verification, verses what the control system indicated it was. For output devices, this checklist shall indicate what the response actually was verses what it should have been for each mode of operation. Any defective control component shall be replaced, and any programming errors identified shall be corrected and re-demonstrated to the Commissioning Agent.

I. For equipment with programmable controllers, the setup menu input data shall be provided to Commissioning Agent for backcheck during Functional Testing. This data shall be included in the O&M Manual.

3.3 OWNER TRAINING

A. The Contractor shall provide Owner Training as indicated in the Contract Documents. (See section 017823)

3.4 SECOND SEASON AND POST OCCUPANY FUNCTIONAL TESTING

A. Second Season and Post Occupancy functional testing will be performed on the major equipment and building systems to verify system performance under design conditions.

1. The same commissioning team must be assembled for this work.

2. The testing will be reduced scope and focus on thermal performance and identification of issues that have arisen since the construction period.

3.5 COMMISSIONING REPORT

A. The Final Commissioning Report will be prepared by the Commissioning Agent with the following information provided by the Contractor.

1. Site Visit Reports
2. Issues and Benefits Logs
3. Completed Pre-functional Checklists
4. Completed Functional Checklists
5. Startup Reports
6. TAB Report

3.6 ONGOING COMMISSIONING

A. The Commissioning Agent shall provide an Ongoing Commissioning Plan with the Final Commissioning Report. Ongoing Commissioning Plan shall detail the following:

1. Ongoing Commissioning Definitions
2. Systems to be Commissioned
3. Project Planning and Budget
4. Systems Testing & Performance Verification
5. Corrective Action Response

3.7 ACCEPTANCE

A. The Commissioning Agent shall make a recommendation of final acceptance of the project to the Owner.

END OF SECTION 230800

SECTION 230500

COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. This Section applies to all HVAC specification Sections.

1.02 SUMMARY

1.03 JOB CONDITIONS

A. The drawings show the general scope and arrangement of the HVAC systems and shall be followed as closely as actual conditions allow.

B. Give consideration to all other trades. Make arrangements to avoid conflicts and interference with other work. Fully coordinate all components of HVAC systems with minor adjustments as required, including provision of offsets, transitions, fittings, and accessories to meet actual conditions.

1.04 ELECTRICAL WORK

A. Electrical equipment and electrical motor-driven equipment specified herein shall be provided complete with motors, integral motor starters where indicated, and controls.

B. Electrical equipment and wiring shall conform to the requirements of Division 26 - Electrical.

C. Manual or automatic control and protective or signal devices required for the operation specified herein, and any control wiring required for control devices but not shown on the electrical plans shall be provided under this Section.

1.05 CONFORMANCE TO REGULATIONS

A. All work shall conform to the regulations of the applicable federal, state, and local laws, ordinances and codes, including but not limited to the 2018 Virginia Uniform Statewide Building Code (VUSBC), the 2018 IMC, the 2018 IECC, and the current edition of the University of Virginia Facility Design Guidelines.

1.06 REGULATORY REQUIREMENTS

A. All products shall be listed by the Underwriters Laboratories, Inc. (UL), and shall bear the UL label. Where UL labels are not provided from the factory, the contractor shall be responsible for having the equipment or materials tested by a UL testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

1.07 QUALITY ASSURANCE

A. Work shall meet or exceed minimum recommendations of:
   1. AGA - American Gas Association
   2. ANSI - American National Standards Institute
   3. ASME American Society of Mechanical Engineers
   4. ASPE - American Society of Plumbing Engineers
   5. ASTM - American Society for Testing and Materials
   6. AWS - American Welding Society
   7. USDOE - United States Department of Energy
   8. EPA - Environmental Protection Agency
   9. IBC - International Building Code 2018
   10. IECC - International Energy Conservation Code 2018
   11. IMC - International Mechanical Code 2018
   12. NEMA - National Electrical Manufacturers Association
   13. NIOSH - National Institute for Occupational Safety and Health
   14. NSF - National Sanitation Foundation
   15. OSHA - Occupational Safety and Health Act
   16. TIMA - Thermal Insulation Manufacturers Association
   17. UL - Underwriters' Laboratories
   18. VUSBC - Virginia Uniform Statewide Building Code 2018

B. Reference to the standards of any technical society, organization, or association, or to the laws, ordinances, or codes of governmental authorities shall mean the latest standard, code, or specification adopted, published, and effective at the date of taking bids.

C. The specifications, codes, and standards referenced in these specifications (including addenda, amendments, and errata) shall govern in all cases where references thereto are made. In case of conflict between the referenced specifications, the more stringent requirement shall govern unless otherwise permitted by the Architect/Engineer. Major conflicts shall be referred to the Engineer for resolution.

1.08 MATERIALS AND EQUIPMENT

A. Unless specifically provided otherwise, all materials and equipment furnished for permanent installation in the Work shall conform to applicable standards and be new, current design, unused, and undamaged.

B. Individual parts shall be manufactured to standard sizes and gauges so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate

equipment shall be interchangeable.

1.09 UTILITIES AND CONNECTIONS

A. Verify location of all existing utilities before laying out and making connections. Report any inconsistencies to Engineer before commencing work. Contractor shall be responsible for any error resulting from failure to exercise these precautions.

1.10 WIRING DIAGRAMS

A. All mechanical equipment shall be provided with complete wiring diagrams showing all power and control connections. The diagrams shall be placed in a clear plastic pouch that is permanently affixed to the equipment.

1.11 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Refer to Division 01 requirements.

B. Protect products from damage, marring, and soiling.

C. Any marring of factory finishes shall be touched up to match the original factory finish.

1.12 SUBMITTALS

A. Refer to Division 01 requirements.

B. Sustainability Submittal Requirements: Submit Sustainable Materials Coversheet (SMC) for Sustainability Consultant’s Review.

1. Each material submittal shall include a completed SMC per Section 018115 and accompanying required backup documentation.
2. All products must comply with Sustainable Material Performance Requirements per Section 018120.

C. General: The Contractor shall submit information, for Architect/Engineer's review, to demonstrate compliance of proposed Products and/or installations with the Contract Documents. This information shall include, but not be limited to: catalog data; performance data; noise levels; etc. Proposed Products that are not in compliance with the Contract Documents may be rejected. Information must be submitted on all required Products, including proposed Products that appear to be in compliance with the Contract Documents.

D. Contractor preparation:

1. The Contractor shall review and approve each submittal and coordinate all other related or affected Work before submitting for review. All copies of each submittal shall bear the Contractor's stamp, with signature or initials, certifying review and approval; verification of field dimensions; and coordination with adjacent Work are in compliance with the requirements of the Contract Documents.

2. The Contractor shall identify variations from the requirements of the Contract Documents on all copies of applicable submittals. No extra charges shall be paid for the providing of Products or furnishing of Work required as a result of failure to comply with this requirement.

E. Submittal Format:
1. Each submittal shall be accompanied by a letter of transmittal listing Project Title, Contractor, Subcontractor or supplier, submitted Products, pertinent drawing and detail number, and specification section number, as appropriate.
2. Provide a minimum of five copies of each submittal. Provide additional copies as required by Owner and/or Contractor. Each copy of a submittal shall be bound in a three-ring binder, and indexed to allow ready reference to each Product.
3. Product data shall be clearly marked to identify the applicable Products or models. Options or modifications required by the Contract Documents shall be clearly identified.
4. Submittals shall be complete with all associated Products. Submittals on portions of a Product or system shall not be reviewed.
5. Provide Manufacturer's start-up procedures, testing and checklists.
6. Contractor shall provide coordinated shop drawings of Division 23 systems. Provide 3-D shop drawings of major mechanical rooms indicating equipment, duct, piping, and service access clearances. Shop drawings shall be prepared in electronic format and submitted in electronic and printed form.

F. Architect/Engineer Procedures: Submittals will be reviewed with reasonable promptness. The Contractor shall allow 15 days for review of each submittal. The Architect/Engineer's comments will be indicated on a Submittal Review Comments form, which will be attached to each copy of the submittal. Contractor shall be responsible for distributing copies of reviewed submittals as appropriate.

G. Resubmission: Contractor shall change or correct submittals as required by the Architect/Engineer and resubmit until approved. The Contractor shall identify any changes other than those required by the Architect/Engineer on all copies of the resubmittal.

H. Approval required: The ordering, fabrication and/or installation of Products before approval of all relevant submittals shall be at the Contractor's risk. Any damage to new or existing Work resulting from the installation of unapproved Products shall be repaired or replaced by the Contractor at no additional cost. Payment will not be

recommended for any Work that does not have an approved submittal.

1.13 SUBSTITUTIONS

A. Refer to Division 01 requirements.

B. For a Product specified by naming one or more manufacturer and model, and followed with the statement “or approved equal,” the Contractor may submit a Product other than the Product specified by manufacturer and model, that Product shall be considered a Substitute Product and shall comply with the following conditions:

1. The Contractor shall verify the Substitute Product is equal or superior in all respects to the Specified Product.
2. The Contractor shall submit data on the Substitute Product in compliance with the “Submittals” paragraph herein.
3. After the Substitute Product has been approved by the Architect/Engineer, the Contractor shall be responsible for coordinating the installation of the Substitute Product with all trades. The Contractor shall be responsible for any changes required to incorporate the Substitute Product into the Work.
4. The Contractor waives all claims for additional costs related to the Substitute Product that becomes apparent before, during or after installation.

C. A product that is not one of the listed brands but is equal or superior in all respects is an equal to the specified product.

1.14 OPERATING AND MAINTENANCE MANUAL

A. Refer to Division 01 requirements.

B. General: The Contractor shall submit one copy of the Operation and Maintenance Manual to the Architect/Engineer for review a minimum of 60 days prior to Instruction and Training Sessions. This copy will be returned to the Contractor with Architect/Engineer's comments or approval. The Contractor shall revise and resubmit one copy of the O&M Manual as required. The Contractor shall provide four copies of the approved O&M Manual. Instruction and Training Sessions shall begin 30 days after receipt of the approved O&M Manuals. Refer to “Instruction and Training Sessions” paragraph herein.

C. Binders: Commercial quality, 8-1/2x11 inch, three ring binders with durable plastic covers; three inch maximum ring size. Attach printed labels to the front and side of each binder stating '(PROJECT NAME) OPERATION AND MAINTENANCE MANUAL'; applicable volume number; and project title. Provide tabbed dividers for each Product and system, with typed description or applicable Specification Section. Provide a table of contents for the entire manual and insert at the front of each

binder.

D. Contents: The manual shall consist of three parts as follows:

1. Part 1: Directory listing names, addresses, and telephone numbers of Architect, Engineer, Contractor, Subcontractors, and major equipment suppliers.
2. Part 2: Operation and maintenance instructions including, but not limited to, the following:
    a. General description and specifications of each component and of each system as a whole.
    b. Manufacturer's catalog description of each component supplemented by approved equipment submittals.
    c. Detailed electrical and logic descriptions.
    d. Installation and start-up instructions, including complete calibration procedures for each component and for system as a whole.
    e. Operating instructions including:
        1) Sequence of operation
        2) Shutdown procedure
        3) Emergency operating procedures
    f. Trouble shooting guide with service instructions
    g. Preventive maintenance schedules
    h. Parts list with names, addresses, and telephone numbers of local parts suppliers.
    i. Names, addresses, and phone numbers of nearest service organizations
    j. Interface requirements and capabilities.
    k. Detailed schematics of equipment.
    l. Complete equipment schedules.
3. Part 3: Project documents including, but not limited to, the following:
    a. Testing, adjusting, and balancing report
    b. Certificates
    c. Copies of warranties.

E. Quality: The manual will be reviewed by the Architect/Engineer to determine accuracy, completeness and quality of printing. Deficiencies will necessitate resubmittals by the Contractor. Refer to “Submittals” paragraph herein.

1.15 INSTRUCTION AND TRAINING SESSIONS

A. Refer to Division 01 requirements.

B. After all equipment and services are in operation and receipt of the approved Operation and Maintenance Manuals, Instruction and Training Sessions shall be conducted for representatives of the Owner.

C. Instruction Session shall be conducted during the Owner's normal working periods and at times satisfactory to the Owner.

1. Session shall be sufficient to address all instruction and training for the installed systems and shall last not less than one 8-hour working day.

D. The Training Session shall address the operation and maintenance of each piece of equipment and of the system as a whole. Preventative maintenance techniques shall be included.

E. Instructions and training shall be given by competent, factory-trained service and operating personnel from the appropriate manufacturer(s). The Contractor shall record the names of all personnel present at each Instruction and Training Session and shall forward a copy of the attendance log to the Architect/Engineer within seven days after each session.

1.16 RECORD DRAWINGS

A. Refer to Division 01 requirements.

1.17 PROJECT/SITE CONDITIONS

A. Install work in locations shown on Drawings, unless prevented by Project conditions.

B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Architect/Engineer before proceeding.

1.18 WARRANTIES

A. Refer to Division 01 requirements.

B. Warranty periods shall begin from Date of Substantial Completion.

C. Special Warranty: Manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

1.19 COMMISSIONING

A. Refer to Division 01 requirements.

B. Start-up of all systems and sub-systems shall be coordinated by the Commissioning Agent. An experienced mechanic(s) shall be on site throughout the start-up and commissioning process to coordinate activities and insure that all equipment is functioning as intended.

1.20 MOCK UPS

A. Provide mock-ups for all equipment, piping, insulations, etc, as indicated on the drawings and in the specifications.
   1. A mock-up schedule shall be submitted for A/E and Owner review. A/E and Ownere shall be notified a minimum of ten (10) days in advance of scheduled mock-up review.
   2. Each mock-up shall be approved by the Owner prior to proceeding with the remaining work.
   3. Each mock-up shall include a complete unit/system with actual installed equipment, piping, specialties, ductwork, insulation, power, controls, etc.

1.21 CONTRACTOR COORDINATION

A. Nomenclature for final room names and numbers may vary from the construction documents. Final names and numbers used in the shop drawings shall be coordinated with final room names and numbers assigned by the Owner and Architect.

B. HVAC contractor(s) shall coordinate their work with all other trades prior to fabrication of systems and commencement of installation. It shall be the responsibility of each contractor to review the work of other trades (including, but not limited to civil, structural, architectural, special equipment, fire alarm, fire suppression, plumbing, and electrical) as it affects their work, and as their work affects other trades, to insure that the construction documents are closely followed. Where discrepancies arise, they shall be referred to the Architect/Engineer for resolution before proceeding with the Work.

PART 2 - PRODUCTS

2.01 SUSTAINABLE MATERIAL PERFORMANCE

A. All products must comply with the Sustainable Material Performance requirements per Section 018120.

PART 3 - EXECUTION

3.01 GENERAL

A. Unless otherwise noted, install equipment in accordance with manufacturer's printed instructions for application indicated.

B. Install, operate, and adjust systems in accordance with the plans and specifications.

C. All work for this division shall conform to the regulations of the applicable federal, state, and local laws, ordinances, and codes.

D. A Request For Information (RFI) shall be submitted to the Architect/Engineer for any portion of the Work that the Contractor determines a clarification is required. Prior to submitting a RFI the Contractor shall thoroughly research the Contract Documents to ensure information has not been overlooked. The RFI shall include references to the portion of the Contract Documents that requires a clarification. The Contractor shall allow a minimum of three business days for the Architect/Engineer to respond to the RFI. The Contractor shall not proceed with that portion of the Work until a response has been returned.

E. All Products delivered to the site(s) shall be stored in accordance with the manufacturer's printed instructions. If a manufacturer does not have printed instructions then the Product shall be adequately housed and otherwise protected against damage or corrosion. If any Product stored at the site(s) is not protected as specified herein, the Contractor shall not receive payment for that Product. That Product shall be stored by the Owner at the expense of the Contractor. Any Product damaged as a result of failure to comply with this requirement shall be replaced by the Contractor at no additional cost to the Owner.

3.02 ACCESSIBILITY

A. Locate all equipment, which must be serviced, operated, or maintained in fully accessible positions in accordance with manufacturer's recommendations and subject to approval of Architect. Provide a minimum of two feet of clearance in front of equipment access doors and components requiring service.

3.03 FIRESTOPPING

A. Refer to Division 07 requirements.

B. For all penetrations or openings in or through fire-rated assemblies including, but not limited to, walls, floors, ceilings, shafts, etc. the Contractor will provide approved UL listed "through penetration firestop" systems to ensure integrity of rated assembly. Refer to architectural drawings and details for approved options and confirm final selection with Architect/Engineer before proceeding with this portion of the Work.

3.04 PROTECTION OF OPENINGS

A. Openings in partially installed systems, including equipment and piping, shall be plugged, capped, or otherwise closed with approved methods and materials or devices until connections are made.

3.05 PROTECTION FROM MOVING PARTS

A. Belts, shafts, couplings, and other rotating or moving parts, located so that any person may come in proximity thereto, shall be fully enclosed or properly guarded.

3.06 COORDINATION WITH FOOD SERVICE CONTRACTOR (FSC)

A. Coordinate work with the requirements of the Food Service drawings and specifications.

B. Ventilation

1. All hoods (ventilators and associated fire suppression system) shall be furnished by FSC with connection and equipment (ductwork, fans, starters, curbs) beyond the hood and above the ceiling or other exposed surface by the HVAC Contractor.
2. The HVAC Contractor shall furnish and install all mechanical supply and exhaust ventilating systems required, including ventilating fan units, motors, drivers, foundation, ductwork, registers and grilles, controls, and appurtenances to comply with NFPA Bulletin #96, latest edition or in force, and all other applicable codes.
3. The FSC shall provide the fire suppression system(s) for surface protection of the cooking appliances, hood plenums, and duct collars as required.

END OF SECTION 230500

SECTION 230513

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. General construction and requirements.

B. Single phase electric motors.

C. Three phase electric motors.

D. Electronically Commutated Motors (ECM).

1.02 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015.

B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; 2004.

C. NEMA MG 1 - Motors and Generators; 2021.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.

C. Test Reports: Indicate test results verifying nominal efficiency and power factor for three phase motors larger than 1/2 horsepower.

D. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

E. Operation Data: Include instructions for safe operating procedures.

F. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture of electric motors with documented experience.

B. Comply with NFPA 70.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove

motors from equipment and store separately.

1.06 WARRANTY

A. Refer to Division 01 and Section 23 0500 requirements.

B. Provide five year manufacturer warranty for motors larger than 10 horsepower.

C. Manufacturer Warranty: Supply manufacturer's standard warranty against defects in product workmanship and materials. Provide five-year manufacturer warranty for motors larger than 10 horsepower. Complete forms in Owner's name and register with manufacturer.

D. Installer Warranty: Provide two-year warranty for [____] commencing on the Date of Substantial Completion. Complete forms in Owner's name and register with installer.

E. Warranty periods shall begin from Date of Substantial Completion.

PART 2 - PRODUCTS

2.01 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Electrical Service:

1. Motors 1/2 HP and Smaller: 115 volts, single phase, 60 Hz.
2. Motors Larger than 1/2 Horsepower:208/480 volts, three phase, 60 Hz.

B. Construction:

1. Open drip-proof type except where specifically noted otherwise.
2. Design for continuous operation in 104 degrees F environment.
3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.

C. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

D. Wiring Terminations:

1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.02 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

A. Starting Torque: Exceeding one fourth of full load torque.

B. Starting Current: Up to six times full load current.

C. Multiple Speed: Through tapped windings.

D. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

E. NEMA premium efficiency motors shall be used on all HVAC systems.

2.03 SINGLE PHASE POWER - CAPACITOR START MOTORS

A. Starting Torque: Three times full load torque.

B. Starting Current: Less than five times full load current.

C. Pull-up Torque: Up to 350 percent of full load torque.

D. Breakdown Torque: Approximately 250 percent of full load torque.

E. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.

F. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve bearings.

G. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

H. NEMA premium efficiency motors shall be used on all HVAC systems.

2.04 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Starting Torque: Between 1 and 1-1/2 times full load torque.

B. Starting Current: Six times full load current.

C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

D. Design, Construction, Testing, and Performance: Comply with NEMA MG 1 for Design B motors.

E. Insulation System: NEMA Class B or better.

1. Motors used with variable frequency drives shall be listed for such.

F. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

G. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

H. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

I. Sound Power Levels: To NEMA MG 1.

J. Part Winding Start Where Indicated: Use part of winding to reduce locked rotor starting current to approximately 60 percent of full winding locked rotor current while providing approximately 50 percent of full winding locked rotor torque.

K. Nominal Efficiency: As indicated at full load and rated voltage when tested in accordance with IEEE 112. NEMA premium efficiency motors shall be used on all HVAC systems.

L. Nominal Power Factor: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

2.05 ELECTRONICALLY COMMUTATED MOTORS (ECM)

A. Variable speed, direct current, brushless type motor.

B. Designed for synchronous rotation.

C. Rotor shall be permanent magnet type with near zero rotor losses.

D. Provide inductors to mimimize harmonic distortion and line noise.

E. Built in soft start and speed change ramps.

F. Permanetly lubricated ball bearings.

G. Minimum 70% efficient over the entire operating range. NEMA premium efficiency motors shall be used on all HVAC systems.

H. Complete with and operated by an integrated speed controller/inverter.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

3.02 IDENTIFICATION

A. Unit information labels and stickers shall never be painted over or covered in any way.

3.03 SCHEDULE

A. Refer to the drawing equipment schedules.

END OF SECTION 230513

SECTION 230516

EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Flexible pipe connectors.

1.02 RELATED REQUIREMENTS

A. Section 232113 - Hydronic Piping.

1.03 REFERENCE STANDARDS

A. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2022.

1.04 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data:

1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

C. Manufacturer's Instructions: Indicate manufacturer's installation instructions, special procedures, and external controls.

D. Project Record Documents: Record installed locations of flexible pipe connectors, expansion joints, anchors, and guides.

PART 2 - PRODUCTS

2.01 FLEXIBLE PIPE CONNECTORS - STEEL PIPING

A. Inner Hose: Bronze.

B. Exterior Sleeve: Single braided, stainless steel.

C. Pressure Rating: 200 psi and 250 degrees F.

D. Joint: Flanged.

E. Size: Use pipe sized units.

F. Maximum offset: 3/4 inch on each side of installed center line.

2.02 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

A. Inner Hose: Bronze.

B. Exterior Sleeve: Braided bronze.

C. Pressure Rating: 200 psi and 250 degrees F.

D. Joint: Flanged.

E. Size: Use pipe sized units.

F. Maximum offset: 3/4 inch on each side of installed center line.

G. Application: Copper piping.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.

C. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

D. Anchor pipe to building structure where indicated. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.

E. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.

END OF SECTION 230516

SECTION 230519

METERS AND GAUGES FOR HVAC PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pressure gauges and pressure gauge taps.

B. Thermometers and thermometer wells.

C. Static pressure gauges.

1.02 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2022.

B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014.

C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014 (Reapproved 2021).

D. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

C. Project Record Documents: Record actual locations of components and instrumentation.

1.04 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 - PRODUCTS

2.01 PRESSURE GAUGES

A. Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.

1. Case: Steel with brass bourdon tube.
2. Size: 4-1/2 inch diameter with 1/4" MPT connection.
3. Mid-Scale Accuracy: One percent.
4. Scale: Psi and KPa.

2.02 PRESSURE GAUGE TAPPINGS

A. Gauge Cock: Tee or lever handle, brass for maximum 150 psi.

2.03 SELF-POWERED THERMOMETERS

A. Self-powered (photovoltaic) digital thermometer with a ten Lux (one foot-candle) rating and a 10-second display update. The unit shall swivel and pivot to meet custom installation requirements. Capable of handling humidity up to 95% RH non-condensing.
   1. Size: 0.375 inch LCD display.
   2. Window: Clear glass.
   3. Hi-Impact plastic case and protective plastic digital display cover.
   4. Accuracy: 2 percent, per ASTM E 77.
   5. Calibration: Degrees F and Degrees C.

2.04 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

2.05 TEST PLUGS

A. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with Nordel core for temperatures up to 350 degrees F.

B. Test Kit: Carrying case, internally padded and fitted containing one 2-1/2 inch diameter pressure gauges, one gauge adapters with 1/8 inch probes, two 1 inch dial thermometers.

2.06 STATIC PRESSURE GAUGES

A. 3-1/2 inch diameter dial in metal case, diaphragm actuated, black figures on white background, front recalibration adjustment, 2 percent of full scale accuracy.

B. Inclined manometer, red liquid on white background with black figures, front recalibration adjustment, 3 percent of full scale accuracy.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide one pressure gage per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gage.

C. Install pressure gages with pulsation dampers. Provide gauge cock to isolate each gauge. Extend nipples to allow clearance from insulation.

D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

E. Provide instruments with scale ranges selected according to service with largest appropriate scale.

F. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

G. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

H. Locate test plugs adjacent thermometers and thermometer sockets.

END OF SECTION 230519

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SECTION 230523

GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Applications.

B. Ball valves.

C. Butterfly valves.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

B. Section 083100 - Access Doors and Panels.

C. Section 230553 - Identification for HVAC Piping and Equipment.

D. Section 230716 - HVAC Equipment Insulation.

E. Section 230719 - HVAC Piping Insulation.

F. Section 232113 - Hydronic Piping.

G. Section 232213 - Steam and Condensate Heating Piping.

1.03 REFERENCE STANDARDS

A. ASME B31.9 - Building Services Piping; 2020.

B. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.

C. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2023).

D. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984, with Editorial Revision (2019).

E. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017.

F. ISO 9001 - Quality Management Systems-Requirements; 2008.

G. MSS SP-67 - Butterfly Valves; 2011.

H. MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends; 2011.

I. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service; 2010.

J. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; 2013.

K. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.

1.04 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

D. Maintenance Materials: Furnish Owner with one wrench for every five plug valves, in each size of square plug valve head.

1. See Section 016000 - Product Requirements for additional provisions.

1.05 QUALITY ASSURANCE

A. Manufacturer:

1. Obtain valves for each valve type from single manufacturer.
2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.
3. The manufacturer shall be fully certified by the International Standards Organization per ISO 9001.

B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
2. Protect valve parts exposed to piped medium against rust and corrosion.
3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
4. Adjust globe, gate, and angle valves to the closed position to avoid clattering.
5. Secure check valves in either the closed position or open position.
6. Adjust butterfly valves to closed or partially closed position.

B. Use the following precautions during storage:

1. Maintain valve end protection and protect flanges and specialties from dirt.
   a. Provide temporary inlet and outlet caps.
   b. Maintain caps in place until installation.
2. Store valves in shipping containers and maintain in place until installation.
   a. Store valves indoors in dry environment.

b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

C. Exercise the following precautions for handling:

1. Handle large valves with sling, modified to avoid damage to exposed parts.
2. Avoid the use of operating handles or stems as rigging or lifting points.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer Warranty: Supply manufacturer's standard warranty against defects in product workmanship and materials. Provide two-year manufacturer warranty for all general duty valves. Complete forms in Owner's name and register with the manufacturer.

C. Installer Warranty: Provide two-year warranty for general duty valves commencing on the Date of Substantial Completion. Complete forms in Owner's name and register with the installer.

D. Warranty periods shall begin from Date of Substantial Completion.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. See drawings for specific valve locations.

B. Listed pipe sizes shown using nominal pipe sizes (NPS) and nominal diameter (DN).

C. Provide the following valves for the applications if not indicated on drawings:

1. Throttling (Hydronic): Butterfly and Ball.
2. Isolation (Shutoff): Ball.
3. Swing Check (Pump Outlet):
   a. Size 2 inch and Smaller: Bronze with bronze disc.
   b. Size 2-1/2 inch and Larger: Iron with lever and weight, lever and spring, center-guided metal, or center-guided with resilient seat.

D. Substitutions of valves with higher CWP classes or WSP ratings for same valve types are permitted when specified CWP ratings or WSP classes are not available.

E. Required Valve End Connections for Non-Wafer Types:

1. Steel Pipe:
   a. Size 2-1/2 inch and Larger: Grooved ends.
2. Copper Tube:
   a. Size 2 inch and Smaller: Threaded ends, except solder-joint valve-ends.

F. Chilled Water Valves:

1. Size 2 inch and Smaller, Brass and Bronze Valves:

a. Solder-joint ends.
b. Ball: Full port, one piece, brass trim.
c. Swing Check: Bronze disc, Class.

2. Size 2-1/2 inch and Larger, Iron Valves:
a. 2-1/2 inch to 4 inch: Flanged ends.
b. Ball: 2-1/2 NPS to 10 inch, Class 150.
c. Single-Flange Butterfly: 2-1/2 inch to 12 inch, aluminum-bronze disc, EPDM seat, 200 CWP.
d. Swing Check with Closure Control: 2-1/2 inch to 12 inch, lever and spring, Class 125.

G. Condenser (Ground Source) Water Valves:
1. Size 2 inch and Smaller, Brass and Bronze Valves:
a. Solder-joint ends.
b. Ball: Full port, one piece, brass trim.
c. Swing Check: Bronze disc, Class 125.

2. Size 2-1/2 inch and Larger, Iron Valves:
a. 2-1/2 inch to 4 inch: Flanged ends.
b. Ball: 2-1/2 inch to 10 inch, Class 150.
c. Single-Flange Butterfly: 2-1/2 inch to 12 inch, aluminum-bronze disc, EPDM seat, 200 CWP.
d. Swing Check with Closure Control, 2-1/2 inch to 12 inch: Lever and spring, Class 125.

H. Heating Hot Water Valves:
1. 2 NPS and Smaller, Brass and Bronze Valves:
a. Soldered ends.
b. Ball: Full port, one piece, brass trim.
c. Swing Check: Bronze disc, Class 125.

2. Size 2-1/2 inch and Larger, Iron Valves:
a. 2-1/2 inch to 4 inch: Flanged ends.
b. Ball: 2-1/2 NPS to 10 NPS, Class 150.
c. Single-Flange Butterfly: 14 NPS to 24 NPS, aluminum-bronze disc, EPDM seat, 150 CWP.
d. Swing Check: 2-1/2 inch to 12 inch, lever and spring closure control, Class 125.

2.02 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.

B. Valve Sizes: Match upstream piping unless otherwise indicated.

C. Valve Actuator Types:

1. Hand Lever: Quarter-turn valves 6 NPS and smaller.

D. Valves in Insulated Piping: Provide 2 NPS stem extensions and the following features:

1. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

E. Valve-End Connections:

F. General ASME Compliance:

1. Building Services Piping Valves: ASME B31.9.

2.03 BRASS, BALL VALVES

A. One Piece, Full Port with Brass Trim and Push-to-fit or Threaded Connections:

1. Comply with MSS SP-110.
2. CWP Rating: 200 psi.
3. Body: Forged brass.
4. Ends: Threaded.
5. Seats: PTFE or TFE.
6. Stem: Brass.
7. Ball: Chrome-plated brass.

2.04 BRONZE, BALL VALVES

A. General:

1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

B. One Piece, Reduced Port with Bronze Trim:

1. Comply with MSS SP-110.
2. CWP Rating: 400 psi.
3. Body: Bronze.
4. Ends: Threaded.
5. Seats: PTFE.

2.05 IRON, BALL VALVES

A. Split Body, Full Port:

1. Comply with MSS SP-72.
2. CWP Rating: 200 psi.
3. Body: ASTM A126, gray iron.
4. Ends: Flanged.
5. Seats: PTFE.
6. Stem: Stainless steel.
7. Ball: Stainless steel.

2.06 IRON, SINGLE FLANGE BUTTERFLY VALVES

A. Lug Style; Bidirectional dead-end service without use of downstream flange:
1. Comply with MSS SP-67, Type I.
2. Lug Style, CWP Ratings:
a. Sizes 2 to 12 inch: 150 psi.
b. Sizes 14 to 24 inch: 100 psi.
c. Vacuum Service: Down to 29.9 in-Hg.
3. Body Material: ASTM A126 cast iron or ASTM A536 ductile iron.
4. Stem: One or two-piece stainless steel.
5. Seat: NBR.
6. Disc: Coated ductile iron.

2.07 BRONZE, SWING CHECK VALVES

A. Class 125: CWP Rating: 200 psig (1380 kPa).
1. Comply with MSS SP-80, Type 3.
2. Body Design: Horizontal flow.
3. Body Material: Bronze, ASTM B62.
4. Ends: Threaded.
5. Disc: Bronze.

2.08 IRON, SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125:
1. Comply with MSS SP-71, Type I.
2. Body Design: Clear or full waterway.
3. Body Material: ASTM A126, gray iron with bolted bonnet.
4. Ends: Flanged.
5. Trim: Bronze.
6. Gasket: Asbestos free.
7. Closer Control: Factory installed, exterior lever, and spring or weight.

PART 3 EXECUTION

3.01 EXAMINATION

A. Discard all packing materials and verify that valve interior, including threads and flanges, are completely clean without signs of damage or degradation that could result in leakage.

B. Verify valve parts to be fully operational in all positions from closed to fully open.

C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.

D. Should valve is determined to be defective, replace with new valve.

3.02 INSTALLATION

A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.

B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

C. Install valve handle extendors where handles conflict with insulation.

END OF SECTION 230523

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SECTION 230529

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components for equipment, piping, and other HVAC/hydronic work.

1.02 RELATED REQUIREMENTS

A. Section 230548 - Vibration and Seismic Controls for HVAC.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General - Purpose Piping; 2014.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999 (Reapproved 2014).

F. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

I. MFMA-4 - Metal Framing Standards Publication; 2004.

J. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
2. Coordinate the work with other trades to provide additional framing and materials required for installation.

3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
5. Notify Architect/Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. Refer to Division 01, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, non-penetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.
1. Application of protective inserts, saddles, and shields at pipe hangers for each type of insulation and hanger.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Installer Qualifications for Powder-Actuated Fasteners (when specified): Certified by fastener system manufacturer with current operator's license.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
1. Comply with MSS SP-58.
2. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
3. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the

load to be supported with a minimum safety factor of 1.5. Include consideration for vibration, equipment operation, and shock loads where applicable.

5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
    a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
    b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
    1. Comply with MFMA-4.
    2. Channel Material:
        a. Indoor Dry Locations: Use zinc-plated steel or galvanized steel.
        b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
    3. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch.
    4. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.

C. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
    1. Minimum Size, Unless Otherwise Indicated or Required:
        a. Equipment Supports: 1/2 inch diameter.
        b. Piping up to 1 inch (27 mm) nominal: 1/4 inch diameter.
        c. Piping larger than 1 inch (27 mm) nominal: 3/8 inch diameter.
        d. Trapeze Support for Multiple Pipes: 3/8 inch diameter.

D. Thermal Insulated Pipe Supports:
    1. General Construction and Requirements:
        a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
        b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
        c. Pipe supports to be provided for nominally sized, 1/2 inch to 30 inch iron pipes.
        d. Insulation inserts to consist of rigid polyisocyanurate (urethane) insulation surrounded by a 360 degree, PVC jacketing.
    2. PVC Jacket:

a. Pipe insulation protection shields to be provided with a ball bearing hinge and locking seam.
b. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
c. Thickness: 60 mil.

3. Pipe insulation protection shields to be provided at the hanger points and guide locations on pipes requiring insulation as indicated on drawings.

E. Pipe Supports:
1. Liquid Temperatures Up To 122 degrees F:
a. Overhead Support: MSS SP-58 Types 1, 3 through 12.
b. Support From Below: MSS SP-58 Types 35 through 38.
2. Operating Temperatures from 122 to 446 degrees F:
a. Overhead Support: MSS SP-58 Type 1 or 3 through 12, with appropriate saddle of MSS SP-58 Type 40 for insulated pipe.

F. Beam Clamps: MSS SP-58 Types 19 through 23, 25 or 27 through 30 based on required load.
1. Material: ASTM A36/A36M carbon steel or ASTM A181/A181M forged steel.
2. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.

G. Riser Clamps:
1. Provide copper plated clamps for copper tubing support.
2. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.

H. Strut Clamps: Two-piece pipe clamp.

I. Insulation Clamps: Two bolt-type clamps designed for installation under insulation.

J. Pipe Hangers: For a given pipe run use hangers of the same type and material.
1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
2. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

K. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Masonry: Use toggle bolts.

5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Plastic and lead anchors are not permitted.
9. Powder-actuated fasteners are not permitted.
10. Hammer-driven anchors and fasteners are not permitted.
11. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    a. Comply with MFMA-4.
    b. Channel Material: Use galvanized steel.
    c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.
B. Verify that mounting surfaces are ready to receive support and attachment components.
C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Provide pipe shields for all insulated piping.
C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
D. Unless specifically indicated or approved by Architect/Engineer, do not provide support from suspended ceiling support system or ceiling grid.
E. Unless specifically indicated or approved by Architect/Engineer, do not provide support from roof deck.
F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
G. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.
H. Equipment Support and Attachment:
    1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.

2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

I. Secure fasteners according to manufacturer's recommended torque settings.

J. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 230529

SECTION 230548

VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Vibration isolation requirements.

B. Vibration-isolated equipment support bases.

C. Vibration isolators.

D. Inertia bases.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete.

B. Section 230529 - Hangers and Supports for HVAC Piping and Equipment.

1.03 REFERENCE STANDARDS

A. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.

1.04 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes. Provide schedule of vibration isolator type with location and load on each.

1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.

C. Shop Drawings - Vibration Isolation Systems:

1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.
2. Vibration-Isolated Equipment Support Bases: Include base weights, including concrete fill where applicable; indicate equipment mounting provisions.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section.

1. Member of vibration Isolation and Seismic Control Manufacturers Association (VISCMA).

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing HVAC equipment and/or HVAC connections to vibration-isolated equipment.

B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:

C. General Requirements:

1. Select vibration isolators to provide required static deflection.
2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.

2.02 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

A. Vibration-Isolated Concrete Inertia Bases:

1. Description: Concrete-filled engineered steel forms with integral mounting provisions for vibration isolators, sized and configured for mounting of equipment.
2. Minimum Base Depth: 6 inches.
3. Minimum Base Mass (Including Concrete): 1.5 times weight of supported equipment.
4. Concrete Reinforcement: Welded or tied reinforcing bars running both ways in a single layer.
5. Concrete: Filled on site with minimum 3000 psi concrete in accordance with Section 033000.

2.03 VIBRATION ISOLATORS

A. General Requirements:

1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
2. Spring Elements for Spring Isolators:
   a. Color code or otherwise identify springs to indicate load capacity.
   b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.

c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
f. Selected to function without undue stress or overloading.

B. Resilient Material Isolator Pads:
1. Description: Single or multiple layer pads utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material.
2. Pad Thickness: As required for specified minimum static deflection; minimum 0.25 inch thickness.
3. Multiple Layer Pads: Provide bonded, galvanized sheet metal separation plate between each layer.

C. Open (Unhoused) Spring Isolators:
1. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) without a housing.
2. Bottom Load Plate: Nonskid, molded, elastomeric isolator material or steel with nonskid elastomeric isolator pad with provisions for bolting to supporting structure as required.
3. Furnished with integral leveling device for positioning and securing supported equipment.

D. Housed Spring Isolators:
1. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing.
2. Furnished with integral elastomeric snubbing elements, nonadjustable type, for limiting equipment movement and preventing metal-to-metal contact between housing elements.
3. Bottom Load Plate: Steel with nonskid, elastomeric isolator pad with provisions for bolting to supporting structure as required.
4. Furnished with integral leveling device for positioning and securing supported equipment.

E. Restrained Spring Isolators, Nonseismic:

1. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop.
2. Bottom Load Plate: Steel with nonskid elastomeric isolator pad with provisions for bolting to supporting structure as required.
3. Furnished with integral leveling device for positioning and securing supported equipment.
4. Provides constant free and operating height.

F. Resilient Material Isolator Hangers, Nonseismic:

1. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material for the lower hanger rod connection.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Secure fasteners according to manufacturer's recommended torque settings.

D. Vibration Isolation Systems:

1. Vibration-Isolated Equipment Support Bases:
   a. Provide specified minimum clearance beneath base.
2. Spring Isolators:
   a. Position equipment at operating height; provide temporary blocking as required.
   b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
   c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
3. Isolator Hangers:

a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.

4. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
5. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
6. Adjust isolators to be free of isolation short circuits during normal operation.
7. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

3.03 FIELD QUALITY CONTROL

A. Inspect vibration isolation and/or seismic control components for damage and defects.
B. Vibration Isolation Systems:
1. Verify isolator static deflections.
2. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.
C. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

3.04 SCHEDULE

A. Equipment Isolation Schedule.
1. HVAC Pumps, base mounted.
a. Base: Concrete inertia base.
b. Base Thickness: 4 inches.
c. Isolator Type: Open Spring Isolators
2. HVAC Pumps, in-line.
a. Isolator Type: Open spring isolators.
3. Modular Water Chillers.
a. Base: Concrete Base.
b. Isolator Type: Neoprene pad isolators.
4. Computer Room Air Conditioning Units.
a. Base: Concrete Base.
5. Air Handling Unit, floor mounted.

a. Base Type: Concrete housekeeping pad.
b. Base Thickness: 4 inches.
c. Isolator Type: Neoprene pad

6. Fan Coil Unit, floor mounted.
   a. Base Type: Concrete housekeeping pad.
   b. Base Thickness: 4 inches.
   c. Isolator Type: Neoprene Pad Isolators
7. Fan Coil Unit, suspended.
   a. Isolator Type: Spring Hanger
   b. Isolator Deflection: 1 inches.
8. Fans, suspended.
   a. Isolator Type: Spring Hanger
   b. Isolator Deflection: 1 inches.
9. Air Terminal Units, suspended.
   a. Isolator Type: Spring Hanger
10. Roof Mounted Equipment.
    a. Base: Roof curb.
    b. Base Thickness: 18 inches.

END OF SECTION 230548

SECTION 230553

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe markers.

E. Ceiling tacks.

1.02 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2023.

1.03 SUBMITTALS

A. Refer to Division 01 requirements.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

F. Project Record Documents: Record actual locations of tagged valves.

PART 2 - PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Air Handling Units: Nameplates.

B. Air Terminal Units: Tags.

C. Automatic Controls: Tags. Key to equipment served.

D. Control Panels: Nameplates.

E. Dampers: Ceiling tacks, where located above lay-in ceiling.

F. Ductwork: Stenciled painting or duct markers.

G. Heat Transfer Equipment: Nameplates.

H. Instrumentation: Tags.

I. Major Control Components: Nameplates.

J. Piping: Pipe markers.

K. Pumps: Nameplates.

L. Small-sized Equipment: Tags.

M. Tanks: Nameplates.

N. Thermostats: Nameplates.

O. Valves: Tags and ceiling tacks where located above lay-in ceiling.

P. Water Treatment Devices: Nameplates.

2.02 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.

1. Letter Color: White.
2. Letter Height: 1/4 inch.
3. Background Color: Black.

2.03 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

C. Chart: Typewritten letter size list in anodized aluminum frame.

2.04 ADHESIVE-BACKED DUCT MARKERS

A. Material: High gloss acrylic adhesive-backed vinyl film 0.0032 inch; printed with UV and chemical resistant inks.

B. Style: Individual Label.

C. Color: Yellow/Black.

2.05 STENCILS

A. Stencils: With clean cut symbols and letters of following size:

1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.
2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.
3. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.
4. 8 to 10 inch Outside Diameter of Insulation or Pipe: 24 inch long color field, 2-1/2 inch high letters.
5. Over 10 inch Outside Diameter of Insulation or Pipe: 32 inch long color field, 3-1/2 inch high letters.
6. Ductwork and Equipment: 2-1/2 inch high letters.

B. Stencil Paint: As specified in Division 09, semi-gloss enamel, colors conforming to ASME A13.1.

2.06 PIPE MARKERS

A. Color: Comply with ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Underground Plastic Pipe Markers:

1. Tape shall be acid- and alkali-resistant polyethylene film, 6 inches wide with minimum thickness of 0.004 inch and shall have a minimum strength of 1750 psi lengthwise and 1500 psi crosswise with an elongation factor of 350 percent.
2. Tape color shall be yellow and shall bear a continuous printed inscription describing the service.
3. Tape shall have integral wires, foil backing, or other means to enable detection by a metal detector when the tape is buried up to 3 feet deep. The metallic core shall be encased in a protective jacket or provided with other means to protect it from corrosion.

2.07 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

B. Color code as follows:

1. HVAC Equipment: Yellow.
2. Fire Dampers and Smoke Dampers: Red.
3. Heating/Cooling Valves: Blue.

PART 3 - EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Division 09 for stencil painting.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. All piping and equipment in mechanical equipment rooms shall be completely painted according to the "Scheme for the Identification of Piping Systems," ANSI A13.1 and the "Safety Code Color for Marking Physical Hazards," ANSI Z53.1, latest revisions.

C. Exterior nameplates: install with corrosive-resistant mechanical fasteners.

D. Install tags with corrosion resistant chain.

E. Apply stencil painting in accordance with Division 09.

F. Install plastic pipe markers in accordance with manufacturer's instructions.

G. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

H. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.

I. Identify control panels and major control components outside panels with plastic nameplates.

J. Identify valves in main and branch piping with tags.

K. Identify air terminal units and reheat coil valves with numbered tags.

L. Tag automatic controls, instruments, and relays. Key to control schematic.

M. Identify piping, concealed or exposed, as scheduled herein. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

N. Identify ducts with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

O. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

P. Wall mount framed valve chart in mechanical room. Provide additional copy of chart in Operations and Maintenance Manual.

END OF SECTION 230553

SECTION 230593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of hydronic systems.

C. Measurement of final operating condition of HVAC systems.

D. Sound measurement of equipment operating conditions.

E. Commissioning activities.

1.02 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.

B. ASHRAE Std 110 - Methods of Testing Performance of Laboratory Fume Hoods; 2016.

C. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008.

D. NEBB (TAB) - Procedural Standard for Testing Adjusting and Balancing of Environmental Systems; 2019.

E. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2002.

1.03 SUBMITTALS

A. Refer to Division 01 requirements.

B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.

1. Submit to the Architect/Engineer.
2. Submit to the Commissioning Authority and Construction Manager.
3. Submit six weeks prior to starting the testing, adjusting, and balancing work.
4. Include certification that the plan developer has reviewed the contract documents, the equipment and systems, and the control system with the Architect/Engineer and other installers to sufficiently understand the design intent for each system.
5. Include at least the following in the plan:
   a. Preface: An explanation of the intended use of the control system.

b. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
c. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
d. Identification and types of measurement instruments to be used and their most recent calibration date.
e. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
f. Final test report forms to be used.
g. Detailed step-by-step procedures for TAB work for each system and issue, including:
    1) Terminal flow calibration (for each terminal type).
    2) Diffuser proportioning.
    3) Branch/submain proportioning.
    4) Total flow calculations.
    5) Rechecking.
    6) Diversity issues.
h. Expected problems and solutions, etc.
i. Criteria for using air flow straighteners or relocating flow stations and sensors; analogous explanations for the water side.
j. Details of how TOTAL flow will be determined; for example:
    1) Air: Sum of terminal flows via control system calibrated readings or via hood readings of all terminals, supply (SA) and return air (RA) pitot traverse, SA or RA flow stations.
    2) Water: Pump curves, circuit setter, flow station, ultrasonic, etc.
k. Specific procedures that will ensure that both air and water side are operating at the lowest possible pressures and methods to verify this.
l. Confirmation of understanding of the outside air ventilation criteria under all conditions.
m. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
n. Method of checking building static and exhaust fan and/or relief damper capacity.

o. Methods for making coil or other system plant capacity measurements, if specified.
p. Time schedule for TAB work to be done in phases (by floor, etc.).
q. Description of TAB work for areas to be built out later, if any.
r. Time schedule for deferred or seasonal TAB work, if specified.
s. False loading of systems to complete TAB work, if specified.
t. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
u. Procedures for formal progress reports, including scope and frequency.
v. Procedures for formal deficiency reports, including scope, frequency and distribution.

D. Field Logs: Submit at least once a week to the Commissioning Authority and Construction Manager.

E. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

F. Progress Reports.

G. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

1. Submit to the the Commissioning Authority and Construction Manager within two weeks after completion of testing, adjusting, and balancing.
2. Revise TAB plan to reflect actual procedures and submit as part of final report.
3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect/Engineer and for inclusion in operating and maintenance manuals.
4. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
5. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
6. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.

7. Units of Measure: Report data in I-P (inch-pound) units only.
8. Include the following on the title page of each report:
    a. Name of Testing, Adjusting, and Balancing Agency.
    b. Address of Testing, Adjusting, and Balancing Agency.
    c. Telephone number of Testing, Adjusting, and Balancing Agency.
    d. Project name.
    e. Project location.
    f. Project Architect.
    g. Project Engineer.
    h. Project Contractor.
    i. Project altitude.
    j. Report date.

H. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

PART 2 - PRODUCTS

2.01 NOT USED

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
    1. AABC (NSTSB), AABC National Standards for Total System Balance.
    2. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:
    1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
    2. Certified by one of the following:
        a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
        b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.

E. TAB Supervisor Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
   1. Systems are started and operating in a safe and normal condition.
   2. Temperature control systems are installed complete and operable.
   3. Proper thermal overload protection is in place for electrical equipment.
   4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
   5. Duct systems are clean of debris.
   6. Fans are rotating correctly.
   7. Fire and volume dampers are in place and open.
   8. Air coil fins are cleaned and combed.
   9. Access doors are closed and duct end caps are in place.
   10. Air outlets are installed and connected.
   11. Duct system leakage is minimized.
   12. Hydronic systems are flushed, filled, and vented.
   13. Pumps are rotating correctly.
   14. Proper strainer baskets are clean and in place.
   15. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
   1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

C. Provide additional balancing devices as required.

3.04 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:
   1. Running log of events and issues.
   2. Discrepancies, deficient or uncompleted work by others.
   3. Contract interpretation requests.
   4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, sealing test holes, restoring insulation, and restoring thermostats to specified settings.

G. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Architect/Engineer.

H. Provide a drawing indicating actual locations of all balancing dampers.

I. Check and adjust systems approximately six months after final acceptance and submit report.

3.06 FUME HOOD TESTING (ON SITE)

A. General: Test fume hoods as installed to assess airflow velocity, airflow visualization, and level of containment. Perform tests with static mode (set sash position) conditions. Conduct testing as outlined below for 100% of the hoods provided in the Project.

B. Preparation: Visit the project site to confirm that construction activities related to the fume hood system(s) and equipment are complete. Review design documents and Contractor's submittals. Verify that mechanical ventilation systems serving the space are functioning and operating in the normal mode. Notify Owner in writing, if conditions exist which preclude proper fume hood testing. Starting of testing constitutes acceptance of site conditions.

C. Testing Requirements:
   1. Perform the following tests, in order:

a. Airflow Velocity Test.
b. Airflow Visualization Test.

2. Airflow Velocity Test: Comply with Section 9 of NEBB (FHT) Fume Hood Testing Standard - current edition.
3. Airflow Visualization Test: Comply with Section 10 of NEBB (FHT) Fume Hood Testing Standard - current edition.

3.07 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
C. Measure air quantities at air inlets and outlets.
D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
K. Where modulating dampers are provided, take measurements and balance at extreme conditions.

3.08 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.
B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gages to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer

elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.09 COMMISSIONING

A. Refer to Division 01 and 23 specification sections relating to Commissioning.

B. The TAB contractor shall participate in functional performance testing of specific equipment at the direction of the Commissioning Authority. The TAB contractor's participation will include, but not be limited to, the use of TAB equipment for temperature and airflow measurements for such equipment as boilers, fluid coolers, energy recovery units, outside air units, and similar.

C. Perform prerequisites prior to starting commissioning activities.

D. Fill out Prefunctional Checklists for:

1. Air side systems.
2. Water side systems.

E. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.

F. Re-check minimum outdoor air intake flows and maximum and intermediate total airflow rates for 50 percent of the air handlers plus a random sample equivalent to 20 percent of the final TAB report data as directed by Commissioning Authority.

1. Original TAB agency shall execute the re-checks, witnessed by the Commissioning Authority.
2. Use the same test instruments as used in the original TAB work.
3. Failure of more than 10 percent of the re-checked items of a given system shall result in the rejection of the system TAB report; rebalance the system, provide a new system TAB report, and repeat random re-checks.
4. For purposes of re-check, failure is defined as follows:

a. Air Flow of Supply and Return: Deviation of more than 10 percent of instrument reading.
b. Minimum Outside Air Flow: Deviation of more than 10 percent of instrument reading; for inlet vane or VFD OSA compensation system using linear proportional control, deviation of more than 15 percent at intermediate supply flow.
c. Temperatures: Deviation of more than one degree F.
d. Air and Water Pressures: Deviation of more than 10 percent of full scale of test instrument reading.
e. Sound Pressures: Deviation of more than 3 decibels, with consideration for variations in background noise.

5. For purposes of re-check, a whole system is defined as one in which inaccuracies will have little or no impact on connected systems; for example, the air distribution system served by one air handler or the hydronic chilled water supply system served by a chiller or the condenser water system.

G. In the presence of the Commissioning Authority, verify that:
1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.
2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off downstream of the static pressure sensor, the terminal unit on the critical leg has its damper 90 percent or more open.
3. The water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from the pump to the coil having all balancing valves wide open and that during full cooling the cooling coil valve of that leg is 90 percent or more open.

3.10 SCOPE

A. Test, adjust, and balance the following:
1. Plumbing Pumps and Balancing Valves
2. HVAC Pumps.
3. Plumbing Hot Water Generators.

4. Water to Water Heat Pump Chillers.
5. Computer Room Air Conditioning Units.
6. Air Coils.
7. Terminal Heat Transfer Units.
8. Air Handling Units.
9. Fans.
10. Air Filters.
11. Air Terminal Units.
12. Air Inlets and Outlets.
13. Outdoor Air Units

3.11 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
1. Identification/location.
2. Manufacturer.
3. Model/Frame.
4. HP/BHP.
5. Phase, voltage, amperage; nameplate, actual, no load.
6. RPM.
7. Service factor.
8. Starter size, rating, heater elements.
9. Sheave Make/Size/Bore.

B. V-Belt Drives:
1. Identification/location.
2. Required driven RPM.
3. Driven sheave, diameter and RPM.
4. Belt, size and quantity.
5. Motor sheave diameter and RPM.
6. Center to center distance, maximum, minimum, and actual.

C. Pumps:
1. Identification/number.
2. Manufacturer.
3. Size/model.
4. Impeller.
5. Service.
6. Design flow rate, pressure drop, BHP.

7. Actual flow rate, pressure drop, BHP.
8. Discharge pressure.
9. Suction pressure.
10. Total operating head pressure.
11. Shut off, discharge and suction pressures.
12. Shut off, total head pressure.

D. Air Cooled Condensers:
1. Identification/number.
2. Location.
3. Manufacturer.
4. Model number.
5. Serial number.
6. Entering DB air temperature, design and actual.
7. Leaving DB air temperature, design and actual.
8. Number of compressors.

E. Chillers:
1. Identification/number.
2. Manufacturer.
3. Capacity.
4. Model number.
5. Serial number.
6. Evaporator entering water temperature, design and actual.
7. Evaporator leaving water temperature, design and actual.
8. Evaporator pressure drop, design and actual.
9. Evaporator water flow rate, design and actual.
10. Condenser entering water temperature, design and actual.
11. Condenser pressure drop, design and actual.
12. Condenser water flow rate, design and actual.

F. Cooling Coils, water:
1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Air flow, design and actual.
6. Entering air DB temperature, design and actual.

7. Entering air WB temperature, design and actual.
8. Leaving air DB temperature, design and actual.
9. Leaving air WB temperature, design and actual.
10. Water flow, design and actual.
11. Water pressure drop, design and actual.
12. Entering water temperature, design and actual.
13. Leaving water temperature, design and actual.
14. Saturated suction temperature, design and actual.
15. Air pressure drop, design and actual.

G. Heating Coils, water:
1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Air flow, design and actual.
6. Water flow, design and actual.
7. Water pressure drop, design and actual.
8. Entering water temperature, design and actual.
9. Leaving water temperature, design and actual.
10. Entering air temperature, design and actual.
11. Leaving air temperature, design and actual.
12. Air pressure drop, design and actual.

H. Coils, Refrigerant:
1. Identification/number
2. Location
3. Service
4. Manufacturer
5. Air flow, design and actual
6. Air pressure drop, design and actual
7. Entering air DB temperature, design and actual
8. Entering air WB temperature, design and actual
9. Leaving air DB temperature, design and actual
10. Leaving air WB temperature, design and actual
11. Saturated suction temperature, design and actual
12. Condenser entering and leaving water temperatures, design and actual

13. Condenser water pressure drop, design and actual
14. Condenser water flow rate, design and actual

I. Air Moving Equipment:
1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Arrangement/Class/Discharge.
6. Air flow, specified and actual.
7. Return air flow, specified and actual.
8. Outside air flow, specified and actual.
9. Total static pressure (total external), specified and actual.
10. Inlet pressure.
11. Discharge pressure.
12. Sheave Make/Size/Bore.
13. Number of Belts/Make/Size.
14. Fan RPM.
15. Damper positions.

J. Return Air/Outside Air:
1. Identification/location.
2. Design air flow.
3. Actual air flow.
4. Design return air flow.
5. Actual return air flow.
6. Design outside air flow.
7. Actual outside air flow.
8. Return air temperature.
9. Outside air temperature.
10. Required mixed air temperature.
11. Actual mixed air temperature.
12. Design outside/return air ratio.
13. Actual outside/return air ratio.
14. Damper positions.

K. Exhaust Fans:
1. Location.

2. Manufacturer.
3. Model number.
4. Serial number.
5. Air flow, specified and actual.
6. Total static pressure (total external), specified and actual.
7. Inlet pressure.
8. Discharge pressure.
9. Sheave Make/Size/Bore.
10. Number of Belts/Make/Size.
11. Fan RPM.

L. Duct Traverses:
1. System zone/branch.
2. Duct size.
3. Area.
4. Design velocity.
5. Design air flow.
6. Test velocity.
7. Test air flow.
8. Duct static pressure.
9. Air temperature.
10. Air correction factor.

M. Duct Leak Tests:
1. Description of ductwork under test.
2. Duct design operating pressure.
3. Duct design test static pressure.
4. Duct capacity, air flow.
5. Maximum allowable leakage duct capacity times leak factor.
6. Test apparatus:
    a. Blower.
    b. Orifice, tube size.
    c. Orifice size.
    d. Calibrated.
7. Test static pressure.
8. Test orifice differential pressure.
9. Leakage.

N. Air Monitoring Stations:
   1. Identification/location.
   2. System.
   3. Size.
   4. Area.
   5. Design velocity.
   6. Design air flow.
   7. Test velocity.
   8. Test air flow.

O. Flow Measuring Stations:
   1. Identification/number.
   2. Location.
   3. Size.
   4. Manufacturer.
   5. Model number.
   6. Serial number.
   7. Design Flow rate.
   8. Design pressure drop.
   9. Actual/final pressure drop.
   10. Actual/final flow rate.
   11. Station calibrated setting.

P. Outside Air and Air Handler Unit Data:
   1. Manufacturer.
   2. Identification/number.
   3. Location.
   4. Model number.
   5. Size.
   6. Supply and exhaust fans:
      a. Refer to "Air Moving Equipment"
   7. Heating Coils (water):
      a. Refer to "Heating Coils, water."
   8. Cooling Coils (water):
      a. Refer to "Cooling Coils, water."
   9. Energy recovery wheels:
      a. Air pressure drop, supply and exhaust side

b. Entering air DB temperature, design and actual, outside and exhaust air
c. Entering air WB temperature, design and actual, outside and exhaust air
d. Leaving air DB temperature, design and actual, outside and exhaust air
e. Leaving air WB temperature, design and actual, outside and exhaust air

Q. Make-Up Air Units:
1. Manufacturer
2. Identification/number
3. Location
4. Model number
5. Size
6. Supply fan:
a. Refer to "Air Moving Equipment"
7. Coils (water):
a. Refer to "Coils, refrigerant."

R. Air Terminal Unit Data:
1. Manufacturer.
2. Type, constant, variable, single, dual duct.
3. Identification/number.
4. Location.
5. Model number.
6. Size.
7. Minimum static pressure.
8. Minimum design and actual air flow.
9. Maximum design and actual air flow.
10. Inlet static pressure.
11. Heating Coils (water):
a. Refer to "Heating Coils, water."

S. Terminal Heat Transfer Unit Data:
1. Manufacturer
2. Identification/number
3. Location
4. Model number
5. Size
6. Supply fan:
a. Refer to "Air Moving Equipment."

7. Water Coils:
    a. Refer to "Cooling Coils, water" and "Heating Coils, water."

T. Blower and Fan Coil Unit Data:
1. Manufacturer
2. Identification/number
3. Location
4. Model number
5. Size
6. Supply fan:
    a. Refer to "Air Moving Equipment."
7. Water Coils:
    a. Refer to "Cooling Coils, water" and "Heating Coils, water."

U. Air Distribution Tests:
1. Air terminal number.
2. Room number/location.
3. Terminal type.
4. Terminal size.
5. Area factor.
6. Design velocity.
7. Design air flow.
8. Test (final) velocity.
9. Test (final) air flow.
10. Percent of design air flow.

V. Sound Level Reports:
1. Locations:
    a. In rooms below roof mounted equipment.
2. Octave bands - equipment off.
3. Octave bands - equipment on.

END OF SECTION 230593

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SECTION 230713
DUCT INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.
B. Duct liner.
C. Fire rated duct wrap.

1.02 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.
B. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2014.
C. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.
D. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.
E. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2014.
F. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2012.
G. ASTM C1338 - Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings; 2019.
H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.
I. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.
J. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.
K. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.
L. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Rev. 2009).
M. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

D. LEED Submittals: Comply with Division 01 requirements.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.06 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 - PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Insulation: ASTM C553; flexible, noncombustible blanket, formaldehyde free.

1. K value: 0.25 at 75 degrees F, when tested in accordance with ASTM C518.
2. Maximum Service Temperature: 450 degrees F.
3. Maximum Water Vapor Absorption: 5.0 percent by weight.

B. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
3. Secure with pressure sensitive tape.

C. Vapor Barrier Tape:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

2.03 GLASS FIBER, RIGID

A. Insulation: ASTM C612; rigid, noncombustible blanket, formaldehyde free.
   1. K Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Maximum Service Temperature: 450 degrees F.
   3. Maximum Water Vapor Absorption: 5.0 percent.
   4. Maximum Density: 8.0 lb/cu ft.

B. Vapor Barrier Jacket:
   1. 0.0032 inch vinyl.
   2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
   3. Secure with pressure sensitive tape.

C. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

2.04 DUCT LINER

A. Elastomeric Foam Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form, formaldehyde free. Liner shall be epoxy, acrylic, synthetic latex or Mylar coated.
   1. 'K' value: 0.25 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Minimum Service Temperature: Minus 40 degrees F.
   3. Maximum Service Temperature: 180 degrees F.
   4. Fungal Resistance: No growth when tested according to ASTM G21.
   5. Apparent Thermal Conductivity: Maximum of 0.28 at 75 degrees F.
   6. Minimum Noise Reduction Coefficients:
      a. 1 inch Thickness: 0.55.
   7. Erosion Resistance: Does not show evidence of breaking away, flaking off, or delamination at velocities of 10,000 fpm per ASTM C1071.
   8. Connection: Waterproof vapor barrier adhesive.

B. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.
   1. Water based with no volatile organic compounds as calculated by SCAQMD Rule 443.1.

2.05 FIRE-RATED DUCT WRAP

A. General: Nominal 3" thick fire-resistant wrap consisting of inorganic blanket encapsulated with scrim-reinforced foil. Wrap shall have 1-hour rating and shall be approved for 0-clearance to combustible materials.

B. Performance: Wrap shall have Flame Spread of 0 and Smoke Developed value of 0 and be tested in accordance with ASTM E 84.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Test ductwork for design pressure prior to applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated ducts conveying air above and below ambient temperature:

1. Provide insulation with vapor barrier jackets.
2. Finish with tape and vapor barrier jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. Duct Liner Application:

1. Adhere insulation with adhesive for 100 percent coverage.
2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
3. Seal and smooth joints. Seal and coat transverse joints.
4. Seal liner surface penetrations with adhesive.
5. Duct dimensions indicated are net inside dimensions required for air-flow. Increase duct size to allow for insulation thickness.

3.03 SCHEDULES

A. Refer to the drawings.

END OF SECTION 230713

SECTION 230716

HVAC EQUIPMENT INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Equipment insulation.

1.02 REFERENCE STANDARDS

A. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2014.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

C. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for equipment scheduled.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

D. LEED Submittals: Comply with Section 018113.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

PART 2 - PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with UL 723, ASTM E84, UL 723, or ASTM E84.

B. No fiberglass insulation with added formaldehyde shall be used. Insulation shall have GreenGuard Gold certification to meet this requirement.

2.02 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
   1. Minimum Service Temperature: Minus 40 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

B. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that equipment has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Factory Insulated Equipment: Do not insulate.

C. Exposed Equipment: Locate insulation and cover seams in least visible locations.

D. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

E. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.

F. Insulated equipment containing fluids below ambient temperature; insulate entire system.

G. Fiber glass insulated equipment containing fluids below ambient temperature; provide vapor barrier jackets, factory-applied or field-applied. Finish with glass cloth and vapor barrier adhesive.

H. For hot equipment containing fluids over 140 degrees F, insulate flanges and unions with removable sections and jackets.

I. Finish insulation at supports, protrusions, and interruptions.

J. Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with canvas jacket sized for finish painting.

K. Cover glass fiber insulation with metal mesh and finish with heavy coat of insulating cement.

L. Enclose base mounted pumps in an insulated removable sheet metal box. Box halves shall have quick connect latches or wingnuts to facilitate easy removal.

M. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

N. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

3.03 SCHEDULE

A. Heating Systems: Refer to piping insulation schedule.
   1. Pump Bodies.

B. Cooling Systems: Refer to piping insulation schedule.
   1. Pump Bodies.
   2. Buffer Tanks.

END OF SECTION 230716

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SECTION 230719
HVAC PIPING INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Flexible removable and reusable blanket insulation.

B. Jackets and accessories.

1.02 RELATED REQUIREMENTS

A. Section 078400 - Firestopping.

1.03 REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.

C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.

D. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2013).

E. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.

F. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2014.

G. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2015.

H. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2015.

I. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2013).

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

K. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

L. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

M. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

D. LEED Submittals: Comply with Division 01.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with documented experience.

B. Applicator Qualifications: Company specializing in manufacturing the Products specified in this section with documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 - PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, UL 723, ASTM E84, or UL 723.

B. No fiberglass insulation with added formaldehyde shall be used. Insulation shall have GreenGuard Gold certification to meet this requirement.

2.02 GLASS FIBER

A. Insulation: ASTM C547and ASTM C795; rigid molded, noncombustible.

1. 'K' Value: ASTM C177, 0.24 at 75 degrees F.
2. Maximum Service Temperature: 850 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.

B. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
   1. Minimum Service Temperature: Minus 40 degrees F.
   2. Maximum Service Temperature: 180 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

B. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.04 JACKETS

A. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
   1. Thickness: 0.016 inch sheet.
   2. Finish: Embossed.
   3. Joining: Longitudinal slip joints and 2 inch laps.
   4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
   5. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids above and below ambient temperature; insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

E. Fittings and Valves:
   1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
   2. When premolded sections of insulation are not available, apply mitered sections of cellular-glass insulation. Secure insulation materials with wire, tape, or bands.
   3. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch at each end. Secure fitting covers with

manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

4. Provide valve extension handles that extend past insulation and jacket.

F. Inserts and Shields:

1. Application: Piping 1-1/2 inches diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert location: Between support shield and piping and under the finish jacket.
4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

G. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions.

H. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV resistant finish for flexible elastomeric cellular insulation without jacketing.

3.03 SCHEDULE

A. Refer to drawings.

END OF SECTION 230719

SECTION 232113
HYDRONIC PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Hydronic system requirements.
B. Heating water piping, above grade.
C. Chilled water piping, above grade.
D. Ground source water piping, above grade.
E. Pipe and pipe fittings for:
   1. Heating water piping system.
   2. Chilled water piping system.
   3. Pipe hangers and supports.
   4. Unions and flanges

1.02 RELATED REQUIREMENTS

A. Section 230516 - Expansion Fittings and Loops for HVAC Piping.
B. Section 230523 - General-Duty Valves for HVAC Piping.
C. Section 230719 - HVAC Piping Insulation.

1.03 REFERENCE STANDARDS

A. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2023.
B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.
C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.
D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.
E. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2013.
F. ASME B31.9 - Building Services Piping; 2020.
G. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2005).
H. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
I. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2023a.
J. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).
K. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.

L. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

M. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 2024.

N. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.

O. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

P. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.05 SYSTEM DESCRIPTION

A. Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

B. Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.

C. Connections between pipe of dissimilar metals shall be made with 6“ long brass nipples (6” between the threads). Dielectric unions, flanges and plated nipples shall not be used.

D. Provide pipe hangers and supports in accordance with ASME B31.9 unless indicated otherwise.

E. Use full port ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

F. Use 3/4 inch ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment. Pipe to nearest floor drain.

1.06 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Include data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.

C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

D. Project Record Documents: Provide minimum 18" x 24" drawing of building floor plan with all valves clearly labeled and shown in as-built locations. Provide two copies to Owner.

E. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.07 QUALITY ASSURANCE

A. Installer: Company specializing in performing work of the type specified in this section, with documented experience.

B. Welder Qualifications: Certify in accordance with ASME BPVC-IX.

1. Provide certificate of compliance from authority having jurisdiction, indicating approval of welders.

1.08 REGULATORY REQUIREMENTS

A. Conform to ASME B31.9 code for installation of piping system.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 - PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping: Provide piping, fittings, hangers and supports as required, as indicated, and as follows:

1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.

2. Connections between pipe of dissimilar metals shall be made with 6“ long brass nipples (6” between the threads). Dielectric unions, flanges and plated nipples shall not be used.

3. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.

C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.

D. Valves: Provide valves where indicated:

1. Provide drain valves where indicated, and if not indicated provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch ball valves with cap; pipe to nearest floor drain.
2. For throttling, bypass, or manual flow control services, use ball valves.
3. For shut-off and to isolate parts of systems or vertical risers, use ball valves.

2.02 HEATING WATER PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A 53/A 53M, Schedule 40, black, using one of the following joint types:

1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.

B. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), drawn, using one of the following joint types:

1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.
   a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
   b. Braze: AWS A5.8M/A5.8 BCuP copper/silver alloy.
2. Mechanical Press Sealed Fittings: Double pressed type complying with ASME B16.22, utilizing EPDM, nontoxic synthetic rubber sealing elements.

2.03 CHILLED WATER PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black; using one of the following joint types:

1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.

B. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), hard drawn; using one of the following joint types:

1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22, solder wrought copper fittings.
   a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
   b. Braze: AWS A5.8M/A5.8 BCuP copper/silver alloy.

2. Mechanical Press Sealed Fittings: Double pressed type complying with ASME B16.22, utilizing EPDM, nontoxic synthetic rubber sealing elements.

2.04 GROUND SOURCE PIPING, ABOVE GRADE (INTERIOR)

A. Up to and including 2-1/2 inches:
   1. Copper Tube: ASTM B 88 (ASTM B 88M), Type L (B), hard drawn.
   2. Fittings: ASME B16.18, cast brass, or ASME B16.22, solder wrought copper.
   3. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.
   4. Joints: Solder, lead free, ASTM B 32, HB alloy (95-5 tin-antimony), or tin and silver.

B. Over 2-1/2 inches:
   1. Steel Pipe: ASTM A 53/A 53M, Schedule 40, black.
   2. Fittings: ASME B16.3, malleable iron or ASTM A 234/A 234M, wrought steel welding type.
   3. Joints: AWS D1.1 welded.

2.05 CONDENSER WATER PIPING, ABOVE GROUND (EXTERIOR TO BUILDING)

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black.
   1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings with finish matching piping; AWS D1.1/D1.1M welded.
   2. Threaded Joints: ASME B16.3, malleable iron fittings with finish matching piping.

2.06 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tube: ASTM B88 (ASTM B88M), Type M (C), drawn; using one of the following joint types:
   1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
   2. Joints: Solder, lead free, ASTM B 32, HB alloy (95-5 tin-antimony), or tin and silver.

2.07 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58 AND IMC.
B. Conform to ASME B31.9.
C. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron, adjustable swivel, split ring.
D. Hangers for Cold Pipe Sizes 2 Inches and Greater: Carbon steel, adjustable, clevis.
E. Hangers for Hot Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.

F. Hangers for Hot Pipe Sizes 6 Inches and Greater: Adjustable steel yoke, cast iron roll, double hanger.

G. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

H. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Greater: Steel channels with welded spacers and hanger rods, cast iron roll.

I. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

J. Wall Support for Pipe Sizes 4 Inches and Greater: Welded steel bracket and wrought steel clamp.

K. Wall Support for Hot Pipe Sizes 6 Inches and Greater: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.

L. Vertical Support: Steel riser clamp.

M. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

N. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

O. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

P. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.

Q. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

R. In grooved installations, use rigid couplings with offsetting angle-pattern bolt pads or with wedge shaped grooves in header piping to permit support and hanging in accordance with ASME B31.9.

2.08 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND CONNECTIONS

A. Unions for Pipe 2 Inches and Less:

1. Ferrous Piping: 150 psig malleable iron, threaded.
2. Copper Pipe: Bronze, soldered joints.

B. Flanges for Pipe 2 Inches and Greater:

1. Ferrous Piping: 150 psig forged steel, slip-on.
2. Copper Piping: Bronze.
3. Gaskets: 1/16 inch thick preformed neoprene.

PART 3 - EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Prepare pipe for grooved mechanical joints as required by coupling manufacturer.

C. Remove scale and dirt on inside and outside before assembly.

D. Prepare piping connections to equipment using jointing system specified.

E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

F. After completion, fill, clean, and treat systems.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. All piping shall be tested at 150PSI or 1.5 times the design pressure, whichever is greater. Test duration shall be at least two hours; where mechanical joints (such as Pro-Press) are allowed, the hydro test shall be held for 24 hours.

C. Install heating water piping to ASME B31.9 requirements. Install chilled water piping to ASME B31.5 requirements.

D. Route piping in orderly manner, parallel to building structure, and maintain gradient.

E. Install piping to conserve building space and to avoid interfere with use of space.

F. Group piping whenever practical at common elevations.

G. Sleeve pipe passing through partitions, walls and floors.

H. Slope piping and arrange to drain at low points.

I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

J. Inserts:

1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

K. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-58.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

6. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
8. Provide copper plated hangers and supports for copper piping.
9. Prime coat and paint exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed. Coordinate paint color with Architect.

L. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 230719.

M. Provide access where valves and fittings are not exposed.

N. Install valves with stems upright or horizontal, not inverted.

3.03 SCHEDULES

A. Pipe Hanger Spacing: In accordance with the VMC/IMC.

END OF SECTION 232113

SECTION 232113.33
GROUND-COUPLED HEAT EXCHANGER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Ground-coupled heat exchanger and connections to building piping system, serving:
   1. Hydronic piping system specified in Section 232113.
   2. Heat pumps specified in Sections 23 8129 and 23 7200.

B. Section 312316.13 - Trenching: Procedures for trenching and backfilling for execution of work of this section.

C. Section 312316.26 - Rock Removal: Procedures for removal of rock during execution of work of this section.

D. Section 232113 - Hydronic Piping: Building heating piping system.

1.02 PRICE AND PAYMENT PROCEDURES

A. Horizontal Piping:
   1. Basis of Measurement: By the linear foot, refer to drawings.
   2. Basis of Payment: Includes excavating, placing pipe and fittings, and backfilling.

B. Vertical Bore and Piping:
   1. Basis of Measurement: By the linear foot, refer to drawings.
   2. Basis of Payment: Includes excavating, placing pipe and fittings, backfilling, and thermal grout.

C. Permanent Casing:
   1. Basis of Measurement: By the linear foot, refer to drawings..

1.03 REFERENCE STANDARDS

A. 49 CFR 192.285 - Plastic Pipe: Qualifying Persons to Make Joints; current edition.

B. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications, Chapter 32, Geothermal Energy; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.; 2007.

C. ASTM D 2447 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter; 2003.

D. ASTM D 2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing; 2004.

E. ASTM D 2737 - Standard Specification for Polyethylene (PE) Plastic Tubing; 2012

F. ASTM D 2837 - Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products; 2008.

G. ASTM D 3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter; 2008.

H. ASTM D 3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing; 2003.

I. ASTM D 3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Material; 2010.

J. ASTM F 714 - Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter; 2008.

K. ASTM F 1055 - Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing; 1998 (Reapproved 2006).

L. IGSHPA (GROUT) - Grouting Procedures for GHP Systems; International Ground Source Heat Pump Association; 1991.

M. IGSHPA (GVERT) - Grouting for Vertical GHP Systems; International Ground Source Heat Pump Association; 2000.

N. IGSHPA (INSTALL) - Closed-Loop/Ground-Source Heat Pump Systems: Installation Guide; International Ground Source Heat Pump Association; 2009.

O. PPI TR4 - PPI Listing of Hydrostatic Design Basis (HDB), Strength Design Basis, Pressure Design Basis (PDB) and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe; Plastics Pipe Institute; 2009a

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section. Require attendance by all installers involved with site work and HVAC work.

1.05 SUBMITTALS

A. Refer to Division01 requirements.

B. Product Data, Polyethylene Piping: Provide manufacturer's data for piping and pipe fittings, showing compliance with specified requirements.
   1. Provide manufacturer's recommendations for fusion jointing.
   2. Include certification of long term hydrostatic basis, or test reports.

C. Product Data, Grout and Slurry: Provide information on thermal conductivity of proposed materials.

D. Shop Drawings: Show complete piping layout, water table, water level, depths of excavation, final depths of piping, backfill placement, point of entrance to building, point of connection to equipment, test point locations, and fittings used for all joints and connections.

E. Soiland Rock Samples: Provide one sample from the area of proposed installation.

F. Provide boring log for each well. Log shall include detailed information of soil properties at boring depths.

G. Test Reports, Piping: Indicate test method and results of hydrostatic pressure tests.

H. Record Documents: Record actual locations of all underground piping installed relative to Contractor's permanent structure on same property.

1. Include global positioning system (GPS) coordinate survey of all horizontal pipe routing and vertical wells.

I. Operation and Maintenance Data: Provide procedures for pressurizing, charging, and isolation for equipment replacement.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years of documented experience and accredited by IGSHPA.

B. Heat Fusion Technician Certification: IGSHPA training and certification, certified within three years prior to the date of project commencement.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver piping and fittings to project site in shipping containers with labeling in place.

1. Verify that labels on piping indicate manufacturer's name, pipe or tube size, and PE cell classification.

2. Verify that piping complies with specifications and is undamaged.

B. Protect from weather, humidity and temperature variations, dirt and dust, and other environmental contaminants.

C. Store piping capped or plugged until time of installation.

1.08 WARRANTY

A. Contractor shall provide a 50-year warranty on geothermal loop piping below grade.

PART 2 PRODUCTS

2.01 HEAT EXCHANGER

A. The ground-coupled heat exchanger has been designed; the Contractor is responsible for execution as required in the Contract Documents.

B. Heat Exchanger Configuration: Closed system; polyethylene piping in vertical boreholes located adjacent to building, as indicated on drawings.

C. Heat Exchanger Performance: As indicated on the drawings.

2.02 MATERIALS

A. Pipe: High density polyethylene pipe, type PE3408, PE3608, or PE4710, with minimum ASTM D 3350 cell classification of PE345364C. Comply with ASTM D 2737

and other standards listed in this section.

1. Pipe Used in Vertical Bore Applications: Comply with ASTM D 3035 with minimum working pressure rating of 160 psi.
2. Other Pipe of 3 Inches Diameter and Larger: Comply with ASTM D 3035 or ASTM F 714, with minimum working pressure rating of 100 psi, or ASTM D 2447 Schedule 40.
3. Other Pipe 1.25 Inches But Less Than 3 Inches In Diameter (Nominal): Comply with ASTM D 3035 with minimum working pressure rating of 110 psi, or ASTM D 2447 Schedule 40.
4. Other Pipe Less Than 1.25 Inches in Diameter (Nominal): Comply with ASTM D 3035 with minimum working pressure rating of 160 psi.
5. Long Term Hydrostatic Design Basis: 1600 psi at 73 degrees F, when tested in accordance with ASTM D 2837; appropriate listing in current edition of PPI TR-4 will constitute evidence of compliance with this requirement; otherwise, submit independent test results.
6. UV Stability: Provide pipe made of polyethylene with ASTM D 3350 cell classification of PE345434, PE355434, or PE355434, with UV stabilizer C, D, or E, and slow crack growth resistance failure rate of zero (F0), rather than 20 percent.
7. Joints and Fittings: Polyethylene of same type as pipe, of sizes and types suitable for the pipe being used; use only heat fusion or stab-type mechanical fittings that are quality controlled to provide a leak-free union between piping ends that is stronger than the piping itself. Do not use other barbed fittings or hose clamps.
    a. Electrofusion Type Fittings: Comply with ASTM F 1055.
    b. Butt Fusion Fittings: Comply with ASTM D 3261.
    c. Socket Type Fittings: Comply with ASTM D 2683.
    d. Where threaded fittings must be used for connection to equipment or dissimilar piping, use fittings and thread sealant compatible and effective with antifreeze used.

B. Heat Exchange Fluid: Potable water.

C. Detectable Underground Tape: Magnetic detectable conductor in 6 inch wide rot-resistant plastic tape or mesh, brightly colored, imprinted with "Water Line" in large letters.

D. Backfill for Vertical Boreholes: Refer to drawings.

2.03 UNDERGROUND PIPING VAULT

A. Quality Assurance:

1. The vault supplier shall submit certification that the HDPE material meets the specifications.
2. The fabricator of the structure shall submit drawings showing the position of the inlets, outlets and the overall dimensions along with any other special features such as manways, ladders, etc.
3. The fabricator of vertical structures shall submit data indicating that the structures meet the requirements of ASTM F 1759, “Design of High Density Polyethylene (HDPE) Manholes for Subsurface Applications”. The structure should be proven to have acceptable design for the following areas: Ring Compressive Strain, Combined Ring Compressive and Ring Bending Strain, Ring Buckling, Axial Strain, Axial Buckling, and Thickness of the bottom based on depth and groundwater. Thickness of the bottom should be based on acceptable stress and deflection amounts. Horizontally oriented vaults should provide calculations that prove the vault cylinder can withstand burial and traffic loads with acceptable design criteria for pipe deflection, wall buckling and wall crush.
4. Calculations supporting these requirements will be part of the submittal package.
5. The fabrication technician shall perform work in accordance to butt fusion of high-density polyethylene per ASTM F 2620-09 and for extrusion and hot air welding per ASTM C 1147. The fabricator shall submit the written quality assurance program used during fabrication of the structures. The fabricator may be required to submit their overall QA/QC program for fabricating thermoplastic structures and the welding certification program for all personnel involved in the fabrication of the structure.
6. Shop welds on pipe and fittings larger than 4” OD shall be made using a McElroy Manufacturing DataLogger. The fabricator shall maintain records of the temperature, pressure, and graph of the fusion cycle and shall maintain records in a distinct and exclusive file related to the job/job number.
7. The structure and piping shall be tested with water, air, or vacuum. The structure shall be determined to be leak free before shipping. An identification plate indicating, the job number, testing data, and when built and by whom, shall be attached to the structure.

8. The vault shall be factory tested to be leak-free and free of defectives before shipment. To ensure leak free condition after installation, a field air test must be performed on the structure after all fusion connections are made and backfilling is complete. A 1” male threaded port shall be provided in the manway to use for a low pressure air test (1psi or less), for a period not to exceed 30 minutes. The installing contractor along with the owner representative and/or general contractor shall witness the test and provide a signed document to the manufacturer with the location, date, witnesses and test conditions. The manufacturer or its representative shall be contacted to be available to witness the testing, which is expected to occur within 60 days of structure delivery. A successful test will extend the warranty to one year from the test date.
9. Pipe shall be manufactured from a PE 3608 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material will meet the specifications of ASTM D 3350 with a cell classification of 345464C. Pipe shall have a manufacturing standard of ASTM F 714. Pipe shall be DR 17 (100psi WPR) unless otherwise specified on the plans. The pipe shall contain no recycled compounds except that generated in the manufacturer’s own plant from resin of the same specification from the same raw material.
10. Butt Fusing Fittings - Fittings shall be PE3608 HDPE, minimum cell classification of 345464C as determined by as determined by ASTM D 3350. Molded butt fusion fittings shall have a manufacturing standard of ASTM D 3261. Molded fittings shall have the same pressure rating as the pipe unless otherwise specified on the plans. Fabricated fittings are to be manufactured using a Data Logger. Temperature, fusion pressure and a graphic representation of the fusion cycle shall be part of the quality control records.
11. Electrofusion Fittings - Fittings shall be PE3608 HDPE, minimum cell classification of 345464C as determined by ASTM D 3350. Electrofusion Fittings shall have a manufacturing standard of ASTM F 1055. Fittings shall have the same pressure rating as the pipe unless otherwise specified on the plans.
12. Flanged and Mechanical Joint Adapters - Flanged and Mechanical Joint Adapters shall be PE 3608 HDPE, minimum cell classification of 345464C as determined by ASTM D 3350. Flanged and Mechanical Joint Adapters shall have a manufacturing standard of ASTM D 3261. Fittings shall have the same

pressure rating as the pipe unless otherwise specified on the plans.

B. Underground Vault:

1. The underground vault shall be made from a HDPE profile wall cylinder with a nominal ID of at least 72” for horizontal construction/orientation.
   a. HDPE Material - The internal HDPE piping material shall be high density, high molecular weight. The HDPE material shall conform to ASTM D 3350-07 with minimum cell classification values of 34564C.
2. The end-cap thickness shall be no less than 1-1/2” and of the same material as the structure cylinder.
3. The inlets and outlets shall be extrusion welded on the outside of the structure using good welding practice.
4. All external connections to structure shall be butt fusion welded or electrofusion welded.
5. Structures shall be factory tested with a 1 psi Air Test for no less than 30 minutes, with no leaks. The Piping system shall be hydrostatically tested to 100 psi with water for no less than 30 minutes, with no leaks. Data showing the structure to be leak-free can be supplied. The owner or their representative may request to observe the test.
6. Entry Way
   a. Man-way
      1) The man-way shall be constructed of the same material as the vault.
      2) The man-way shall be attached by means of extrusion welding to outside wall of the structure.
      3) The minimum ID of the man-way cylinder shall be no less than 24”.
   b. Ladder:
      1) The entry ladder shall conform to current OSHA guidelines.
      2) Ladders constructed from HDPE Pipe shall not be allowed.
      3) The first rung of the entry ladder shall be no less than 2” from bottom of man-way.
7. Top of the man-way shall be built to the requirements of the drawings. If air testing is required, flanged tops or manways will be required. A reinforced concrete pad shall be provided around the HDPE man-way. A traffic rated frame and cover shall be provided. The manufacturer shall provide the design of the concrete pad, approved by a professional engineer - provide stamped drawings with the submittal.

C. Valves:
   1. The isolation shut-off valves shall be Butterfly valves suitable for above ground and/or buried service applications.
   2. Body shall be Cast Iron, Wafer or Lug Style.
   3. Disc shall be aluminum bronze with stainless steel stem.
   4. Flange locating holes or tapered holes shall be as per ANSI 125/150.
   5. Elastomeric sealing members of valves shall be made of EPDM or Buna-N material selected for use in water service.
   6. Wrench / lever operated valves shall be available in sizes ½“ through 8”. Gear operated valves shall be available in sizes 10” and above.
   7. Valves shall have a position indicator.
   8. Valves shall be suitable for use at temperatures of 0º F to 140º F, and shall be suitable for pressures and vacuums compatible with the piping.
   9. Purge Valves shall be quarter-turn type brass full port ball valves. The valves shall provide positive stops at the full-open and full closed positions.

D. Pressure Temperature (P/T) Test Ports:
   1. Test ports shall be suitable for use in geothermal applications.
   2. Test ports shall be located per project drawing. At a minimum, (1) Test port shall be located on the Return main piping, and (1) Test port on each of the Circuit piping with flow coming from the bore field.
   3. Test ports shall be capable of receiving a thermometer probe with a minimum diameter of 1/16” and a maximum diameter of 1/8”.
   4. The test ports shall be capable of allowing the injection/extraction of liquids through an inducement probe not to exceed 1/8” in diameter.
   5. The test ports outer body shall be of all brass construction including a 9/16” knurled cap with a plastic retainer.
   6. Test orts shall have a dual seal core design of Nordel allowing sealing of the system before complete removal of any probe, good up to 350º F for water.
   7. Core membrane shall be of a design that maintains proper alignment for increase ease when inserting probes.
   8. Test ports shall be rated zero leakage from full vacuum to 1000 PSIG.

PART 3 EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Verify location of existing structures and utilities prior to excavation.

B. Verify soil composition and rock depth, if any, before beginning excavation.

C. Protect adjacent structures from the effects of excavation.

D. Verify that layout dimensions are correct and that available land is sufficient for design.

E. Notify Architect/Engineer of unsatisfactory conditions.

F. Do not proceed with installation until unsatisfactory conditions have been corrected.

G. Coordinate work with site grading, site backfilling, and foundation construction.

3.02 EXCAVATION

A. Excavate in accordance with requirements of authorities having jurisdiction.

B. Remove rock as specified in Section 312316.26, Rock Removal.

C. Vertical Boreholes: Drill to depths required.

1. Minimize over-drilling; fill over-drilled areas with backfill or excavated materials.
2. Piping: Assemble heat exchanger piping and test before installation.

D. Trenches: Excavate trenches for piping to lines and grades shown on drawings.

1. Minimize over-excavation; fill over-excavated areas with backfill or excavated materials.
2. Excavate to accommodate grade changes.
3. Excavate using the procedures specified in Section 312316.13, Trenching for Site Utilities.
4. Maintain trenches free of debris, material, and obstructions that may damage pipe.
5. Piping: Assemble heat exchanger piping and test before backfilling.

3.03 POLYETHYLENE PIPING - GROUND-COUPLED HEAT EXCHANGER

A. Join piping and fittings using heat fusion or electrofusion; do not use solvents, adhesives, or mechanical fittings.

B. Provide flanges or unions to connect heat exchanger piping to equipment or piping of different type; locate all transitions between piping of different types inside the building or otherwise accessible (i.e. above grade).

C. Keep dirt, water, and debris out of pipe assemblies; cap or plug open ends until connected to adjacent piping.

D. Do not bend piping to shorter radius than recommended by pipe manufacturer; do not kink piping; use elbow or other fittings for sharp bends.

E. Partially backfill radius bends in narrow trenches by hand to ensure that piping is properly supported and to prevent kinking.

F. Test piping to be installed in boreholes after assembly but before installation in boreholes; re-cap tested assemblies before installation.

G. Test piping to be installed in trenches after installation but before backfilling.

H. Testing: Perform hydrostatic test on all piping; portions of assembled piping may be tested separately.

1. Prior to testing, isolate piping from all connections to building systems.
2. Flush all dirt and debris using potable water flowing at twice the normal operating flow rate for a minimum of four hours or until no dirt or debris is visible, whichever is longer.
3. Plug or cap piping.
4. Pressurize piping to 150 psi for 30 minutes and monitor.
5. If there is any pressure loss or visible leakage, identify leak and repair in accordance with manufacturer's recommendations.
6. Repeat test until there is no loss of pressure for the duration of the test.

I. Burry horizontal piping a minimum of 4 feet deep. Install underground pipe markers above all horizontal loop piping.

J. Where piping passes through foundation walls, provide sleeves sealed with non-hardening, waterproof material.

K. After connection of piping to building systems and installation of equipment served by heat exchanger, fill piping with heat exchange fluid and pressurize.

1. Water Temperature of 70 to 90 degrees F: Pressurize to 20 to 30 psi, minimum.
2. Water Temperature of 40 to 50 degrees F: Pressurize to 40 to 50 psi, minimum.
3. If adequate flooding of circulating pump can be accomplished without pressurization and pump manufacturer approves, pressurization is not required.
4. After pressurization, remove charging valve handles, or plug ports, whichever is applicable, and deliver handles to Architect/Engineer.
5. Install system label at charging valves, indicating:
    a. Heat exchange fluid, including antifreeze type and concentration.
    b. Service date.
    c. Company name.
    d. Company phone number and responsible person.

3.04 BACKFILLING

A. Install in compliance with local authorities having jurisdiction.

B. Vertical Boreholes: Backfill after pipe installation in accordance with IGSHPA Grouting Procedures for GHP Systems.

C. Trenches:
   1. Backfill trenches after pipe has been installed and tested, using fill free of rocks and other debris.
   2. Install detectable tape continuously 12 inches above top of all buried pipe.
   3. Backfill and compact using the procedures specified in Section 312316.13, Trenching for Site Utilities.
   4. Backfill to original grades with sufficient overfill to allow for settlement.

D. Protect piping from displacement.

3.05 UNDERGROUND VAULT

A. HDPE structures shall be stored on clean, level, and dry ground to prevent undue scratching or gouging of the pipe or cylinder. The handling of HDPE structures shall be done in such a manner that there is no damage. Nylon slings are preferred.

B. Pipe Joining: HDPE pipe joined in the field external to the vault shall be joined using butt fusion. All butt fusion welds shall be made as described in ASTM F 2620-09. Electrofusion welding can be substituted for making pipe welds. Hot air and extrusion welding are not permitted for pipe joining. Welds on pipe and fittings larger than 4” OD shall be made using a McElroy Manufacturing DataLogger. The fabricator shall maintain records of the temperature, pressure, and graph of the fusion cycle.

C. Handling of Fused Pipe: Fused segments of pipe shall be handled so as to avoid damage to the pipe. Limit bending of the pipe welded to fittings or to the structures. Nylon slings are preferred.

D. Equipment Mounting: Special provisions must be made when mounting equipment inside the vault. Bolting directly to the wall of an HDPE structure is not allowed.

E. Trench Construction: The trench and trench bottom shall be constructed in accordance with ASTM D 2321, Section 6, Trench Excavation, and Section 7, Installation. The HDPE structure shall be installed on a stable base consisting of 12” of Class I materials compacted to 95% proctor density per ASTM F 1759, Section 4.2. All required safety precautions for vault installation are the responsibility of the contractor.

F. Embedment materials: Embedment materials shall be Class I or Class II materials as defined by ASTM D 2321, Section 5, Materials. Class I materials are preferred. Backfill and bedding materials shall be free of debris.

G. Bedding of the structure shall be performed in accordance with ASTM D 2321, Section 7.2. Compaction shall conform to Section 7.5 and 7.51.

H. Backfilling shall be done to conform to the ASTM F 1759, Section 4.2, “Design Assumptions”. Backfill shall extend at least 3.5 feet beyond the edge of the structure for the full height of the structure and extend laterally to undisturbed soils. Compaction shall be to 90% proctor density.

3.06 CLEANING

A. Leave adjacent paved areas broom clean.

B. Clear debris, including excess backfill and excavated dirt and rock, from heat exchanger area.

3.07 PROTECTION

A. Protect area during excavation from excess runoff and erosion.

B. Protect pipe protrusions from damage until connections to building systems are installed.

END OF SECTION 232113.33

SECTION 232114
HYDRONIC SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Expansion tanks.
B. Air vents.
C. Air separators.
D. Strainers.
E. Suction diffusers.
F. Pump connectors.
G. Pressure-temperature test plugs.
H. Balancing valves.
I. Flow meters.
J. Relief valves.
K. Pressure reducing valves.
L. Condensate pump.
M. Buffer tanks.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
B. Section 232500 - HVAC Water Treatment: Pipe cleaning.

1.03 REFERENCE STANDARDS

A. Publications listed here are part of this specification to the extent they are referenced. Where no specific edition of the standard or publication is identified, the current edition shall apply.
B. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; 2015.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. Refer to Division 01 requirements.
B. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service

sizes, and finishes. Include product description and model.

C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

D. Project Record Documents: Record actual locations of flow controls.

E. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.08 WARRANTY

A. See Division 01 for additional warranty requirements.

B. Manufacturer Warranty: Supply manufacturer's standard warranty against defects in product workmanship and materials. Provide five-year manufacturer warranty for all specialties and parts. Complete forms in Owner's name and register with the manufacturer.

C. Installer Warranty: Provide two-year warranty for all hydronic specialties commencing on the Date of Substantial Completion. Complete forms in Owner's name and register with the installer.

D. Warranty periods shall begin from Date of Substantial Completion.

E. Correct defective work within a five year period after Substantial Completion.

PART 2 PRODUCTS

2.01 EXPANSION TANKS

A. Construction: Carbon steel, tested and stamped in accordance with ASME (BPV VIII, 1); supplied with National Board Form U-1, rated for working pressure of 125 psi, with heavy duty butyl rubber bladder.

B. Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced pressure zone assembly back flow preventer that meets ASSE Std. 1013, test cocks, strainer, vacuum breaker, and valved by-pass.

C. Accessories: Provide air-charging fitting, bulls eye sight glass, and pressure gauge.

2.02 AIR VENTS

A. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

B. Automatic Float Type:

1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

C. Maximum Fluid Pressure: 150 psi.

D. Maximum Fluid Temperature: 250 degrees F.

2.03 AIR SEPARATORS

A. Centrifugal Air Separators:

1. Steel, tested and stamped in accordance with ASME BPVC-VIII-1; for 125 psi operating pressure, tangential inlet and outlet connections, and internal stainless steel air collector tube.

2.04 STRAINERS

A. Size 2 inch and Under:

1. Screwed brass or iron body for 175 psi working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

B. Size 2-1/2 inch to 4 inch:

1. Flanged iron body for 175 psi working pressure, Y pattern with 3/64 inch stainless steel perforated screen.

2.05 SUCTION DIFFUSERS

A. Fitting: Angle pattern, cast-iron body, threaded for 2 inch and smaller, flanged for 2-1/2 inch and larger, rated for 175 psi working pressure, with inlet vanes, cylinder strainer with 3/16 inch diameter openings, disposable fine inch mesh strainer to fit over cylinder strainer, 20 mesh start up screen, and permanent magnet located in flow stream and removable for cleaning.

B. Accessories: Adjustable foot support, blowdown tapping in bottom, gage tapping in side.

2.06 PUMP CONNECTORS

A. Flexible Connectors: Flanged, braided type with wetted components of stainless steel, sized to match piping.
   1. Maximum Allowable Working Pressure: 150 psig at 120 degrees F.
   2. Accommodate the Following:
      a. Axial Deflection in Compression and Expansion: 3 inch.
      b. Lateral Movement: 3 inch.
      c. Angular Rotation: 15 degrees.
      d. Force developed by 1.5 times specified maximum allowable operating pressure.
   3. End Connections: Same as specified for pipe jointing.
   4. Provide necessary accessories including, but not limited to, swivel joints.

2.07 AUTOMATIC FLOW CONTROL VALVES (PRESSURE INDEPENDENT)

A. Construction:
   1. Brass, bronze, or iron body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet with blowdown/backflush drain.
   2. Built-in lug-type outlet butterfly valve with 2-position handle.
B. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 20 times minimum pressure required for control, maximum minimum pressure 2 psi.
C. Control Mechanism: Provide stainless steel or nickel-plated, brass piston or regulator cup, operating against stainless steel helical or wave formed spring or elastomeric diaphragm and polyphenylsulfone orifice plate.
D. Size: Match system flow capacity.
E. Flow Characteristics: Two-way valves shall have equal percentage characteristics.
F. Flow Characteristics: Three-way valves shall have linear characteristics.
G. Accessories: Provide hanging tag, inlet in-line strainer, outlet ball valve, and PT test plug extension.
   1. Circuit setter is not required for balancing pressure-independent control (PIC) valves.
H. Refer to section 253519 - Integrated Automation Control Valves for additional information.

2.08 RELIEF VALVES

A. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.09 CONDENSATE REMOVAL PUMP

A. Unit shall be fully automatic including start, stop and overflow detection modes. The unit shall be complete with pump, concealing cover, ceiling plate, and all hardware, wiring and tubing necessary to install the unit. The unit shall be adaptable to be installed on the right or left side of the air handler.

2.10 BUFFER TANK

A. Buffer tank shall be ASME Code constructed and stamped in accordance with Section VIII of the ASME Code. Tank shall be registered with the National Board of Boiler and Pressure Vessel Inspectors and a certificate of shop inspection shall be furnished.

B. ASME maximum design pressure shall be 125 psi @ 375 degree F.

C. Material of construction shall be Carbon Steel. Vessels wiith 48 inches and 54 inches diameter shall be furnished with a 5" inspection opening.

D. Tank shall be furnished with an air vent, a 1/2-inch flexible, elastomeric thermal insulation black in color, and internal baffle to divert water flow.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install specialties in accordance with manufacturer's instructions.

B. Provide manual air vents at system high points and as indicated.

C. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

D. Provide air separator on suction side of system circulation pump and connect to expansion tank.

E. Provide valved drain and hose connection on strainer blow down connection.

F. Provide pump suction fitting on suction side of base mounted centrifugal pumps where indicated. Remove temporary strainers after cleaning systems.

G. Support pump fittings with floor mounted pipe and flange supports.

H. Provide balancing valves on water outlet from terminal heating units such as hydronic unit heaters, water source heat pumps and fan coil units.

I. Provide relief valves on pressure tanks, low pressure side of reducing valves, heat exchangers, and expansion tanks.

J. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

K. Install strainers near floor level and as close to floor drains as possible.

L. Pipe relief valve outlet to nearest floor drain.

3.02 IDENTIFICATION

A. Unit information labels and stickers shall never be painted over or covered in any way.

3.03 START-UP

A. Start up and commissioning shall be performed by factory authorized representatives.

END OF SECTION 232114

SECTION 232123
HYDRONIC PUMPS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. In-line circulators.

B. Base-mounted pumps.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete.

B. Section 230513 - Common Motor Requirements for HVAC Equipment.

C. Section 230548 - Vibration and Seismic Controls for HVAC.

D. Section 230716 - HVAC Equipment Insulation.

E. Section 232113 - Hydronic Piping.

F. Section 232114 - Hydronic Specialties.

G. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. NEMA MG 1 - Motors and Generators; 2021.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 778 - Standard for Motor-Operated Water Pumps; Current Edition, Including All Revisions.

1.04 PERFORMANCE REQUIREMENTS

A. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

1.05 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

C. Millwright's Certificate: Certify that base mounted pumps have been aligned.

D. Manufacturer's Installation Instructions: Indicate hanging and support requirements and recommendations.

E. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Pump Seals: 1 for each type and size of pump.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture, assembly, and field performance of pumps, with documented experience.
B. Manufacturer Qualifications: Company specializing in manufacture, assembly, and field performance of pumps, with minimum three years of documented experience.
C. Alignment: Base mounted pumps shall be aligned by qualified millwright.

1.07 WARRANTY

A. Manufacturer Warranty: Supply manufacturer's standard warranty against defects in product workmanship and materials. Provide two-year manufacturer warranty for each pump, motor, and drive. Complete forms in Owner's name and register with manufacturer.
B. Installer Warranty: Provide two-year warranty for commencing on the date of Substantial Completion. Complete forms in Owner's name and register with installer.
C. Warranty periods will begin from date of Substantial Completion.

1.08 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by UL 778 as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.01 HVAC PUMPS - GENERAL

A. Provide pumps that operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
B. Base Mounted Pumps: Aligned by qualified millwright.
C. Pump motors shall be premium efficiency type. Motors used with VFDs shall be inverter duty wth grounded shafts.
D. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

2.02 IN-LINE CIRCULATORS

A. Type: Horizontal shaft, single stage, direct connected, with resiliently mounted motor for in-line mounting, oil lubricated, for 125 psi maximum working pressure.
B. Casing: Cast iron, with flanged pump connections.
C. Impeller: Non-ferrous keyed to shaft.

D. Bearings: Ceramic/Alumina.

E. Shaft: Ceramic/Alumina.

F. Electrical Characteristics:

1. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

2.03 BASE-MOUNTED PUMPS

A. Type: Horizontal shaft, single stage, direct connected, radially or horizontally split casing, for 125 psi maximum working pressure.

B. Casing: Cast iron, or ductile iron with suction and discharge gauge ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.

C. Impeller: Stainless steel, fully enclosed, keyed to shaft.

D. Bearings: Oil lubricated roller or ball bearings.

E. Shaft: Alloy steel with copper, bronze, or stainless steel shaft sleeve.

F. Seal: Mechanical seal, 225 degrees F maximum continuous operating temperature.

G. Drive: Flexible coupling with coupling guard.

H. Baseplate: Cast iron or fabricated steel with integral drain rim.

I. Electrical Characteristics:

1. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide access space around pumps for service. Provide no less than minimum space recommended by manufacturer.

C. Provide line sized shut-off valve and strainer on pump suction, and line sized soft seat check valve and balancing valve on pump discharge.

D. Provide air cock and drain connection on horizontal pump casings.

E. Check, align, and certify alignment of base mounted pumps prior to start-up, per manufacturer's instructions.

F. Install base mounted pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place. Refer to Section 23 0548.

G. Lubricate pumps before start-up.

H. Install pumps at a height no greater than 5'-0" from finished floor.

I. Provide and install pressure gauges on discharge and suction side of base mounted pumps.

3.03 SCHEDULES

A. Refer to the drawings.

END OF SECTION 232123

SECTION 232500
HVAC WATER TREATMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Materials.
   1. System cleaner.
   2. Closed system treatment (water).
B. By-pass (pot) feeder.
C. Side-stream filtration equipment.
D. Cleaning of piping systems.
E. Chemical feeder equipment.

1.02 RELATED REQUIREMENTS

A. Section 016000 - Product Requirements: Owner furnished treatment equipment.

1.03 SUBMITTALS

A. Refer to Division 01 requirements.
B. Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.
C. Shop Drawings: Indicate system schematic, equipment locations, and controls schematics, electrical characteristics and connection requirements.
D. Manufacturer's Installation Instructions: Indicate placement of equipment in systems, piping configuration, and connection requirements.
E. Manufacturer's Field Reports: Indicate start-up of treatment systems when completed and operating properly. Indicate analysis of system water after cleaning and after treatment.
F. Project Record Documents: Record actual locations of equipment and piping, including sampling points and location of chemical injectors.
G. Operation and Maintenance Data: Include data on chemical feed pumps, agitators, and other equipment including spare parts lists, procedures, and treatment programs. Include step by step instructions on test procedures including target concentrations.
H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Sufficient chemicals for treatment and testing during required maintenance period.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with documented experience. Company shall have local representatives with water analysis laboratories and full time service personnel.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with documented experience and approved by manufacturer.

1.05 REGULATORY REQUIREMENTS

A. Conform to applicable code for addition of non-potable chemicals to building mechanical systems and to public sewage systems.

1.06 PERFORMANCE REQUIREMENTS

A. Water quality for HVAC systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment.

B. Base HVAC water treatment on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.

C. Closed non-glycol hydronic systems without aluminum components shall have the following water qualities:

1. pH: Maintain a value within 9.0 to 10.0.
2. Boron: Maintain a value within 50 to 200 ppm.
3. Sodium Nitrite:
    a. Chilled Water: 400 to 800 ppm.
    b. Dual Temperature Water:800 to 1200 ppm.
    c. Hot Water: 800 to 1200 ppm.
4. Soluble Copper: Maintain a maximum value of 0.20 ppm.
5. Total Dissolved Solids (TDS): Maintain a maximum value of 2000 ppm.
6. Free Caustic Alkalinity: Maintain a maximum value of 20 ppm.
7. Microbiological Limits:
    a. Total Aerobic Plate Count: Maintain a maximum value of 1000 organisms/ml.
    b. Total Anaerobic Plate Count: Maintain a maximum value of 100 organisms/ml.
    c. Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.
    d. Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.

e. Iron Bacteria: Maintain a maximum value of 0 organisms/ml.

8. Oxygen: Less than 150 ppb (operating condition)
9. Total Iron/Copper: Less than 5 ppm.
10. Corrosion Inhibitor: Capable of maintaining iron corrosion rates <2 mpy.
11. Chlorides: Less than 150 ppm.
12. Calcium and magnesium (total hardness): Less than 250 ppm.
13. Hydrogen Sulfide: Less than 1 ppm.
14. Sulfates: Less than 100 ppm.
15. Carbon Dioxide: Less than 75 ppm.

D. Passivation for Galvanized Steel: For the first 60 days of operation.

1. Produce site specific passivation plan based on tower manufacturers data for approval prior to implementation to be based on either natural or chemically enhanced methods.
2. General pH Guideline: Maintain a value within 7 to 8.
3. General Calcium Carbonate Hardness Guideline: Maintain 200 to 300 ppm.
4. General Calcium Carbonate Alkalinity: Maintain 200 to 300 ppm.

E.

PART 2 PRODUCTS

2.01 MATERIALS

A. System Cleaner:

1. Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products; sodiumtripoly phosphate and sodium molybdate.
2. Biocide chlorine release agents such as sodium hypochlorite or calcium hypochlorite or microbiocides such as quarternary ammonia compounds, tributyltin oxide, methylene bis (thiocyanate).

B. Closed System Treatment (Water):

1. Sequestering agent to reduce deposits and adjust pH; polyphosphate.
2. Corrosion inhibitors; boron-nitrite, sodium nitrite and borax, sodium totyltriazole, low molecular weight polymers, phosphonates, sodium molybdate, or sulphites.
3. Conductivity enhancers; phosphates or phosphonates.

2.02 BY-PASS (POT) FEEDER

A. 2 quart quick opening cap for working pressure of 175 psi.

2.03 SIDE-STREAM FILTRATION SYSTEM

A. System: Flow indicator, Electropolished stainless steel filter housing with cartridge filter suitable for operation up to140 degrees F and 150 psi (max), shut-off valves (provided by contractor), and flow control valve. Auto-flow balance valve furnished by vendor, contractor installed. Coordinate with plans and drawings.

B. Performance:

1. Fluid Type: Closed Loop Water
2. Design minimum Operating Flow Rate: 80 gpm
3. Design Average Operating Flow Rate: 100 gpm (max 130 gpm)
4. Typical Operating Temperature: 80°F
5. Fluid Temperature range: 45-95°F
6. Pressure differential set point to initiate backwash: 7 psi
7. Minimum design influent pressure: 20 PSI

C. Cartridges: 100 micron for start-up and 50 micron for system operation.

D. Components:

1. High Performance 100µ 316L SST screens.
2. Perforated 316L SST Coarse Screen
3. One (1) inlet and one (1) outlet flanges
4. One (1) 2” flushing ball valves
5. One (1) 1/4 h/p 90VDC motor.
6. One (1) Controller with a weather-resistant enclosure (NEMA 4 or better).
7. One (1) 3-way solenoid, 24vac

E. All metallic wetted parts shall be SST 316L or better.

F. Upper Bearing, Lower Bearing and Piston Tip shall be Super Duplex 2507.

G. Furnish with contractor installed 55-Gallon dewatering tank and connect to mechanical floor drain per manufacturer’s requirements.

PART 3 EXECUTION

3.01 PREPARATION

A. Systems shall be operational, filled, started, and vented prior to cleaning. Use water meter to record capacity in each system.

B. Place terminal control valves in open position during cleaning.

C. Verify that electric power is available and of the correct characteristics.

D. Provide isolation and drain valves in new sections of piping to allow new equipment and piping to be flushed and cleaned in an isolated manner from the existing piping system. New hydronic piping and equipment shall be thoroughly flushed, cleaned and

filled with potable water.

3.02 CLEANING SEQUENCE

A. Concentration:
   1. As recommended by manufacturer.

B. Hot Water Heating Systems:
   1. Apply heat while circulating, slowly raising temperature to 160 degrees F and maintain for 12 hours minimum.
   2. Remove heat and circulate to 100 degrees F or less; drain systems as quickly as possible and refill with clean water.
   3. Circulate for 6 hours at design temperatures, then drain.
   4. Refill with clean water and repeat until system cleaner is removed.

C. Chilled Water Systems:
   1. Circulate for 48 hours, then drain systems as quickly as possible.
   2. Refill with clean water, circulate for 24 hours, then drain.
   3. Refill with clean water and repeat until system cleaner is removed.

D. Water-Source Heat Pump Water Systems:
   1. Circulate for 48 hours, then drain systems as quickly as possible.
   2. Refill with clean water, circulate for 24 hours, then drain.
   3. Refill with clean water and repeat until system cleaner is removed.

E. Use neutralizer agents on recommendation of system cleaner supplier and approval of Architect/Engineer.

F. Flush open systems and glycol filled closed systems with clean water for one hour minimum. Drain completely and refill.

G. Remove, clean, and replace strainer screens.

H. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

3.04 CLOSED SYSTEM TREATMENT

A. Provide one bypass feeder on each system. Install isolating and drain valves and necessary piping. Install around balancing valve downstream of circulating pumps unless indicated otherwise.

B. Introduce closed system treatment through bypass feeder when required or indicated by test.

3.05 CLOSEOUT ACTIVITIES

A. Training: Train Owner's personnel on operation and maintenance of chemical treatment system.
   1. Provide minimum of two hours of instruction for two people.
   2. Have operation and maintenance data prepared and available for review during training.
   3. Conduct training using actual equipment after treated system has been put into full operation.

END OF SECTION 232500

SECTION 233100
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal ducts.
B. Flexible ducts.
C. Nonmetal ducts.
D. Air plenums and casings.
E. Ducts for kitchen exhaust applications.
F. Ducts for laboratory and industrial-grade applications.

1.02 RELATED REQUIREMENTS

A. Section 099123 - Interior Painting: Weld priming, paint or coating.
B. Section 230548 - Vibration and Seismic Controls for HVAC.
C. Section 230593 - Testing, Adjusting, and Balancing for HVAC.
D. Section 230713 - Duct Insulation: External insulation and duct liner.
E. Section 233300 - Air Duct Accessories.
F. Section 233319 - Duct Silencers.
G. Section 233600 - Air Terminal Units.
H. Section 233700 - Air Outlets and Inlets: Fabric air distribution devices.

1.03 REFERENCE STANDARDS

A. ANSI Z9.5 - Laboratory Ventilation; 2012.
B. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals; 2013.
C. ASHRAE Std 62.1-2010 - Ventilation for Acceptable Indoor Air Quality; 2010.
D. ASHRAE Std 126 - Method of Testing HVAC Air Ducts; 2016.
E. ASME AG-1 - Code on Nuclear Air and Gas Treatment; 2019.
F. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.
H. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2015.
I. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021.
J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

K. NFPA 45 - Standard on Fire Protection for Laboratories Using Chemicals; 2019.

L. NADCA ACR - Assessment, Cleaning and Restoration of HVAC Systems; 2014.

M. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

N. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2015.

O. NFPA 91 - Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids; 2020.

P. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2014.

Q. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Rev. 2009).

R. SMACNA (KVS) - Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines; 2001.

S. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; 2012, 2nd Edition.

T. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

U. UL 1978 - Grease Ducts; Current Edition, Including All Revisions.

V. UL 2221 - Tests of Fire Resistive Grease Duct Enclosure Assemblies; Current Edition, Including All Revisions.

W. UL 2518 - Standard for Safety Air Dispersion Systems; Current Edition, Including All Revisions.

1.04 PERFORMANCE REQUIREMENTS

A. Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA (DCS) "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA (DCS) "HVAC Duct Construction Standards - Metal and Flexible"

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE Std 62.1-2010.

D. No variation of duct configuration or sizes is permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with the ASHRAE table of equivalent rectangular and round ducts.

1.05 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Provide data for duct materials, Liners and adhesives, and Sealants and gaskets.

C. Shop Drawings: Digital generated coordination drawing at an appropriate scale for the project Indicating the entire ductwork systems including duct fittings, particulars such as gages, sizes, elevations, reinforcement and spacing, seam and joint construction, welds, and configuration prior to start of work for 1 pressure class and higher systems. Sheet Metal coordinated shop drawings shall be submitted for review and approval to indicate the following

1. Length, width, height and elevation of bottom of each duct segment
2. Sheet metal gauge
3. Clearly indicated locations of duct silencers (DS), fire dampers (FD), smoke dampers (SD), combination fire/smoke dampers (FSD), motorized dampers (MD), manual balancing dampers, and remote balancing dampers.
4. Transition segments marked with entrance and exit sizes, as well as length and elevation
5. Indication of duct offsets in the horizontal or vertical direction
6. Duct lining thickness, including, if it changes, where it changes.
7. Any constraints or points of conflict due to existing conditions or planned piping, conduit, structure, or finish which will interfere with the installation of the ductwork

D. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate per appropriate seal class, following SMACNA (LEAK).

1. All duct work pressure testing shall be coordinated to be witnessed by Owner representative and the TAB contractor.

E. Project Record Documents: Record actual locations of ducts, dampers, and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with documented experience. Provide welding certificates.

1.07 REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA 90A standards.

1.08 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

C. All duct shall be stored and secured to prevent damage from precipitation and surrounding construction. Maintain duct section seals prior to installation.

D. All ductwork shall be sealed onsite and no tape shall be used to seal ductwork.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A and SMACNA (DCS) guidelines unless stated otherwise.

B. Acoustical Treatment: Provide sound-absorbing liners and sectional silencers for metal-based ducts in compliance with Section 233319.

C. Duct Fabrication Requirements:

1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
2. No variation of duct configuration or size permitted except by written permission. Size round duct installed in place of rectangular ducts in accordance with ASHRAE (FUND) Handbook - Fundamentals.
3. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.
4. Construct tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide airfoil turning vanes of perforated metal with glass fiber insulation.
5. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
6. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
7. Provide turning vanes of perforated metal with glass fiber insulation when an acoustical lining is required.

8. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

D. Ducts: Galvanized steel, unless otherwise indicated.

E. Medium and High Pressure Supply: 2 inch w.g. pressure class, galvanized steel.

F. Outside Air Intake: 1 inch wg pressure class, galvanized steel.

2.02 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.

1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
2. VOC Content: Not more than 250 g/L, excluding water.
   a. LEED compliant.
3. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.

C. Gasket Tape: Provide butyl rubber gasket tape for a flexible seal between transfer duct connector (TDC), transverse duct flange (TDF), applied flange connections, and angle rings connections.

D. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.03 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.

B. No variation of duct configuration or size permitted except by written permission. Size round duct installed in place of rectangular ducts in accordance with ASHRAE (FUND) Handbook - Fundamentals.

C. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

D. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.

E. T's, bends, and elbows: Construct according to SMACNA (DCS).

F. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

G. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

H. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

I. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.04 MANUFACTURED DUCTWORK AND FITTINGS

A. Material Requirements:

1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. Round Metal Ducts:

1. Round Single Wall Duct: Round lock seam duct with galvanized steel outer wall.
2. Round Double Wall Insulated Duct: Round spiral lock seam duct with galvanized steel outer wall, perforated galvanized steel inner wall; fitting with the solid inner wall.
   a. Insulation:
      1) Thickness: 1 inch.
      2) Material: Air.
3. Round Connection System: Interlocking duct connection system per SMACNA (DCS).

C. Round Spiral Duct:

1. Round spiral lock seam duct with galvanized steel outer wall.

D. Connectors, Fittings, Sealants, and Miscellaneous:

1. Fittings: Manufacture with solid inner wall of perforated galvanized steel.
2. Transverse Duct Connection System: SMACNA "E" rated rigid class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips in accordance with SMACNA (DCS).
3. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.

a. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
b. VOC Content: Not more than 250 g/L, excluding water.
1) LEED compliant.
c. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.

4. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

E. Manufacture in accordance with SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

2.05 FLEXIBLE DUCTS

A. Acoustic Flexible Air Ducts:
1. UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire.
2. Inner Core: Spun-bonded, nonwoven inner core.
3. Pressure Rating: From 6 in-wc to 5 in-wc negative.
4. Temperature Range: Minus 20 to 250 degrees F.

2.06 NON-METAL DUCTS

A. Air Dispersion (Fabric) Ducts:
1. 1/4 to 3.1 in-wc static, linear-vent type with hangers, supports and appurtenances as listed per UL 2518.

2.07 AIR PLENUMS AND CASINGS

A. Fabricate in accordance with SMACNA (DCS) for indicated operating pressures indicated.

B. Minimum Fabrication Requirements:
1. Fabricate acoustic plenum or casing with reinforcing turned inward.
2. Provide 16-gauge, 0.059-inch sheet steel back facing and 22-gauge, 0.029-inch perforated sheet steel front facing with 3/32 inch diameter holes on 5/32 inch centers.
3. Construct panels 3 inches thick, packed with 4.5 pcf minimum glass fiber insulation media, on inverted channel of 16-gauge, 0.059-inch sheet steel.
4. Mount floor-mounted plenum or casings on 4-inch high concrete curbs. At floor, rivet panels on 8-inch centers to angles. Where floors are acoustically

insulated, provide liner of galvanized 18-gauge, 0.052-inch expanded metal mesh supported at 12-inch centers, turned up 12 inches at sides with sheet metal shields.

C. Access Doors:
   1. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection.
   2. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles.
   3. Provide clear wire glass observation ports, minimum 6 by 6 inch size.

2.08 DUCTS FOR KITCHEN EXHAUST APPLICATIONS

A. Provide ductwork, fittings, and appurtenances per NFPA 96, SMACNA (KVS), UL 1978, and UL 2221 requirements and guidelines.

B. Class 1 duct for air with gas and grease particle exhaust at an air velocity of 1,500 to 2,500 fpm.

C. Where ducts are not self-draining back to equipment, provide low-point drain pocket with the copper drain pipe to a sanitary sewer.

D. Design, fabricate, and install liquidtight preventing exhaust leakage into building.

E. Dishwasher Exhaust Duct:
   1. Duct Size: 1 in-wc pressure class welded aluminum.
   2. Fabricate using single wall, 16-gauge, 0.059-inch aluminum with continuous external welded joints to form rectangular sections.
   3. Seal joints during installation with factory-supplied overlapping V-bands and sealant.

F. Kitchen Hood and Grease Exhaust Duct:
   1. Fabricate in accordance with ductwork manufacturer's instructions, SMACNA (DCS), SMACNA (KVS), and NFPA 96.
   2. Round, Single-Wall, Premanufactured Grease Exhaust Duct:
      a. UL Listed and labeled to UL 1978.
      b. Construct of 20-gauge, 0.035-inch Type 316 stainless steel.
      c. Seal joints during installation with factory-supplied overlapping V-bands and sealant.
      d. Minimum horizontal slope of 1/16 inch per foot per manufacturers listing to UL 1978.
   3. Rectangular, Single-Wall, Premanufactured Grease Exhaust Duct:
      a. UL Listed and labeled to UL 1978.

b. Construct of 16-gauge, 0.059-inch sheet steel using continuous external welded joints in rectangular sections.

2.09 DUCTS FOR LABORATORY EXHAUST

A. Laboratory Exhaust Applications:

1. Fume Hood Cabinet Exhaust:

a. Minimum 20-gauge, 0.035-inch Type 316 stainless steel, unless noted otherwise.

1) Fabricate in accordance with ductwork manufacturer's instructions; test duct system to sustain positive and negative pressures in accordance with ASHRAE Std 126 and ASME AG-1.

b. Provide ductwork and appurtenances in accordance with NFPA 91 requirements except where NFPA 45 applications take precedence.

c. Coordinate duct, fittings, hangers, and accessories to comply with ANSI Z9.5.

d. Design, fabricate, and install liquidtight preventing exhaust leakage into the building.

2.10 FABRIC AIR DISPERSION SYSTEM

A. Air diffusers shall be constructed of a woven fire retardant fabric complying with the following physical characteristics:

1. Fabric Construction: 100% Flame Retardant and treated with a machine wash-able anti-microbial agent from the manufacturer.
2. Weight: 6.75 oz/sq-yd per ASTM D3776
3. Color: (Standard: blue, white, tan, red, green, gray, black or custom) To be coordinated with Architect prior to fabrication.
4. Air Permeability: 2 (+2/-1) cfm/sq-ft per ASTM D737, Frazier
5. Temperature Range: 0 degrees F to 180 degrees F
6. Fire Retardancy: Classified by Underwriters Laboratories in accordance with the flame spread/smoke developed requirements of NFPA 90-A and ICC AC167.
7. Antimicrobial agent shall be proven 99% effective after 10 laundry cycles per AATCC Test Method 100.

B. Systems Fabrication Requirements:

1. Air dispersion is accomplished by linear vent and permeable fabric. Linear vent is to consist of an array of open orifices. Linear vents shall be designed to minimize dusting on fabric surface.

2. Size of vent openings and location of linear vents to be specified and approved by the manufacturer as necessary to meet project requirements.
3. Inlet connection to metal duct via fabric draw band with anchor patches as supplied by the manufacturer. Anchor patches to be secured to metal duct via zip screw fastener - supplied by the contractor.
4. Inlet connection shall include a zipper for easy removal/maintenance.
5. Lengths to include required zippers as specified by the manufacturer.
6. System to include Adjustable Flow Devices to balance turbulence, airflow and distribution as needed. Flow restriction device shall include the ability to adjust the airflow resistance from 0.06 - 0.60 in. w.g. static pressure.
7. End cap shall include a zipper for easy maintenance.
8. Fabric system shall include connectors to accommodate the suspension system listed herein.
9. Any deviation from a straight run shall be made using a gored elbow or an efficiency tee. Normal 90-degree elbows shall be 5 gores with an elbow radius of 1.5 times the diameter of the duct.

C. Design Parameters:
1. Use fabric diffusers only for positive pressure air distribution components of the mechanical ventilation system.
2. Do not use fabric diffusers in concealed locations.
3. Fabric diffusers shall be designed from 0.25” water gage minimum to 3.0” maximum, with 0.5” as the standard.
4. Fabric air diffusers shall be limited to design temperatures between 0 degrees F and 180 degrees F (-17.8 degrees C and 82 degrees C).
5. Design CFM, static pressure and diffuser length shall be designed or approved by the manufacturer.

D. Suspension Hardware:
1. 3x1 Suspension: System shall include a 3-row connection to fabric system at 10, 12, and 2 o'clock locations. Attachment spacing shall not to exceed 3 feet. The powder-coated aluminum hangers shall be secured and integrated to a single (1-row) tension cable every 3' and connect to the fabric system at the 10 and 2 o'clock locations with detachable D-clasps. The fabric system shall have clips located at 12 o'clock to attach directly to the single tension cable system located 3” above top-dead-center location of the fabric system. Tension cable hardware to include cable, eye bolts, cable clamps, and turnbuckles as

required. Provide galvanized steel cables.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install products following the manufacturer's instructions.

C. Install ducts with fewest possible joints.

D. Install factory-fabricated fittings for changes in direction, size, and shape and for branch connections.

E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

G. Install ducts with sufficient clearance, plus allowance for insulation thickness.

H. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.

I. Kitchen Hood Exhaust: Provide residue traps at the base of vertical risers with provisions for the cleanout.

1. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.
2. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 12 feet in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings. Locate access panel on top or sides of duct a minimum of 1-1/2 inches from bottom of duct.
3. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.
4. All joints, seams and penetrations shall be welded liquid-tight.

J. Exposed Ductwork

1. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
2. Trim duct sealants flush with the metal. Create a smooth and uniform exposed bead. Do not use a two-part tape sealing system.
3. Grind welds to provide a smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration

caused by welding.

4. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
5. Repair or replace damaged sections and finished work that does not comply with these requirements.
6. Paint exposed ductwork with metal primer and with 2-finish coats in color as directed by the Architect.

K. Duct sizes indicated are precise inside dimensions. For lined ducts, maintain sizes inside lining.

L. Do not provide duct take-offs within 6" of supply plenum or supply trunk cap.

M. Do not support any other systems from ducts.

N. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

O. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with a crimp in the direction of airflow.

P. Use double nuts and lock washers on threaded rod supports.

Q. Connect terminal units to supply ducts directly or with 5 feet maximum length of flexible duct. Do not use flexible duct to change direction.

R. Duct Insulation: Provide duct insulation in compliance with Section 230713.

S. Duct Isolation

1. Ducts shall be connected to fans and fan casings by means of flexible connectors. Flexible connectors shall be installed to prevent metal-to-metal contact across flexible connection. Flexible duct connectors shall not be used outside the mechanical room unless expressly shown on the drawings.

T. Ductwork Bracing

1. Do not install tie rods within ducts serving noise critical spaces.

U. Acoustical Lining of Ducts

1. Transfer air ductwork shall be acoustically lined where shown on the drawings.
2. The acoustical liner shall be fixed to the duct with a minimum of 50% coverage of a fire resistant adhesive. Where the duct width exceeds 12 inches or the height 24 inches, the liner shall be additionally secured with mechanical fastening on maximum 16 inch centers on all sides. Mechanical fasteners that pierce the duct are unacceptable. All ends of the liner shall be coated with a fire resistant cementing material to prevent delamination, leakage or erosion. All joints shall be firmly butted and ends coated with an adhesive to ensure that the

lining is smooth across all joints.

3. Where acoustical duct lining is installed, the dimensions of the sheet metal shall be increased to include the thickness of the lining material. Dimensions shown on the mechanical drawings are the clear internal dimensions after the liner has been installed.

V. Duct Penetrations

1. Where each duct passes through a noise critical wall, floor or ceiling surrounding any noise critical spaces, there shall be a clear annular space of 1 inch between the duct and structure. After all of the ductwork is installed the Contractor shall check the clearance, pack the voids full depth with mineral fiber batt insulation and caulk both ends with a non aging, non hardening sealant backed by a polyethylene foam rod or permanently flexible firestop material.
2. Where there is not sufficient access space to pack around all sides of a duct (for example, at the underside of a slab), place a short stub duct in the wall, pack and caulk around it and then attach the inlet and outlet ducts to each end.

3.02 DUCT SYSTEM CLEANLINESS TESTS:

A. Visually inspect all duct systems to ensure that no visible contaminants are present.
B. Test sections of the metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
   1. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
C. Duct system will be considered defective if it does not pass tests and inspections.
D. Prepare test and inspection reports.

3.03 CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing if and only if the system is considered defective from the duct cleanliness testing.
B. Clean the following components by removing surface contaminants and deposits:
   1. Air outlets and inlets (registers, grilles, and diffusers).
   2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
   3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate

collectors and drains.

4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

C. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from the building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to the downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging the integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA ACR. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash-down procedures.
7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if the fungus is present. Apply antimicrobial agents according to the manufacturer's written instructions after removal of surface deposits and debris.
8. Source-Removal Cleaning Methods: The HVAC system shall be cleaned using source-removal mechanical cleaning methods designed to extract contaminants from within the HVAC system and to safely remove these contaminants from the facility. No cleaning method, or combination of methods, shall be used that could potentially damage components of the HVAC system or negatively alter the integrity of the system.
    a. Use continuously operating vacuum-collection devices to keep each section being cleaned under negative pressure.

b. Cleaning methods that require mechanical agitation devices to dislodge debris that is adhered to interior surfaces of HVAC system components shall be equipped to safely remove these devices. Cleaning methods shall not damage the integrity of HVAC system components or damage porous surface materials such as duct and plenum liners.

9. Cleaning Mineral-Fiber Insulation Components:
   a. Fibrous-glass thermal or acoustical insulation elements present in equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment while the HVAC system is under constant negative pressure and shall not be permitted to get wet according to NADCA ACR.
   b. Cleaning methods used shall not cause damage to fibrous-glass components and will render the system capable of passing the HVAC System Cleanliness Tests.
   c. Fibrous materials that become wet shall be discarded and replaced.

D. Prior to occupancy and building turnover to the owner, Flush all ductwork systems for a minimum of one week of continuous operation. Replace all filters at the end of the flush sequence and return equipment to normal operation.

END OF SECTION 233100

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SECTION 233300
AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Duct access doors.
B. Duct test holes.
C. Flexible duct connections.
D. Volume control dampers.
E. Remote balancing dampers.
F. Bubble tight dampers.
G. Low leakage (Class 1A) control dampers.
H. Miscellaneous products:
    1. Duct opening closure film.

1.02 RELATED REQUIREMENTS

A. Section 233100 - HVAC Ducts and Casings.
B. Section 233600 - Air Terminal Units: Pressure regulating damper assemblies.

1.03 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.
B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Rev. 2009).
C. UL 33 - Safety Heat Responsive Links for Fire-Protection Service; Current Edition, Including All Revisions.
D. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Refer to Division 01 requirements.
B. Product Data: Provide for shop fabricated assemblies including volume control dampers, duct access doors, duct test holes, and hardware used. Include electrical characteristics and connection requirements.
C. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers.
D. Manufacturer's Installation Instructions: Provide instructions for fire dampers.
E. Project Record Drawings: Record actual locations of access doors and test holes.
F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Fusible Links: Two of each type and size.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 - PRODUCTS

2.01 DUCT ACCESS DOORS

A. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch thick insulation with sheet metal cover.

2.02 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

2.03 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Flexible Duct Connections: Fabric crimped into metal edging strip.

1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.
   a. Net Fabric Width: Approximately 2 inches wide.
2. Metal: 3 inches wide, 24 gage, 0.0239 inch thick galvanized steel.

2.04 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Single Blade Dampers: Fabricate single blade dampers with stiffening beads and a continuous 3/8” aluminum square shaft for strength and rigidity.

C. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

D. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.

E. Quadrants:

1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
3. Where rod lengths exceed 30 inches provide regulator at both ends.

2.05 REMOTE BALANCING DAMPERS

A. Ratings:
   1. Pressure: 1 inch w.g.
   2. Velocity: 2,000 feet per minute.
B. Construction:
   1. Frame and sleeve shall be one-piece design, 20 gauge galvanized steel, 6-3/8 inch depth and a groove for added strength.
   2. Blades: 20 gauge galvanized steel.
   3. Axles: 3/4 inch diameter plated steel.
   4. Bearings: Acetal sleeve type.
   5. Actuator: 9 volt.
C. Accessories:
   1. Rectangular white wall plate with number of ports as required.
   2. Plenum rated cable, length as required.
   3. Cable coupler.
   4. Single gang outlet box.
D. Factory tests: Factory cycle damper to assure proper operation.

2.06 BUBBLE TIGHT DAMPERS

A. Leakage: Dampers are to be zero leakage bubble tight type to 10 in. wg as required by AMCA Standard 500D.
B. Differential Pressure: Dampers shall have a maximum differential pressure rating of 10 in. wg.
C. Velocity: Dampers shall have a maximum velocity rating of 3900 fpm.
D. Construction: Damper frame shall be a minimum of 12 ga. painted steel formed into a rolled channel frame with 2 inch flange. Damper blades shall be a minimum of 12 ga. painted steel flat dual skin with perimeter seal and reinforced as required to meet the system pressures it will be installed in. Blade orientation is horizontal. Blade action is parallel.
E. Seals: Blade edge to be silicone.
F. Actuator: Electric, 24V or 120V

2.07 LOW LEAKAGE (CLASS 1A) CONTROL DAMPERS

A. Maximum Leakage Allowed: 3 cfm/sf at 1 inch wg.

B. Frame:

1. Material: 12 gage galvanized steel.
2. Free-area: Single cross section.

C. Blade:

1. Type: Single-blade rectangle shape.
2. Operation: Opposed type.
3. Material: 12 gauge galvanized steel.
4. Authority: Opposed type, 5 to 50 percent (typically 10 percent).

2.08 MISCELLANEOUS PRODUCTS

A. Duct Opening Closure Film: Mold-resistant, self-adhesive film to keep debris out of ducts during construction.

1. Thickness: 2 mils.
2. UV stable light blue color.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 233100 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8 x 8 inch size for hand access, size for shoulder access, and as indicated. Provide 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.

D. Provide duct test holes where indicated and required for testing and balancing purposes.

E. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

F. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

G. For fans developing static pressures of 5.0 inches and over, cover flexible connections with leaded vinyl sheet, held in place with metal straps.

H. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

I. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION 233300

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SECTION 233423
HVAC POWER VENTILATORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Roof exhausters.

B. Ceiling exhaust fans.

C. Upblast roof exhausters.

D. Ceiling exhaust fans.

E. Laboratory and fume exhaust.

1.02 RELATED REQUIREMENTS

A. Section 233300 - Air Duct Accessories: Backdraft dampers.

1.03 REFERENCE STANDARDS

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.

B. AMCA 99 - Standards Handbook; 2010.

C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2005 (Reaffirmed 2012).

D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2007.

E. AMCA (DIR) - [Directory of] Products Licensed Under AMCA International Certified Ratings Program; Air Movement and Control Association International, Inc.; http://www.amca.org/certified/search/company.aspx.

F. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; 2014.

G. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2014.

H. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

I. UL 705 - Power Ventilators; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Indicate installation instructions.

D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.05 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.01 POWER VENTILATORS - GENERAL

A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.

B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.

C. Sound Ratings: AMCA 301, tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.

D. Fabrication: Conform to AMCA 99.

E. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

F. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

G. Enclosed Safety Switches: Comply with NEMA 250.

2.02 ROOF EXHAUSTERS

A. Fan Unit: V-belt or direct driven as indicated, with spun aluminum housing; resilient mounted motor; 1/2 inch mesh, 0.62 inch thick aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.

B. Roof Curb: 18 inch high self-flashing of aluminum with continuously welded seams, insulation and curb bottom.

C. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor.

D. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked, and line voltage motor drive, power open, spring return.

E. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

F. Hood: Galvanized steel complete with wire mesh bird screen.

2.03 CEILING EXHAUST FANS

A. Centrifugal Fan Unit: Direct driven with galvanized steel housing, resilient mounted motor, gravity backdraft damper in discharge.

B. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted solid state speed controller.

C. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.04 UPBLAST ROOF EXHAUSTERS

A. Direct Drive Fan:
   1. Fan Wheel:
      a. Type: Non-overloading, backward inclined centrifugal.
   2. Housing:
      a. Construct of heavy gage aluminum including curb cap, windband, and motor compartment.
      b. Rigid internal support structure.
      c. One-piece fabricated or fully welded curb-cap base to windband for leak proof construction.
      d. Provide breather tube for fresh air motor cooling and wiring.

B. Shafts and Bearings:
   1. Fan Shaft:
      a. Ground and polished steel with anti-corrosive coating.
      b. First critical speed at least 25 percent over maximum cataloged operating speed.
   2. Bearings:
      a. Permanently sealed or pillow block type.
      b. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
      c. 100 percent factory tested.

C. Drive Assembly:
   1. Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower.
   2. Belts: Static free and oil resistant.
   3. Fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.
   4. Motor pulley adjustable for final system balancing.
   5. Readily accessible for maintenance.

D. Disconnect Switches:
   1. Factory mounted and wired.
   2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

E. Roof Curb: 12 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips, insulation and curb bottom, curb bottom, ventilated double wall, and factory installed nailer strip.

F. Drain Trough: Allows for single-point drainage of water, grease, and other residues.

2.05 LABORATORY AND FUME EXHAUST

A. Direct Drive Fan:
   1. Fan Wheel:
      a. Type: Non-overloading, backward inclined centrifugal.
      b. Material: Aluminum.
   2. Statically and dynamically balanced.
   3. Motors:
      a. Open drip-proof (ODP).
      b. Heavy duty ball bearing type.
      c. Mount on vibration isolators or resilient cradle mounts, out of air stream.
      d. Fully accessible for maintenance.
   4. Housing:
      a. Construct of heavy gage aluminum including curb cap, windband, and motor compartment.
      b. Rigid internal support structure.
      c. One-piece fabricated or fully welded curb-cap base to windband for leak proof construction.
      d. Construct drive frame assembly of heavy gage steel, mounted on vibration isolators.
      e. Provide breather tube for fresh air motor cooling and wiring.

B. Shafts and Bearings:
   1. Fan Shaft:
      a. Ground and polished steel with anti-corrosive coating.
      b. First critical speed at least 25 percent over maximum cataloged operating speed.
   2. Bearings:
      a. Permanently sealed or pillow block type.

b. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.

c. 100 percent factory tested.

C. High Plume Discharge Nozzle:

1. Provide a stack with a minimum of 120 inches discharge height above the roof surface.

2. Provide drain connection at lowest point of housing.

D. Roof Curb: 18 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips, insulation and curb bottom, ventilated double wall, and factory installed nailer strip.

E. Mounting Base: Provide mounting base with lifting lugs.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure roof exhausters with stainless steel lag screws to roof curb.

C. Suspended Cabinet Fans:

1. Install fans with resilient mountings and flexible electrical leads.

2. Install flexible connections between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

D. Provide sheaves required for final air balance.

E. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

3.02 SCHEDULES

A. Refer to the drawings.

END OF SECTION 233423

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SECTION 233433
AIR CURTAINS

PART 1 GENERAL

1.01 SECTION INCLUDE

A. Air curtains.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 260583 - Wiring Connections: Connection to building power.

1.03 REFERENCE STANDARDS

A. Publications listed here are part of this specification to the extent they are referenced. Where no specific edition of the standard or publication is identified, the current edition shall apply.

B. AMCA 220 - Laboratory Methods of Testing Air Curtain Units for Aerodynamic Performance Rating; 2021.

1.04 CONSTRUCTION SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Manufacturer's descriptive literature for products specified in this section; indicate options specified.

C. Manufacturer's Instructions: Printed installation instructions for each product specified.

D. Shop Drawings: Indicate dimensions, weights, loads, clearances required, location and size of field connections.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum ten years of documented experience.

1. For each product specified, provide components by the same manufacturer throughout.
2. The manufacturing company shall have local representation to provide continuing support for each air curtain.

B. The contractor shall be responsible for any and all costs associated with any and all changes resulting from the use of a supplier other than the one used as the "basis of design".

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products of this section in manufacturer's unopened packaging until installation.

B. Maintain dry, heated storage area for products of this section until installation of products.

1.07 WARRANTY

A. Supply manufacturer's standard warranty against defects in product workmanship and materials.

B. Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with the manufacturer.

C. Warranty periods shall begin from Date of Substantial Completion.

D. Correct defective work within a five year period after Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 AIR CURTAINS

A. Description: Self-contained, electrically operated air curtain. Suitable for mounting at head or jamb of door or service window opening.

1. Rated Maximum Mounting Height: As indicated on drawings.
2. Rated Opening Width: As indicated on drawings.

B. Housing:

1. Material: Minimum 16-gage aluminized steel cabinet with welded construction.
2. Finish: Painted epoxy.
3. Color: Architect to select final color..

C. Air Intake: Aluminum mesh air-intake filter; removable and cleanable.

D. Performance: Tested in accordance with AMCA 220

1. Average Outlet Velocity: As indicated on drawings.
2. Air Flow: Indicated on drawings.

E. Controls:

1. ON/OFF control; air curtain turns on when door is opened and off when door is closed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that required utilities are in correct location and are of correct capacities for specified products.

B. Verify that mounting surfaces have sufficient strength to support units.

C. Verify that space is ready for installation of units.

D. Verify clearances required to maintain the units.

3.02 INSTALLATION

A. Install air curtains in accordance with shop drawings and manufacturer's printed installation instructions.

3.03 IDENTIFICATION

A. Unit information labels and stickers shall never be painted over or covered in any way.

END OF SECTION 233433

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SECTION 233600
AIR TERMINAL UNITS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Single-duct terminal units.
   1. Single-duct, variable-volume units.
B. Fan-powered units.

1.02 RELATED REQUIREMENTS

A. Section 233100 - HVAC Ducts and Casings.
B. Section 233300 - Air Duct Accessories.

1.03 REFERENCE STANDARDS

A. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils; 2001 (R2011).
B. AHRI 880 (I-P) - Performance Rating of Air Terminals; 2011 with Addendum 1.
C. ASHRAE Std 130 - Methods of Testing Air Terminal Units; 2008 (R2014).
D. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2012.
E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.
G. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2008.
H. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

1.04 SUBMITTALS

A. Refer to Division 01.
B. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate air flow, static pressure, and NC designation. Include electrical characteristics and connection requirements.
C. Shop Drawings: Indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.
   1. Include schedules listing discharge and radiated sound power level for each of second through sixth octave bands at inlet static pressures of 1 to 4 inch wg.

D. Certificates: Certify that air coil capacities, pressure drops, and selection procedures meet or exceed specified requirements or coils are tested and rated in accordance with AHRI 410.

E. Manufacturer's Installation Instructions: Indicate support and hanging details, installation instructions, recommendations, and service clearances required.

F. Project Record Documents: Record actual locations of units and locations of access doors required for access of valving.

G. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant-volume regulators.

H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 WARRANTY

A. Refer to Division 01.

B. Provide five year manufacturer warranty for air terminal units.

PART 2 - PRODUCTS

2.01 SINGLE-DUCT, VARIABLE-VOLUME UNITS

A. General:

1. Factory-assembled, AHRI 880 (I-P) rated and bearing the AHRI seal, air volume control terminal with damper assembly, flow sensor, externally mounted volume controller, duct collars, and all required features.
2. Control box bearing identification, including but not necessarily limited to nominal cfm, maximum and minimum factory-set airflow limits, coil type and coil (right or left hand) connection, where applicable.

B. Unit Casing:

1. Minimum 22 gage, 0.0299 inch galvanized steel.
2. Air Inlet Collar: Provide round or rectangular, suitable for standard flexible duct sizes.
3. Unit Discharge: Rectangular, with slip-and-drive connections.

4. Acceptable Liners:
    a. 1 inch thick, coated, fibrous-glass complying with ASTM C1071.
        1) Secure with adhesive.
        2) Coat edges exposed to airstream with NFPA 90A approved sealant.
        3) Cover liner with non-porous foil.
    b. Liner not to contain pentabrominated diphenyl ether (CAS #32534-81-9) or octabrominated diphenyl ether.

C. Damper Assembly:
1. Heavy-gage, galvanized steel or extruded aluminum construction with solid steel, nickel-plated shaft pivoting on HDPE, self-lubricating bearings.
2. Provide integral position indicator or alternative method for indicating damper position over full range of 90 degrees.
3. Incorporate low leak damper blades for tight airflow shutoff.

D. Control Transformers: Factory supplied and mounted for electric and electronic control applications.

E. Controls:
1. DDC (Direct-Digital Controls)
    a. Refer to Control Drawings for further detail.

2.02 FAN-POWERED SERIES UNITS

A. General:
1. Factory-assembled and wired, AHRI 880 (I-P) rated, horizontal fan-powered terminal unit with blower, blower motor, mixing plenum, and primary air damper contained in a single unit housing.

B. Unit Casing:
1. Minimum 22 gage, 0.0299 inch galvanized steel.
2. Primary Air Inlet Collar: Suitable for standard flexible duct sizes.
3. Unit Discharge: Rectangular, suitable for flanged duct connection.
4. Acceptable Liners:
    a. 1 inch thick, coated, fibrous-glass complying with ASTM C1071.
        1) Secure with adhesive.
        2) Coat edges exposed to airstream with NFPA 90A approved sealant.
        3) Cover liner with non-porous foil.

C. Primary Air Damper Assembly:
1. Provide indicator on damper shaft or alternative method for indicating damper position over full range of 90 degrees.

2. Incorporate low leak (2 percent) damper blades for tight airflow shutoff.
3. Fan(s): Forward curved, centrifugal type.
4. Fan Motor:
    a. ECM (Electrically Commutated Motor):
    b. Fan motor shaft directly connected to fan and and isolated from unit casing to prevent transmission of vibration.

D. Electrical Requirements:
1. Single-point power connection.
2. Equipment wiring to comply with requirements of NFPA 70.

E. Controls:
1. DDC (Direct-Digital Controls)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that conditions are suitable for installation.
B. Verify that field measurements are as indicated on drawings.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Install the inlets of air terminal units and air flow sensors a minimum of four duct diameters from elbows, transitions, and duct takeoffs.
C. Provide ceiling access doors or locate units above easily removable ceiling components.
D. Support units individually from structure in accordance with SMACNA (SRM).
E. Do not support from ductwork.
F. Connect to ductwork in accordance with Section 233100.

3.03 FIELD QUALITY CONTROL

A. Provide manufacturer's field representative to test, inspect, instruct, and observe field-assembled components and equipment installation, including connectionsand to assist in field testing. Report results in writing.
1. Leak Test:
    a. After installation, fill water coils and test for leaks.
    b. Repair leaks and retest until no leaks exist.

END OF SECTION 233600

SECTION 233700
AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Diffusers.
   1. Perforated ceiling diffusers.
B. Slot ceiling diffusers.
C. Registers/grilles.
   1. Perforated ceiling-mounted return/transfer/exhaust grille
   2. Wall-mounted, supply register/grilles.
   3. Wall-mounted, exhaust and return register/grilles.
D. Louvers.

1.02 REFERENCE STANDARDS

A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2012.
B. ARI 890 - Standard for Air Diffusers and Air Diffuser Assemblies; Air-Conditioning and Refrigeration Institute; 2008.
C. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets; 2006 (R2011).
D. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.03 SUBMITTALS

A. Refer to Division 01 requirements.
B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.
C. Project Record Documents: Record actual locations of air outlets and inlets.
D. Acoustical performance shall be established by ADC 1062GRD and ADC/ARI standard 885 procedures. Sound power data and NC value with correction factors used shall be supplied that meets or exceeds requirements established later in specification section 233319 Duct Silencers. (NC data only is not acceptable.)

1.04 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.
B. Test and rate louver performance in accordance with AMCA 500-L.
C. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented

experience.

1.05 MOCK-UP

A. Provide mock-up of typical interior ceiling module with supply and return air outlets.

B. Provide mock-up of each type of displacement diffuser. Architect/Engineer to approve mock up before Contractor may proceeding forward with remaining installation.

PART 2 - PRODUCTS

2.01 RECTANGULAR CEILING DIFFUSERS

A. Type: Square with a formed backpan and flat face panel diffuser to discharge air in four way pattern .

B. Frame: Inverted T-Bar or Surface Mount type.

C. Color: As selected by Architect/Engineer from manufacturer's standard range.

2.02 PERFORATED FACE CEILING RETURN/TRANSFER/EXHAUST GRILLE

A. Type: Perforated face

B. Frame: Surface mount and inverted t-bar type.

C. Filter Frame (where indicated): A hinge-tab mechanism to allow hinging or removal of the grille from the filter frame. The mounting frame shall be designed to accept a standard [one inch] or [two inch] filter media.

D. Fabrication: Aluminum.

E. Color: As selected by Architect/Engineer from manufacturer's standard range.

2.03 SLOT CEILING DIFFUSERS

A. Type: Refer to Air Inlets & Outlets schedule, on drawings, for exact number of slots and slot width.

B. Fabrication: Aluminum extrusions with factory clear lacquer finish.

C. Color: To be selected by Architect/Engineer from manufacturer's standard range.

D. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket, mitered end border.

E. Plenum: Integral, galvanized steel, insulated.

2.04 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with blades set at 35 degrees, horizontal face.

B. Frame: 1-1/4 inch margin with countersunk screw mounting.

C. Color: To be selected by Architect/Engineer from manufacturer's standard range.

D. Fabrication: Aluminum extrusions, with factory baked enamel finish.

2.05 WALL SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable blades, 3/4 inch minimum depth, 3/4 inch maximum spacing with spring or other device to set blades, horizontal face, single or double deflection as scheduled.

B. Frame: 1-1/4 inch margin with countersunk screw mounting and gasket.

C. Fabrication: Aluminum extrusions, with factory baked enamel finish .

D. Color: To be selected by Architect/Engineer from manufacturer's standard range.

E. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face.

F. Color: To be selected by Architect/Engineer from manufacturer's standard range.

2.06 LOUVERS

A. Type: 4 inch deep with blades on 45 degree slope with center baffle and return bend, heavy channel frame, 1/2 inch square mesh screen over exhaust and 1/2 inch square mesh screen over intake.

B. Color: To be selected by Architect/Engineer from manufacturer's standard range.

C. Fabrication: 12 gage, 0.1046 inch thick extruded aluminum, welded assembly, with factory painted finish.

D. Mounting: Furnish with interior flat flange for installation.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Comply with SMACNA (ASMM) for flashing/counter-flashing of roof penetrations and supports for roof curbs and roof mounted equipment.

C. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.

D. Install diffusers to ductwork with air tight connection.

E. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

F. Paint ductwork visible behind air outlets and inlets matte black. Refer to Division 09 requirements.

3.02 SCHEDULES

A. Refer to the drawings.

END OF SECTION 233700

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SECTION 234000
HVAC AIR CLEANING DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Disposable panel filters.

B. Extended surface high efficiency media filters.

C. Filter gauges.

1.02 REFERENCE STANDARDS

A. AHRI 850 (I-P) - Standard for Performance Rating of Commercial and Industrial Air Filter Equipment; 2013.

B. ASHRAE Std 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air Cleaning Devices Used in General Ventilation for Removing Particulate Matter; American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.{ch#33}

C. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2012, with 2015 amendments.

D. UL 900 - Standard for Air Filter Units; Current Edition, Including All Revisions.

1.03 PERFORMANCE REQUIREMENTS

A. Conform to ASHRAE Std 52.2 Section 7.4.

1. Dust Spot Efficiency: Plus or minus 5 percent.

1.04 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Provide data on filter media, filter performance data, filter assembly and filter frames, dimensions, motor locations and electrical characteristics and connection requirements.

C. Shop Drawings: Indicate filter assembly and filter frames, dimensions, motor locations, and electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Indicate assembly and change-out procedures.

E. Operation and Maintenance Data: Include instructions for operation, changing, and periodic cleaning.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Filters: One set of each type and size.

PART 2 - PRODUCTS

2.01 DISPOSABLE PANEL FILTERS

A. Media: UL 900 Class 2, fiber blanket, factory sprayed with flameproof, non-drip, non-volatile adhesive.

B. Performance Rating:

1. Face Velocity: 500 FPM.
2. Initial Resistance: 0.15 inch WG.
3. Recommended Final Resistance: 0.50 inches WG.

C. Casing: Cardboard frame.

2.02 EXTENDED SURFACE HIGH EFFICIENCY MEDIA FILTERS

A. Media: "V" style filter with organic synthetic filter media, progressively structured, thermally bonded media resistant to physical damage and moisture and chemicals. Must be free of metals, halogens, and glass fibers.

B. Moisture resistance: Up to 100% RH.

C. Temperature Resistance: Continuous 160°F, Peaks 175°F.

D. Housing: High strength all plastic fame with 1" recess to fit in 1" filter rack.

E. Microbial Resistance: Level 4.

F. Minimum Efficiency Reporting Value (MERV): 13, when tested in accordance with ASHRAE 52.2.

G. Performance Rating, per ASHRAE Std 52.2:

1. Dust Spot Efficiency: 95 percent.
2. Initial Resistance at 150 fpm Face Velocity: 0.35 inch WG.
3. Recommended Final Resistance: 1.5 inch WG.

2.03 FILTER GAUGES

A. Inclined Manometer: One piece molded plastic with epoxy coated aluminum scale, inclined-vertical indicating tube and built-in spirit level, range 0-3 inch WG, 3 percent of full scale accuracy.

B. Accessories: Static pressure tips with integral compression fittings, 1/4 inch aluminum tubing, 2-way or 3-way vent valves.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install air cleaning devices in accordance with manufacturer's instructions.

B. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.

C. Install filter gage static pressure tips upstream and downstream of filters. Mount filter gages on outside of filter housing or filter plenum, in accessible position. Adjust and

level.

1. Provide filter gages for packaged central station air handling units (ex - AHU's, RTU's, OAU's.)

D. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with clean set.

E. Filters shall be installed in filter housings with hinged doors that are either factory installed and integral to the equipment or filter frame and housing field-installed on the equipment.

3.02 SCHEDULES

A. Refer to the drawings.

END OF SECTION 234000

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SECTION 236433
MODULAR WATER CHILLERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Modular water cooled chiller.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete housekeeping pads.

B. Section 230593 - Testing, Adjusting, and Balancing for HVAC.

C. Section 230800 - Commissioning of HVAC.

D. Section 232113 - Hydronic Piping.

E. Section 232114 - Hydronic Specialties.

F. Section 260583 - Wiring Connections.

1.03 REFERENCE STANDARDS

A. AHRI 550/590 (I-P) - Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle; 2020.

B. ASHRAE Std 15 - Safety Standard for Refrigeration Systems and Designation and Classification of Refrigerants; 2019, with Errata (2020).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate physical size, weight and location of major pieces of equipment to be installed. Notify Architect/Engineer of any major deviations from the equipment originally specified prior to ordering equipment.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide rated capacities, weights, specialties and accessories, electrical requirements and wiring diagrams.

C. Shop Drawings: Indicate components, assembly, dimensions, weights and loadings, required clearances, and location and size of field connections. Indicate equipment, piping and connections, valves, strainers, and thermostatic valves required for complete system.

D. Manufacturer's Performance Data: Indicate energy input versus cooling load output from 0 to 100 percent of full load at specified and minimum condenser water temperature for water-cooled chillers and at specified and minimum outdoor air temperature for air-cooled chillers.

E. Operation and Maintenance Data: Include start-up instructions, maintenance data, parts lists, controls, and accessories; include trouble-shooting guide.

F. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Chiller/heater modules shall be completely factory assembled, wired and tested prior to shipment.

B. Factory start-up required, contractor to schedule with Owner and Engineer two (2) weeks prior.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's written installation instructions for rigging, unloading, and transporting units.

B. Deliver units to the job site completely assembled and charged with refrigerant and oil by manufacturer.

1.08 WARRANTY

A. Manufacturer's Warranty: Provide a two (2) year parts-only on the whole chiller. Provide an additional three (3) year compressor parts-only warranty.

PART 2 PRODUCTS

2.01 MODULAR 6-PIPE SIMULTANEOUS GROUND-SOURCE CHILLER/HEATER BANK

A. GENERAL:

1. Provide a complete ground-source chiller/heater unit comprised of eight (8) chiller/heater modules arranged into two sections, controlled and operated as one, connected by common chilled water, hot water, and ground loop headers. The Bank of chiller/heater modules shall be capable of continuing to operate in the event of a failure of one or more of the modules.

2. Modules shall have two independent circuits with scroll compressors, single Chilled Water evaporator, single Hot Water condenser, and single Ground Loop source/sink heat exchanger. All modules shall be capable of operating in cooling-only, heating-only, or simultaneous heating/cooling mode as commanded by the System Remote Master Control panel, which in turn responds to building demand and the BMS. All modules shall be capable of operating in any mode at any time, regardless of its location within the bank. The assembled bank shall have a dedicated pair of header pipes for load chilled water, load hot water, and ground-loop for heat source and heat sink. Each chiller/heater module shall be capable of producing leaving condenser water at temperatures to 140 degrees F.

3. Modules shall be equipped with NEMA 3R control panel with through-the-door non-fused disconnect, three-phase fuses, motor starters, safety controls, water piping, refrigerant piping, wiring, mounted on stainless steel base ready for connection to system piping and electrical power source.
4. Chiller module base formed shall be formed from heavy-gauge Stainless Steel with bolted assembly, with 20-gauge bright Stainless Steel front panel, 20-gauge galvanized steel side and top panels. Panels shall be factory-installed on chillers with main headers to simplify installation and reduce installation time. Panels shall be acoustically insulated and completely enclose the chiller module.

B. PROPER FILTRATION AND WATER TREATMENT
1. Chiller modules must be installed and operated in accordance with the manufacturer's IOM manuals. Proper water filtration must be supplied with a minimum of a 3/64” perforated or 30 mesh screen filter installed in each of the main headers and water quality maintained with water treatment in both the evaporator and condenser loops, and be located in an easily-serviceable location. Filtration located inside each module in not acceptable.

C. REFRIGERATION SYSTEM
1. Each chiller module shall contain two independent refrigeration circuits each with liquid line sight glass moisture indicator and thermal expansion valve. Suction line insulated with flexible elastomeric insulation. A system of solenoid and multiple-output valves shall direct the refrigerant along the proper paths between the compressors and the three heat exchangers depending on the module’s mode of operation.

D. COMPRESSORS
1. Each chiller module shall be equipped with two (2) high efficiency 3500 rpm scroll compressors with oil-level sight glass, and solid state internal thermal protection, rubber mounted to the chiller module frame. Each compressor must be provided with circuit breaker or in-line fuses, and line- voltage crankcase heaters with fuse protection.

E. EVAPORATOR
1. Each module shall be equipped with dual-circuit brazed plate evaporator with 316 stainless steel plates and copper brazing, insulated with ¾” flexible elastomeric insulation. Refrigerant side pressure rating 650 psi at 383 F and water side pressure rating 400 psi at 383 F. Evaporator shall be tested and

certified to UL 207 7th edition and C22.2 no. 140.3-M1987 for refrigerant withstand pressure for use with R410a.

F. GROUND LOOP SOURCE / SINK HEAT EXCHANGER

1. Each module shall be equipped with high efficiency dual-circuit brazed plate heat exchanger suitable for use as an evaporator or condenser with 316 stainless steel plates and copper brazing. Refrigerant side pressure rating 650 psi at 383 F and water side pressure rating 400 psi at 383 F. Condenser shall be tested and certified to UL 207 7th edition and C22.2 no. 140.3-M1987 for refrigerant withstand pressure for use with R410a. Heat exchange shall be suitable for use with glycol mixture.

G. HOT WATER CONDENSER

1. Each module shall be equipped with high efficiency dual-circuit brazed plate evaporator with 316 stainless steel plates and copper brazing. Refrigerant side pressure rating 650 psi at 383 F and water side pressure rating 400 psi at 383 F. Condenser shall be tested and certified to UL 207 7th edition and C22.2 no. 140.3-M1987 for refrigerant withstand pressure for use with R410a.

H. CHILLED WATER HEADERS

1. Branch headers shall be fabricated from Stainless Steel S10, grooved and insulated with ¾” flexible elastomeric insulation, and equipped with inlet and outlet lever operated butterfly valves, and inlet and outlet water temperature sensors with brass wells. One isolation valve shall be equipped with an actuator which will allow for use of variable-flow pumping. Branch headers shall be connected to 8” Stainless Steel S10 chilled water main headers and insulated with ¾” flexible elastomeric insulation. EACH MODULE shall be provided with its own flow switch and inlet and outlet temperature sensors to prevent freezing of the evaporator – use of one common flow switch across a bank of chiller modules shall NOT be acceptable for use as a safety device.

I. HOT WATER CONDENSER HEADERS

1. Branch headers shall be fabricated from Stainless Steel S10, grooved, and equipped with a modulating motorized inlet- and lever-operated butterfly outlet valves, and inlet and outlet water temperature sensors with brass wells (on heat pump and heat reclaim chillers). Branch headers shall be connected to 8” Stainless Steel S10 condenser water main headers.

J. GROUND LOOP HEADERS

1. Branch headers shall be fabricated from Stainless Steel S10, grooved and insulated with ¾" flexible elastomeric insulation, and equipped with inlet and outlet lever operated butterfly valves, and inlet and outlet water temperature sensors with brass wells. One isolation valve shall be equipped with a modulating actuator which will be used for head pressure control. Branch headers shall be connected to 8" Stainless Steel S10 chilled water main headers and insulated with ¾" flexible elastomeric insulation. EACH CHILLER MODULE shall be provided with its own flow switch and inlet and outlet temperature sensors to prevent freezing of the evaporator – use of one common flow switch across a bank of chiller modules shall NOT be acceptable for use as a safety device.

K. POWER WIRING

1. Chiller bank to be factory-supplied with a single-point power distribution panel (SPPDP) for each section of 4 modules. Each SPPDP shall contain a suitably-sized circuit breaker for each of the four modules that is to be connected to it. One building power connection shall be made to each SPPDP, and a separate power feed from each circuit breaker shall be made to one of the modules.

L. MODULE CONTROL PANEL

1. NEMA 3R control panel shall be complete with door-mounted non-fused disconnect switch, chiller on-off switch, power on light, compressor fuses/circuit breakers, compressor contactors, door-mounted four-line liquid crystal display, 24VAC control transformer with primary and secondary fuses and chiller PLC controller module. Panel shall come pre-wired to compressors, safety controls, and sensors. Internal fuses or circuit breakers, and wiring MUST be sized for the elevated amp draw of compressors running at high temperatures. Each module's control panel shall be equipped with a phase loss / voltage monitor.

M. CHILLER MODULE CONTROLLER

1. Chiller module controller shall monitor all operating and fault conditions of the individual chiller module, display them in English on the door-mounted display, and communicate all of these points to the System Remote Master.

N. Chiller CH-1: Air-Cooled.

2.02 SYSTEM REMOTE MASTER

A. Shall be enclosed in a NEMA 4 control panel complete with door mounted on-off switch, power on light, and a minimum 7" HMI touch screen display.

B. Shall be provided a separate 120-volt power supply so that it is not electrically powered from any of the chiller modules.

C. Must be able to communicate to the BMS/BAS or DDC in BACnet IP.

D. Shall sense and display, at minimum, entering and leaving chilled water temperature and pressure and condenser entering and leaving water temperature and pressure.

E. Shall sense leaving chilled water temperature and stage on the number of compressors required to maintain the leaving water temperature. The dead band temperature width and stage up and down times shall be field adjustable to suit each chilling/heating system.

F. Shall lead - lag the compressors in the Bank on a first in - first out basis in conjunction with run time. If a compressor is 24 hours ahead of the others it is held off to allow the balance of the compressors to catch up.

G. THE SYSTEM REMOTE MASTER CONTROLLER also monitors and displays the points, faults, and alarms listed above from EACH CHILLER MODULE IN A BANK, providing a one-location view of the status of every circuit in every module. Many of the points are available through the SRM to a Building Management System via BACnet or Modbus.

H. The Default Screen shall indicate entering and leaving chilled water temperature with an icon of a compressor for every compressor in the Bank. Each chiller shall be represented by two (2) icons, one above the other. Depending on the number of chillers in the Bank, a matching the number of double icons shall appear across the display. When the compressor is off the icon shall be an outline of a compressor and when the icon goes dark the compressor is operating.

I. When an out-of-tolerance condition exists is detected by any chiller module controller, its alarm condition is communicated to the System Remote Master, which will take this compressor out of its rotation and signal the building BMS or DDC that an alarm condition exists. The HMI display screen shall display the status of all chiller modules connected to it.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Align chiller package on steel or concrete foundations.

C. Install units on vibration isolators.

D. Connect to electrical service.

E. Install thermometers, flexible connectors, drain valves and pressure gauges at all inlets and outlets.

F. Use flexible connectors at chilled water connections.

G. Arrange piping for easy dismantling to permit tube cleaning and removal.

3.02 MANUFACTURER'S FIELD SERVICES

A. Perform factory startup of the chiller by factory trained and authorized servicing technicians confirming equipment has been correctly installed prior to equipment becoming operational and covered under the manufacturer's warranty.

B. Supply initial charge of refrigerant and oil if not completely factory charged.

C. Demonstrate system operations and verify specified performance.

3.03 CLOSEOUT ACTIVITIES

A. Demonstrate proper operation of equipment to Owner's designated representative.

B. Demonstration: Demonstrate operation of system to Owner's personnel.

1. Use operation and maintenance data as reference during demonstration.
2. Briefly describe function, operation, and maintenance of each component.

C. Training: Train Owner's personnel on operation and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of one day of training.

END OF SECTION 236433

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SECTION 237200

AIR-TO-AIR ENERGY RECOVERY EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Fan-powered outside air and air handling units.
2. Unit operating controls.
3. Electrical power connections.
4. Operations and maintenance service.

1.02 REFERENCES

A. AMCA 99 - Standards Handbook.

B. AMCA 210 - Laboratory Methods of Testing Fans for Rating.

C. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

D. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.

E. ANSI/NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

F. ASHRAE 62 - Ventilation and Indoor Air Quality in Building Design.

G. ARI 210 (Air-Conditioning and Refrigeration Institute) - Unitary Air-Conditioning Equipment.

H. ARI 260 - Sound Rating of Large Outdoor Refrigerating and Air-Conditioning Equipment.

I. ARI 270 (Air-Conditioning and Refrigeration Institute) - Sound Rating of Outdoor Unitary Equipment.

1.03 SUBMITTALS

A. Refer to Division 01 requirements.

B. Shop Drawings: Indicate components, accessories, capacity, weights and loadings, dimensions, and required clearances of manufactured products and assemblies. Indicate locations and sizes of field connections, and electrical service with electrical characteristics.

C. Product Data: Submit data indicating dimensions, rough-in connections, and electrical characteristics and connection requirements. Submit capacity and dimensions of manufactured products and assemblies required for this Project. Indicate duct connections. Submit data for manufactured products and assemblies. Indicate water, drain, valves, and rough-in connection requirements.

1. Filters: Data for filter media, filter performance data, filter assembly, and filter frames.

2. Fans: Performance and fan curves with specified operating point clearly plotted, power, RPM.
3. Electrical Requirements: Indicate electrical service with electrical characteristics and connection requirements. Power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.
4. Sound Power Level Data:
    a. Fan outlet and casing radiation at rated capacity.
    b. Indoor and outdoor sound power level data across all major octave band center frequencies for catalogued operating range of unit at gross total capacity range. Data shall be obtained in conformance with ARI 370-86 for outdoor sound levels and ARI 260 for indoor sound testing and rating standards. Sound data shall be supplied that meets or exceeds requirements shown in equipment schedules. (Data presented in sones or bels is not acceptable.)

D. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

E. Manufacturer's Installation Instructions: Submit assembly, support details, connection requirements, and include start-up instructions.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

G. Provide Manufacturer's start-up procedures, testing and checklists.

1.04 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of controls are separate from units.

B. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data. Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.

B. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

C. Protect equipment from damage by providing temporary covers until installation.

D. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

1.07 WARRANTY

A. Warranty periods shall begin from Date of Substantial Completion.

B. Provide a complete unit parts and labor warranty for 18 months.

C. Provide five (5) year limited warranty for energy recovery heat exchangers, materials only.

1.08 EXTRA MATERIALS

A. Furnish one set of filters and fan belts for each unit.

PART 2 - PRODUCTS

2.01 PACKAGED OUTSIDE AIR UNITS (OAU)

A. The Contractor shall furnish and install the packaged and matched fresh air unit(s) as shown and scheduled on the contract documents. The unit(s) shall be installed in accordance with this specification and perform at the specified conditions as scheduled.

B. General:

1. The units shall be installed in strict accordance with the specifications. Units shall be complete with all components and accessories as specified. All units shall be factory assembled, internally wired, and 100% run tested to check operation, fan and blower rotation and control sequence before leaving the factory. Wiring internal to the unit shall be numbered for simplified identification.

2. Units shall be ETL listed and labeled, classified in accordance with ANSI-UL 1995 / CAN/CSA C22.2 No.236. Units shall be rated and ETL listed for single point power connection for the entire unit.

3. All motors served by a VFD shall have a shaft grounding ring.

C. Quality Assurance:

1. All units shall be factory run tested before shipping. A proof copy of the test shall be placed in the unit electrical power & control panel. Unit(s) shall bear the ETL label, tested in accordance to UL 1995.

2. Electrical components shall be UL listed; fans shall be tested in an AMCA certified laboratory; insulation shall comply with NFPA 90A; coils shall tested in

accordance to ARI 410 and filters shall be tested in accordance to ASHRAE 52.

3. The unit manufacturer shall have an independent testing agency test the air leakage, panel deflection and sound pressure levels for a typical unit providing at minimum the supply airflow of units in question and not exceeding 20,000 CFM. The air leakage of the unit(s) shall not exceed 1% at 8” inches H2O positive static pressure and a copy of the report must be submitted upon request.
4. Unit shall be constructed to limit frame and panel deflection to 1/250th of the panel length at 8” inches H2O positive static pressure and a copy of the report must be submitted upon request.
5. The unit shall be tested in accordance with ANSI S12.34-1998 and instrumentation used must be in compliance with the requirements of AMCA 300 for sound readings. The sound tests conducted shall report overall sound power and pressure readings for supply air outlet, return air inlet and casing radiated.

D. Housing, Thermo-composite panels:

1. The unit housing shall be no-through metal with 2’’ Thermo-Composite and foam panel construction - interior and exterior or an all-aluminum 4” Foam thermal break construction - interior and exterior. Thermal break construction using a gasket to insulate two panels is not an acceptable equivalent to a no-through metal constructed casing. No-through metal construction will be inherent to all the component construction in the assembly.
2. All panels and access doors shall be double wall construction with R14 foam insulation for every 2” of construction. All foam insulation must be Greenguard certified®. Any insulation incorporating CFCs or HCFCs in its construction is strictly prohibited from this application.
3. Unit casing will have no exterior condensation at interior AHU temperatures down to 43F while unit exterior conditions are maintained at 95 F dry bulb / 85 F wet bulb. The air handling unit manufacturer general conrtuction shall be tested to demonstarate the thermal performance of the unit casing. The test shall include placing the entire test unit in a climate controlled environment and exposing the unit to the conditions mentioned previously. If the manufacturer does not have access to such equipment, an independent testing agent must be hired to transport the test unit to a qualified test facility, and perform the test at the expense of the manufacturer. Inability to provide this option to the

engineer will make the manufacturer ineligible to bid on this project he unit housing shall be constructed from a frame, base and panel assembly.

4. The panels shall be tested in accordance with SMACNA and ASHRAE 111 to have a deflection of no more than L/700 at 10'' and withstand air pressures up to 8" w.c with less than 1% leakage. Fire resistance of the panel will be in compliance with UL 94 rated at 5VA; and a flame spread / smoke development in compliance with UL 723 ASTM E84 Class 1 rating.
5. Thermo-Composite or aluminum panels shall be provided for the entire unit construction, including but not limited to, walls, doors, floors, roof, interior partitions, and electrical compartment. Panels shall be non-load bearing type.
6. The frame shall consist of anodized extruded aluminum profiles which incorporates a thermally broken construction; welded together for reinforcement and insulated for superior thermal performance.
7. Base structure shall be fully welded G-90, painted exterior, and have integral lifting lugs which can be removed once the unit is installed.
8. All roof and side wall seams shall be positively sealed to prevent water and air leakage. The OA and EA compartment shall have 1" PVC drains extended to exterior of unit
9. Access doors shall be provided to all major components to facilitate quick and easy access. Access doors will be made from the same material as the unit casing and shall incorporate thermal break construction. Fan access door(s) shall have Allegis type handles, with one handle interlinking multiple latches and threaded insert fastening handles for all remaining doors. If access doors do not open against unit operating pressure, provide safety latches that allow access doors to partially open after first handle movement and fully open after second handle movement. Removable panels provided for equipment pull out for coil(s), and air to air heat exchanger section(s) shall have key tooled threaded insert fasteners. Hinges shall be Nylon hinge type designed to open 180 degrees.
10. Unit shall have the entire exterior finished with a PVDF coating designed for UV resistance. Panels shall pass ASTM B117 3000-hour salt fog resistance test and ASTM D4585 3000-hour moisture condensation resistance test. In addition, paint must meet AAMA 620-02 standard for color, chalking, gloss retention, and abrasion resistance.

11. The air handler unit casing shall be provided with a lifetime warranty against corrosion resistance under normal use.

E. Intake Weather Hood:

1. The outdoor intake weather hood shall be completely constructed in aluminum for superior corrosion resistance. The hood shall ship loose for field installation by the installing contractor. Painted galvanized hoods shall not be acceptable due to its susceptibility to corrosion. The outdoor air hood shall be designed with a 4" extruded aluminum louver, bird screen and a plenum enclosure with drain holes. The louver blades shall be drainable type with a maximum 40 degree angle with integral rain baffle. The louver design shall not allow more than 0.01 oz/ft2 water penetration when tested in accordance to AMCA 500. The pressure drop of the complete hood assembly shall not exceed 0.1”wc at a maximum 500 fpm face velocity.

F. Exhaust Louver:

1. The exhaust air outlet louvers shall be 2" extruded aluminum, with non-restricting blade design and bird screen.

G. Enthalpy Wheel:

1. Enthalpy Wheel shall recover both sensible and latent heat. The matrix shall be constructed from corrugated aluminum and specifically treated and coated with Silica Gel desiccant to assist and enhance latent heat transfer. Segmented wheel shall be provided on diameter sizes above 96”.
2. Seals shall be full contact, low bleed type, made from dual band Ultra High Molecular Weight Polyethylene. Any seal that is non-contact is not to be considered a seal and will not acceptable.
3. Drive system shall be operated by a fractional horsepower motor (maximum 1 HP), reducing gear-box, pulley and v-belt. Belts shall be made of multi link high-tech urethane/polyester composite.
4. The wheel bearing shall be permanently sealed and press fitted into the wheel matrix for long life operation. Provide extended lubrication lines to grease fittings.
5. A double purge sector (2 x 5º) shall be factory installed to reduce cross contamination to under 0.04%.
6. Wheel speed shall not rotate faster than 20 rpm.
7. Media cleaning shall be accomplished with any of the following methods: compressed air, low pressure steam, hot water or light detergent without

degrading the latent recovery.

H. Sensible Wheel

1. Sensible Wheel shall recover sensible heat. The matrix shall be constructed from corrugated aluminum. Segmented wheel shall be provided on diameter sizes above 96".
2. Seals shall be full contact, low bleed type, made from dual band Ultra High Molecular Weight Polyethylene.
3. Drive system shall be operated by a fractional horsepower motor (maximum 1 HP), reducing gear-box, pulley and v-belt. Belts shall be made of multi link high-tech urethane/polyester composite.
4. The wheel bearing shall be permanently sealed and press fitted into the wheel matrix for long life operation. Provide extended lubrication lines to grease fittings.
5. Wheel speed shall not rotate faster than 20 rpm.
6. Media cleaning shall be accomplished with any of the following methods: compressed air, low pressure steam, hot water or light detergent without degrading the energy recovery.
7. Reheat control shall be accomplished by a variable speed drive.

I. Fan with Motor and Speed Controller:

1. The fans shall be carefully positioned and installed at an optimal distance to respect uniform airflow across the heat exchanger & coils.
2. Fans shall be direct drive. No fan belts will be acceptable for this application. Fans shall be compact, optimized and construction made of galvanized sheet steel with airfoil 7-blade high efficiency impeller, protected by an epoxy powder coating.
3. To reduce vibration, the impeller shall be balanced with hub to an admissible vibration severity of less than 2.8 mm/s in conformity with DIN ISO 14694 and proof shall be supplied for each individual impeller. Tests shall be made according to DIN ISO 1940 Part 1, quality of balancing G2.5/6.3.
4. The single inlet shall be mounted onto constant speed direct drive motor, equipped with an air flow optimized inlet cone from galvanized sheet steel. Fans shall have maintenance free ball bearings, closed on both sides, sealed for life.
5. Fans shall be completely certified as per ISO 5801 and in accordance to AMCA standards. Fans will require to be operated by a Variable speed drive.

6. The fan and motor assembly shall be directly wall mounted without isolation.
7. Fans will require to be operated by one speed controller per fan.
8. The input power section shall utilize a full wave 6-pulse bridge design incorporating diode rectifiers. The diode rectifiers shall convert AC line power of fixed voltage and frequency to fixed DC voltage. This power section shall be insensitive to phase sequence of the AC line voltage.
9. The output power section shall change fixed DC voltage to adjustable frequency AC voltage. This section shall utilize insulated gate bipolar transistors (IGBT's).
10. The speed controller includes 3 sets of user adjustable skip frequencies and choice of 0-5Vdc, 0-10Vdc or 4-20mA speed reference for input and output.

J. Filters
1. The air filters shall be as scheduled.
2. Each filter consist of pleated media, expanded metal on the downstream and enclosing with high wet-strength beverage board with diagonal support bonded on air entering and air exiting side of each pleat
3. Filters shall be placed in a completely sealed, galvanized holding frame with quick release latches for easy replacement.
4. Provide magnehelic gauges across all filter sections.
5. Refer to equipment schedules.

K. Dampers
1. Dampers shall be low leak type (Leakage Class 1A at 1 in. w.g. (0.25 kPa) static pressure differential) with rubber edges, opposed or parallel blades, and constructed from extruded aluminum.

L. Heating Water Coil
1. Coils shall be factory installed in the unit.
2. Primary surface shall be round seamless 5/8" OD copper tube with 0.018" wall thickness staggered in the direction of airflow. Secondary surface shall consist of a minimum 0.006" rippled aluminum plate fins for higher capacity and structural strength. Fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Tubes shall be mechanically expanded into the fins to provide a continuous primary to secondary compression bond over the entire finned length for maximum heat transfer rates.

3. Coils shall be circuited for counter-flow heat transfer to provide maximum mean effective temperature difference for maximum heat transfer rates.
4. Headers shall have intruded tube holes to provide a large brazing surface for maximum strength and inherent flexibility
5. Casing shall be constructed of continuous galvanized steel.
6. The complete coil shall be tested with 315 pounds air pressure under warm water and be suitable for operation at 250 psig working pressures. Maximum finned coil height shall be 60” and shall not exceed 500 FPM face velocity.

M. Chilled Water Coil
1. Coils shall be factory installed in the unit.
2. Primary surface shall be round seamless 5/8" OD copper tube with 0.018" wall thickness staggered in the direction of airflow. Secondary surface shall consist of a minimum 0.006” rippled aluminum plate fins for higher capacity and structural strength. Fins shall have full drawn collars to provide a continuous surface cover over the entire tube for maximum heat transfer. Tubes shall be mechanically expanded into the fins to provide a continuous primary to secondary compression bond over the entire finned length for maximum heat transfer rates.
3. Coils shall be circuited for counter-flow heat transfer to provide maximum mean effective temperature difference for maximum heat transfer rates.
4. Headers shall have intruded tube holes to provide a large brazing surface for maximum strength and inherent flexibility
5. Casing shall be constructed of continuous stainless steel.
6. The complete coil shall be tested with 315 pounds air pressure under warm water and be suitable for operation at 250 psig working pressures. Maximum finned coil height shall be 60” and shall not exceed 500 FPM face velocity.
7. Provide stainless steel IAQ drain pan under the coil extending past the coil to ensure condensate retention.

N. Power & Safety Control:
1. All wiring shall be accomplished by the manufacturer and must be tested under a high pot test.
2. A separate access door shall be provided with an approved locking device.
3. All electrical components contained in the panel shall be UL/CSA certified and labeled.

4. The unit shall be complete with VFDs, fuses, relays, terminals for main ON/OFF and step-down transformer. All components shall be factory wired for single point power connection by the manufacturer of the unit.
5. A non-fused safety disconnect switch shall be factory installed for on/off servicing.

2.02 CONTROLS

A. Manufacturer controller with BACNET I/P

B. Refer to Control Drawings and Section 25 4003 Building Automation System (BAS).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that site is ready to receive work and opening dimensions are as indicated on shop drawings.

B. Verify that proper power supply is available.

3.02 INSTALLATION

A. Install in accordance with ARI 435 and manufacturer's reccomendations and instructions.

B. Bolt sections together with gaskets.

C. Verify that the following items have been completed prior to scheduling the AHU manufacturer's final inspection and start up:

1. All spring-isolated components have had their shipping restraints removed and the components have been leveled.
2. On all field-joined units, that all interconnections have been completed, i.e., electrical and control wiring, piping, casing joints, bolting, welding, etc.
3. All water and steam piping connections have been completed and hydrostatically tested and all water flow rates have been set in accordance with the capacities scheduled on the Drawings.
4. All ductwork connections have been completed and all ductwork has been pressure tested for its intended service.
5. All power wiring, including motor starters and disconnects, serving the unit has been completed.
6. All automatic temperature and safety controls have been completed.
7. All dampers are fully operational.
8. All shipping materials have been removed.
9. All (clean) filter media has been installed in the units.

D. Leveling

1. Level all unit sections in accordance with the unit manufacturer's instructions. Provide and install all necessary permanent shim material to ensure individual sections and entire assembled units are level.

E. Install flexible duct connections between fan inlet and discharge ductwork and unit sections. Ensure that metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

F. Make connections to coils with unions or flanges.

G. Hydronic Coils:

1. Connect water supply to leaving air side of coil (counterflow arrangement).
2. Provide manual air vents at high points complete with stop valve.
3. Ensure water coils are drainable and provide drain connection at low points.

H. Insulate Coil Headers Located Outside Air Flow as Specified for Piping.

I. Field-wire each factory provided control for field installation.

J. The Contractor shall laser level all unit mounting surfaces, including housekeeping pads, roof curbs, and/or structural steel prior to rigging and installation of the units.

3.03 MANUFACTURER'S FIELD SERVICES

A. Provide the services of the equipment manufacturer technician or factory trained authorized equipment mechanic/ technician for starting and testing unit.

B. The equipment manufacturer technician or factory trained authorized equipment mechanic/ technician shall provide start-up and instruction for each unit, including energy recovery components and control system. The manufacturer may dispatch factory-trained technicians in the direct employ of the manufacturer's local authorized representative for field services as specified herein.

C. Start-up and instruction shall cover all components assembled and furnished by the manufacturer whether or not of his own manufacture.

3.04 FINAL INSPECTION AND START-UP SERVICE

A. After the Contractor has provided all water piping connections, ductwork connections, field control wiring, and all the field power wiring, the contractor shall inspect the installation. The contractor shall coordinate and partcipate in startup of the equipment.

B. The Building Automation System Contractor shall be scheduled to be at the job site at the time of the equipment start-up.

C. Perform the following tests and services and submit a report outlining the results:

D. Record date, time, and person(s) performing service.

E. Lubricate all moving parts.

F. Check all motor and starter power lugs and tighten as required.

G. Verify all electrical power connections.

H. Conduct a start up inspection per the manufacturer's recommendations.

I. Record fan motor voltage and amperage readings.

J. Check fan rotation and spin wheel to verify that rotation is free and does not rub or bind.

K. Check fan for excessive vibration.

L. Check V belt drive or coupling for proper alignment.

M. Check V belt drive for proper tension. Tighten the belts in accordance with the OAU manufacturer's directions. Check belt tension during the second and seventh day's operation and re-adjust belts, as may be required, to maintain proper tension as directed by the OAU manufacturer.

N. Remove all foreign loose material in ductwork leading to and from the fan and in the fan itself.

O. Disengage all shipping fasteners on vibration isolation equipment.

P. Check safety guards to insure they are properly secured.

Q. Secure all access doors to the fan, the unit and the ductwork.

R. Switch electrical supply "on" and allow fan to reach full speed.

S. Physically check each fan at start up and shut down to insure no abnormal or problem conditions exist.

T. Check entering and leaving air temperatures (dry bulb and wet bulb) and simultaneously record entering and leaving chilled water temperatures and flow, steam pressures and flow, and outside air temperature.

U. Check all control sequences.

3.05 DEMONSTRATION AND TRAINING

A. Demonstrate unit operation and maintenance to Owner's maintenance staff.

END OF SECTION 237200

SECTION 237313

MODULAR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. Rooftop hydronic air-handling units

1.02 REFERENCES

A. AMCA 99 - Standards Handbook.

B. AMCA 210 - Laboratory Methods of Testing Fans for Rating.

C. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.

D. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.

E. ANSI/NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

F. ASHRAE 62 - Ventilation and Indoor Air Quality in Building Design.

G. ARI 210 (Air-Conditioning and Refrigeration Institute) - Unitary Air-Conditioning Equipment.

H. ARI 260 - Sound Rating of Large Outdoor Refrigerating and Air-Conditioning Equipment.

I. ARI 270 (Air-Conditioning and Refrigeration Institute) - Sound Rating of Outdoor Unitary Equipment.

1.03 SUBMITTALS

A. Refer to Division 01 requirements.

B. Shop Drawings: Indicate components, accessories, capacity, weights and loadings, dimensions, and required clearances of manufactured products and assemblies. Indicate locations and sizes of field connections, and electrical service with electrical characteristics.

C. Product Data: Submit data indicating dimensions, rough-in connections, and electrical characteristics and connection requirements. Submit capacity and dimensions of manufactured products and assemblies required for this Project. Indicate duct connections. Submit data for manufactured products and assemblies. Indicate water, drain, valves, and rough-in connection requirements.

1. Filters: Data for filter media, filter performance data, filter assembly, and filter frames.

2. Fans: Performance and fan curves with specified operating point clearly plotted, power, RPM.

3. Electrical Requirements: Indicate electrical service with electrical characteristics and connection requirements. Power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.
4. Sound Power Level Data:
    a. Fan outlet and casing radiation at rated capacity.
    b. Indoor and outdoor sound power level data across all major octave band center frequencies for catalogued operating range of unit at gross total capacity range. Data shall be obtained in conformance with ARI 370-86 for outdoor sound levels and ARI 260 for indoor sound testing and rating standards. Sound data shall be supplied that meets or exceeds requirements shown in equipment schedules. (Data presented in sones or bels is not acceptable.)

D. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

E. Manufacturer's Installation Instructions: Submit assembly, support details, connection requirements, and include start-up instructions.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

G. Provide Manufacturer's start-up procedures, testing and checklists.

1.04 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of controls are separate from units.

B. Operation and Maintenance Data: Submit manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data. Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.

B. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

C. Protect equipment from damage by providing temporary covers until installation.

D. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

1.07 WARRANTY

A. Warranty periods shall begin from Date of Substantial Completion.

B. Provide a complete unit parts and labor warranty for 18 months.

PART 2 - PRODUCTS

2.01 ROOFTOP HYDRONIC AIR HANDLING UNITS

A. General:

1. Outdoor air handling unit shall include filters, supply fans, dampers,chilled water coils,exhaust fans,energy recovery wheels,and unit controls.
2. Unit shall be factory assembled and tested includingleak testing of the chilled water coils,and run testing of the completed unit. Run test report shall be supplied with the unit in the service compartment’s literature pocket.
3. Unit shall have decals and tags to indicate lifting and rigging, service areas and caution areas for safety and to assist service personnel.
4. Unit components shall be labeled, includingpipe stub outs,electrical and controls components.
5. Estimated sound power levels (dB) shall be shown on the unit ratings sheet.
6. Installation, Operation, and Maintenance manual shall be supplied within the unit.
7. Laminated color-coded wiring diagram shall match factory installed wiring and shall be affixed to the interior of the control compartment’s hinged access door.
8. Unit nameplate shall be provided in two locations on the unit, affixed to the exterior of the unit and affixed to the interior of the control compartment’s hinged access door.

B. Construction:

1. All cabinet walls, access doors, and roof shall be fabricated of double wall, impact resistant, rigid polyurethane foam panels.
2. Unit insulation shall have a minimum thermal resistance R-value of 13. Foam insulation shall have a minimum density of 2 pounds/cubic foot and shall be tested in accordance with ASTM D1929-11 for a minimum flash ignition temperature of 610°F.
3. Unit construction shall be double wall with G90 galvanized steel on both sides and a thermal break. Double wall construction with a thermal break prevents

moistureaccumulation on the insulation, provides a cleanable interior, reduces heat transfer through the panel, and prevents exterior condensation on the panel.

4. Unit shall be designed to reduce air leakage and infiltration through the cabinet. Cabinet leakage shall not exceed 1% of total airflow when tested at 3 times the minimum external static pressure provided in AHRIStandard 340/360. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, at a maximum 8 inches of positive or negative static pressure, to reduce air leakage. Deflection shall be measured at the midpointof the panel height and width. Continuous sealing shall be included between panels and between access doors and openings to reduce air leakage. Piping and electrical conduit through cabinet panels shall include sealing to reduce air leakage.
5. Roof of the air tunnel shall be sloped to provide complete drainage. Cabinet shall have rain break overhangs above access doors.
6. Access to filters, dampers,cooling coils,energy recovery wheels,and electrical and controls components shall be through hinged access doors with quarter turn, zinc cast, lockable handles. Full length stainless steel piano hinges shall be included on the doors.
7. Exterior paint finish shall be capable of withstanding at least 2,500 hours, with no visible corrosive effects, when tested in a salt spray and fog atmosphere in accordance with ASTM B 117-95 test procedure.
8. Units with cooling coils shall include double sloped 304 stainless steel drain pans.
9.
10. Unit shall be provided with base discharge and return air openings. All openings through the base pan of the unit shall have upturned flanges of at least 1/2 inch in height around the opening.
11. Unit shall include lifting lugs on the top of the unit.
12. Unit base pan shall be provided with 1/2 inch thick foam insulation.

C. Supply Fans:
1. Unit shall include direct drive, unhoused, backward curved, plenum supply fans.
2. Blowers and motors shall be dynamically balance and mounted on rubber isolators.
3. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.

4. Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be premium efficiency.

D. Exhaust Fans:
1. Exhaust dampers shall be sized for 100% relief.
2. Fans and motors shall be dynamically balanced.
3. Unit shall include barometric relief dampers.
4. Motors shall be premium efficiency ODP with ball bearings rated for 200,000 hours service with external lubrication points.
5. Access to exhaust fans shall be through double wall, hinged access doors with quarter turn lockable handles.
6. Unit shall include belt driven, unhoused, backward curved, plenum exhaust fans.
7. Variable frequency drives shall be factory wired and mounted in the unit. Fan motors shall be premium efficiency.

E. Enthalpy Wheel:
1. Enthalpy Wheel shall recover both sensible and latent heat. The matrix shall be constructed from corrugated aluminum and specifically treated and coated with Silica Gel desiccant to assist and enhance latent heat transfer. Segmented wheel shall be provided on diameter sizes above 96”.
2. The energy recovery component shall incorporate a rotary wheel in an insulated cassette frame complete with seals, drive motor and drive belt.
3. The energy recovery cassette shall be an Underwriters Laboratories Recognized Component for electrical and fire safety. The wheel drive motor shall be an Underwriters Laboratory Recognized Component and shall be mounted in thecassette frame and supplied with a service connector or junction box. Thermal performance shall be certified by the manufacturer in accordance with ASHRAE Standard 84, Method of Testing Air-to-Air Heat Exchangersand AHRI Standard 1060, Rating Air-to-Air Energy Recovery Ventilation Equipment. Cassettes shall be listed in the AHRI Certified Products.
4. Seals shall be full contact, low bleed type, made from dual band Ultra High Molecular Weight Polyethylene. Any seal that is non-contact is not to be considered a seal and will not acceptable.
5. Drive system shall be operated by a fractional horsepower motor (maximum 1 HP), reducing gear-box, pulley and v-belt. Belts shall be made of multi link high-tech urethane/polyester composite.

6. The wheel bearing shall be permanently sealed and press fitted into the wheel matrix for long life operation. Provide extended lubrication lines to grease fittings.
7. Wheel speed shall not rotate faster than 20 rpm.
8. Media cleaning shall be accomplished with any of the following methods: compressed air, low pressure steam, hot water or light detergent without degrading the latent recovery.

F. Electrical:
1. Unit shall have a 35kAIC SCCR and a factory wired circuit breaker.
2. Unit shall be provided with factory installed and factory wired circuit breaker.
3. Unit shall be provided with phase and brown out protection which shuts down all motors in the unit if the electrical phases are more than 10% out of balance on voltage, the voltage is more than 10% under design voltage or on phase reversal.
4. Unit shall be provided with remote stop/start terminals which require contact closure for unit operation. When these contacts are open the low voltage circuit is broken and the unit will not operate.

G. Filters
1. The air filters shall be as scheduled.
2. Each filter consist of pleated media, expanded metal on the downstream and enclosing with high wet-strength beverage board with diagonal support bonded on air entering and air exiting side of each pleat
3. Filters shall be placed in a completely sealed, galvanized holding frame with quick release latches for easy replacement.
4. Provide magnehelic gauges across all filter sections.
5. Refer to equipment schedules.

H. Outside Air Dampers/Economizer:
1. Unit shall include 0-100% economizer consisting of a motor operated outside air damper and return air damper assembly constructed of extruded aluminum, hollow core, airfoil blades with rubber edge seals and aluminum end seals.Damper blades shall be gear driven and designed to have no more than 20 cfm of leakage per sq ft. at 4 in. w.g. air pressure differential across the damper.Low leakage dampers shall be Class 2 AMCA certified, in accordance with AMCA Standard 511. Damper assembly shall be controlled by spring returnDDCactuator. Unit shall include outside air opening bird screen and

outside air hood. Unit, except for horizontal series, shall also include barometric relief dampers.

I. Heating Water Coil
   1. Coils shall be certified in accordance with AHRI Standard 410 and be hydrogen or helium leak tested.
   2. Coils shall be constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.
   3. Coil shall have half serpentine circuitry, two rows and 12 fins per inch.

J. Chilled Water Coil
   1. Coils shall be certified in accordance with AHRI Standard 410 and be hydrogen or helium leak tested.
   2. Coil shall be constructed of copper tubes with aluminum fins mechanically bonded to the tubes and galvanized steel end casings. Fin design shall be sine wave rippled.
   3. Coil shall have single serpentine circuitry, 6 rows and 12 fins per inch.
   4. Coils shall be factory installed in the unit.

K. Power & Safety Control:
   1. All wiring shall be accomplished by the manufacturer and must be tested under a high pot test.
   2. A separate access door shall be provided with an approved locking device.
   3. All electrical components contained in the panel shall be UL/CSA certified and labeled.
   4. The unit shall be complete with VFDs, fuses, relays, terminals for main ON/OFF and step-down transformer. All components shall be factory wired for single point power connection by the manufacturer of the unit.
   5. A non-fused safety disconnect switch shall be factory installed for on/off servicing.

L. Controls
   1. DDC controls are to be provided by others and are to be factory mounted. Outside Air Unit manufacturer shall will physically mount the DDC in the control panel, but will not be responsible for the programming and wiring of the DDC.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that site is ready to receive work and opening dimensions are as indicated on shop drawings.

B. Verify that proper power supply is available.

3.02 INSTALLATION

A. Install in accordance with ARI 435 and manufacturer's reccomendations and instructions.

B. Bolt sections together with gaskets.

C. Verify that the following items have been completed prior to scheduling the AHU manufacturer's final inspection and start up:

1. All spring-isolated components have had their shipping restraints removed and the components have been leveled.
2. On all field-joined units, that all interconnections have been completed, i.e., electrical and control wiring, piping, casing joints, bolting, welding, etc.
3. All water and steam piping connections have been completed and hydrostatically tested and all water flow rates have been set in accordance with the capacities scheduled on the Drawings.
4. All ductwork connections have been completed and all ductwork has been pressure tested for its intended service.
5. All power wiring, including motor starters and disconnects, serving the unit has been completed.
6. All automatic temperature and safety controls have been completed.
7. All dampers are fully operational.
8. All shipping materials have been removed.
9. All (clean) filter media has been installed in the units.

D. Leveling

1. Level all unit sections in accordance with the unit manufacturer’s instructions. Provide and install all necessary permanent shim material to ensure individual sections and entire assembled units are level.

E. Install flexible duct connections between fan inlet and discharge ductwork and unit sections. Ensure that metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

F. Make connections to coils with unions or flanges.

G. Hydronic Coils:

1. Connect water supply to leaving air side of coil (counterflow arrangement).
2. Provide manual air vents at high points complete with stop valve.
3. Ensure water coils are drainable and provide drain connection at low points.

H. Insulate Coil Headers Located Outside Air Flow as Specified for Piping.

I. Field-wire each factory provided control for field installation.

J. The Contractor shall laser level all unit mounting surfaces, including housekeeping pads, roof curbs, and/or structural steel prior to rigging and installation of the units.

3.03 MANUFACTURER'S FIELD SERVICES

A. Provide the services of the equipment manufacturer technician or factory trained authorized equipment mechanic/ technician for starting and testing unit.

B. The equipment manufacturer technician or factory trained authorized equipment mechanic/ technician shall provide start-up and instruction for each unit, including energy recovery components and control system. The manufacturer may dispatch factory-trained technicians in the direct employ of the manufacturer's local authorized representative for field services as specified herein.

C. Start-up and instruction shall cover all components assembled and furnished by the manufacturer whether or not of his own manufacture.

3.04 FINAL INSPECTION AND START-UP SERVICE

A. After the Contractor has provided all water piping connections, ductwork connections, field control wiring, and all the field power wiring, the contractor shall inspect the installation. The contractor shall coordinate and partcipate in startup of the equipment.

B. The Building Automation System Contractor shall be scheduled to be at the job site at the time of the equipment start-up.

C. Perform the following tests and services and submit a report outlining the results:

D. Record date, time, and person(s) performing service.

E. Lubricate all moving parts.

F. Check all motor and starter power lugs and tighten as required.

G. Verify all electrical power connections.

H. Conduct a start up inspection per the manufacturer's recommendations.

I. Record fan motor voltage and amperage readings.

J. Check fan rotation and spin wheel to verify that rotation is free and does not rub or bind.

K. Check fan for excessive vibration.

L. Check V belt drive or coupling for proper alignment.

M. Check V belt drive for proper tension. Tighten the belts in accordance with the AHU manufacturer's directions. Check belt tension during the second and seventh day's operation and re-adjust belts, as may be required, to maintain proper tension as directed by the AHU manufacturer.

N. Remove all foreign loose material in ductwork leading to and from the fan and in the fan itself.

O. Disengage all shipping fasteners on vibration isolation equipment.

P. Check safety guards to insure they are properly secured.

Q. Secure all access doors to the fan, the unit and the ductwork.

R. Switch electrical supply "on" and allow fan to reach full speed.

S. Physically check each fan at start up and shut down to insure no abnormal or problem conditions exist.

T. Check entering and leaving air temperatures (dry bulb and wet bulb) and simultaneously record entering and leaving chilled water temperatures and flow, steam pressures and flow, and outside air temperature.

U. Check all control sequences.

3.05 DEMONSTRATION AND TRAINING

A. Demonstrate unit operation and maintenance to Owner's maintenance staff.

END OF SECTION 237313

SECTION 238124

COMPUTER ROOM AIR CONDITIONERS - FLOOR MOUNTED

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cabinet
B. Direct Expansion DX System
C. Coils
D. Electric Heat
E. Humidifier
F. Fans
G. Controls
H. Accessories

1.02 RELATED REQUIREMENTS

A. Section 212200 - Clean-Agent Fire-Extinguishing System: Interlock with fire suppression system.

1.03 REFERENCE STANDARDS

A. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2012, with 2015 amendments.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide for manufactured products and assemblies. Indicate water, drain, refrigeration, rough-in connections, and electrical characteristics and connection requirements.
C. Shop Drawings: Indicate manufactured products and assemblies. Indicate water, drain, refrigeration, rough-in connections, and electrical characteristics and connection requirements.
D. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.
E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, and maintenance and repair data.
F. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.05 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
B. Warranty: 1 year standard, 5 years on compressors.

PART 2 PRODUCTS

2.01 AIR CONDITIONING UNIT CONSTRUCTION

A. Caninet

1. Single-wall insulated panels, heavy gauge galvanized steel with powder-coat paint finish.
2. Insulation to be 1 inch high density 2 lb/f t2 closed cell foam.
3. Drain pan: Stainless steel, insulated.

B. Assembly: Up-flow air delivery, in draw-through configuration.

2.02 SUPPLY FANS AND MOTORS

A. Fan: Direct Drive ECM, Backward-inclinded, high high efficiency impeller.

B. Motor: Size as indicated drawings. Maintenance free, permanently lubricated deep-groove bearings. Service factor 1.15

2.03 DIRECT EXPANSION (DX) COOLING SYSTEM

A. Compressors: Dual circuit, fixed speed, digital scroll.

B. Refrigeration Circuits: Thermal expansion valve with external equalizer, liquid line solenoid valve, liquid line filter-drier, refrigerant sight glass with moisture indicator, service shut-off valves and charging valves and accumulator sized for liquid seal under light load. Crankcase heater, low ambient control. Refrigerant to be R-410A with overload protection.

C. Condenser coil: Aluminum-plate fin and seamless copper tube in galvanized steel casing.

D. Condenser fan: Direct drive ECM axial propeller.

2.04 DIRECT EXPANSION EVAPORATOR COILS

A. Alternate row circuits, direct expansion cooling coils of seamless copper tubes expanded into aluminum fins in A-frame configuration.

B. Mount coil assembly in stainless steel drain pan.

2.05 CHILLED WATER COILS (CRAC-3)

A. Aluminum-plate fin and seamless copper tube in galvanized steel casing. Factory installed 2-way modulating control valve, rated for 300 psig.

2.06 FILTERS

A. Media: Pleated, lofted, non-woven, reinforced cotton fabric; supported and bonded to welded wire grid; enclosed in cardboard frame; 4 inch nominal thickness.

B. Minimum Efficiency Reporting Value (MERV): 8, when tested in accordance with ASHRAE Std 52.2.

2.07 MICROPROCESSOR CONTROL SYSTEM

A. BMS Communication: BACnet IP

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that flooring system is ready to receive work and opening dimensions are as indicated on shop drawings.

B. Verify that proper power supply is available and of the correct characteristics.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Coordinate installation of computer room air conditioning units with computer room raised floor installer.

C. Complete all ductwork, refrigerant piping, control, power wiring, and other service connections in accordance with Division 23 and Division 26.

D. Verify unit has been leak checked in accordance with manufacturer’s requirements and provided with an appropriate starting charge when breaking vacuum.

E. Provide adequate drainage connections for water cooled units.

3.03 FIELD QUALITY CONTROL

3.04 SYSTEM STARTUP

A. Prepare and start systems. Set initial temperature and humidity set points.

B. Engage a factory-authorized service representative to test and inspect components, assemblies, equipment installation, and final connection.

C. The factory-authorized service representative shall complete all tests as required by the manufacturer.

D. Prepare and submit startup report to manufacturer.

END OF SECTION 238124

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SECTION 238200
CONVECTION HEATING AND COOLING UNITS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Fan-coil units.

B. Wall mounted fan-coil units.

1.02 RELATED REQUIREMENTS

A. Section 230719 - HVAC Piping Insulation.

B. Section 232113 - Hydronic Piping.

C. Section 232114 - Hydronic Specialties.

D. Section 233100 - HVAC Ducts and Casings.

1.03 REFERENCE STANDARDS

A. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI); current edition at www.ahrinet.org.

B. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils; 2001 (R2011).

C. AHRI 440 - Performance Rating of Room Fan-Coil Units; 2008.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

F. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Rev. 2009).

1.04 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Provide typical catalog of information including arrangements.

C. Shop Drawings

1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
2. Indicate air coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.
3. Submit sound power data shall be provided as etablished by AMCA Standard 350 procedures. Submittal may be rejected if sound power level data is more than 5 dB higher in the 63 Hz octave band or 3 dB higher in any other octave band when compared against the specified unit.

4. Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.
5. Submit the following for blower-coil units indicating:
    a. Overall dimensions including installation, operation, and service clearances.
    b. Unit shopping, installation, and operating weights including dimensions.
    c. Fan curves with specified operating point clearly plotted.
    d. Safety and start-up instructions.

D. Manufacturer's Instructions: Indicate installation instructions and recommendations.

E. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access or valving.

F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

G. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 WARRANTY

A. Refer to Division 01 requirements.

PART 2 - PRODUCTS

2.01 FAN-COIL UNITS

A. Performance Data and Safety Requirements:
1. Unit capacities certified in accordance with AHRI 440.
2. Provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL), Intertek (ETL), or testing firm acceptable to Authority Having Jurisdiction as suitable for the purpose indicated.
3. Insulation to comply with NFPA 90A requirements for flame spread and smoke generation.
4. Equipment wiring to comply with requirements of NFPA 70.

B. Required Directory Listings: AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI).

C. Coils:

1. Evenly spaced aluminum fins mechanically bonded to copper tubes.
2. Water Coil: Suitable for working temperatures not less than 200 degrees F.
3. Provide drain pan under cooling coil easily removable for cleaning.

D. Vertical Cabinet and Horizontal Exposed Units: Minimum 18 gage, 0.0478 inch thick sheet steel with exposed corners and edges rounded, easily removed panels, glass fiber insulation, integral air outlet, and inlet grilles.

E. Finish: Factory applied baked primer coat on visible surfaces of enclosure or cabinet.

F. Fans: Centrifugal forward-curved double-width wheels, statically and dynamically balanced, direct driven.

G. Motor: Tap wound multiple speed electrically commutated motor with sleeve bearings, resiliently mounted. ECM compatible with 0-10 VDC signal.

H. Filter: Easily removed 1 inch thick glass fiber throw-away type, located to filter air before coil.

2.02 WALL MOUNTED FAN-COILS

A. General:

1. Unit shall be factory assembled and tested chilled and hot water.
2. Containted within the unit shall be all factory wiring, piping, associated controls and special accessories.

B. Unit Cabinet:

1. Composed of high impact polymers.
2. Shall be internally insulated to ensure quiet operation.

C. Fan Motors:

1. Fan motors shall be multi-speed, direct drive.
2. Totally enclosed.
3. Internal overload protection.

D. Blower Wheels:

1. Blower wheels shall be dynamically balanced.

E. Water Coil:

1. Manufactured using 3/8" copper tubing mechanically bonded to aluminum fins.
2. Maximum operating pressure is 150 psi.
3. Maximum inlet water temperature 160°F.

F. Drain Pan:

1. Shall be molded with high impact polymers.
2. The exterior of all drain pans shall be insulated with closed cell insulation to prevent condensation.
3. Pans shall contain flexibile drain tubing that is accessible from the back of the unit.

G. Filters:
1. Unit shall contain washable filters.

H. Controls:
1. Fan coils shall be completely factory wired and tested.
2. Controls shall include a circuit board, room sensor, indoor coil thermistor, transformer, and wireless remote.
3. Controls shall be capable of incorporating an optional hard-wired thermostat.

2.03 BLOWER-COIL UNITS

A. Performance Data and Safety Requirements:
1. Coils rated and tested in accordance with AHRI 410.
2. Provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL), Intertek (ETL), or testing firm acceptable to Authority Having Jurisdiction as suitable for the purpose indicated.
3. Comply with NFPA 90A for unit construction, including filters and related equipment, for protection of life and property from fire, smoke, and gases resulting from conditions having manifestations similar to fire.

B. Unit Casing:
1. Fabricate from heavy gage galvanized steel sheet.
2. Insulate inside walls with 1 inch thick, fiberglass insulation for thermal and acoustical control.
3. Provide access panels allowing servicing of coils, drain pan, fan, motor, and drive.
4. Provide knockouts or hanger rod holes at all four corners for suspended units.

C. Air Coils:
1. Aluminum fins mechanically expanded or bonded to copper tubes having standard sweat connections.
a. Water: Manual, automatic or self-venting, designed to a working pressure and temperature of not less than 250 psig and 200 degrees F.

D. Fans: Forward curved, centrifugal blower, dynamically balanced, adjustable speed direct drive with fan shaft supported by heavy-duty, permanently sealed ball bearings.

E. Drain Pan: Cleanable, one-piece construction of stainless steel; with drain connection and sloped for positive drainage.

F. Filters: Fully accessible, flat filter rack with pleated media filters.

G. Motors: Muliple speed electrically commutated motor, wired to unit junction box, and mounted on a resilient motor base.

H. Electrical Controls:

1. 24-volt control circuit transformer.
2. Terminal strip for connection of field wiring.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are suitable for installation.

B. Verify that field measurements are as indicated on drawings.

3.02 INSTALLATION

A. Install in accordance with manufacturer's recommendations.

B. Install equipment exposed to finished areas after walls and ceilings are finished and painted.

C. Do not damage equipment or finishes.

D. Fan-Coil Units:

1. Install as indicated.
2. Coordinate to ensure correct recess size for recessed units.

E. Units with Hydronic Coils:

1. If not easily accessible, extend air vent to exterior surface of cabinet for ease of servicing.

F. Units with Cooling Coils: Connect drain pan to condensate drain.

G. Blower-Coil Units:

1. Verify all surfaces and openings at unit location can suitably accommodate unit(s).
2. Install in accordance with manufacturer's recommendations.
3. General piping installation requirements are specified in other Sections and drawings indicate general arrangement of piping, fittings, and specialties.
4. Connect hydronic, condensate drain, and overflow drain piping to unit.

3.03 CLEANING

A. After construction and painting is completed, clean exposed surfaces of units.

B. Vacuum clean coils and inside of units.

C. Touch-up marred or scratched surfaces of factory-finished cabinets using finish materials furnished by the manufacturer.

D. Install new filters.

3.04 CLOSEOUT ACTIVITIES

A. See Section 017800 - Closeout Submittals, for closeout submittals.

B. See Section 017900 - Demonstration and Training, for additional requirements.

3.05 PROTECTION

A. Provide finished units with protective covers during the balance of construction.

END OF SECTION 238200

SECTION 254002

BUILDING AUTOMATION SYSTEM (BAS)

PART 1 - GENERAL

1.01 GENERAL

A. The system has been prebid to the Owner and the proposal amount shall be provided directly to the Owner

B. Supplier: SIEMENS – Virginia

C. Manufacturer: **Siemens Industry, Inc.**

D. BAS Contractor shall be responsible for all BAS and Temperature Control wiring, components, conduit, and sensors for a complete and operable system. The BAS Contractor shall coordinate their work with all other trades prior to fabrication of systems and commencement of installation. It shall be the responsibility of the BAS Contractor to review the work of other trades (including, but not limited to architectural, fire alarm, plumbing, HVAC, and electrical) as it affects their work, and as their work affects other trades, to insure that the Construction Documents are closely followed. Where discrepancies arise, they shall promptly be referred to the Architect/Engineer for resolution before proceeding with the Work.

1.02 SCHEDULING

A. Refer to Division 01 requirements.

B. BAS Contractor shall adequately staff the project and shall be responsible for sequencing, scheduling and coordinating the Work, for monitoring the progress of the Work, and for taking appropriate action to keep the Work on schedule.

C. BAS Contractor shall cooperate in the development of Construction Schedules to meet the Owner’s substantial completion and final occupancy dates.

1.03 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Pressure and temperature sensor wells & sockets.

B. Control valves.

C. Flow meters.

D. Dampers not internal to the provided equipment.

E. Variable frequency drives, unless noted otherwise.

1.04 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Low voltage interlock wiring to HVAC equipment for Smoke Detectors/Fire Stats.

1.05 PRODUCTS NOT FURNISHED OR INSTALLED BUT INTEGRATED WITH THE WORK OF THIS SECTION

A. Coordination Meeting:

1. The BAS Contractor shall meet with the Installer(s) furnishing all of the products controlled by the BAS to coordinate details of the interface between these products and the DDC network. The Owner or his designated representative shall be present at this meeting. Each Installer shall provide the Owner and all other Installers with details of the proposed interface with the DDC network.
    a. The Contractor shall be responsible for submitting written meeting minutes, clearly indicating items discussed and detail of the coordinated interface between all or the products and the BAS.

1.06 RELATED SECTIONS

A. The General Conditions of the Contract, Supplementary Conditions, and General Requirements are part of this Specification and shall be used in conjunction with this section as part of the Contract Documents.

1.07 DESCRIPTION

A. General: The control system shall consist of a high-speed, peer-to-peer network of DDC controllers and a web-based operator interface. Depict each mechanical system and building floor plan by a point-and-click graphic. A web server with a network interface card shall gather data from this system and generate web pages accessible through a conventional web browser on each PC connected to the network. Operators shall be able to perform all normal operator functions through the web browser interface.

B. The system shall directly control systems as indicated on the Control Drawings. Each controller shall provide occupied and unoccupied modes of operation by individual zone. Furnish energy conservation features such as optimal start and stop, night setback, request-based logic, and demand level adjustment of setpoints as specified.

1.08 SYSTEM PERFORMANCE

A. Table 1 - Reporting Accuracy (Measured Variable: Reported Accuracy)
    1. Space Temperature: ±0.5ºC (±1ºF)
    2. Ducted Air: ±0.5ºC (±1ºF)
    3. Outside Air: ±1.0ºC (±2ºF)
    4. Dew Point: ±1.5ºC (±3ºF)
    5. Water Temperature: ±0.5ºC (±1ºF)
    6. Delta-T: ±0.15ºC (±0.25ºF)
    7. Relative Humidity: ±5% RH
    8. Water Flow: ±2% of full scale
    9. Airflow (terminal): ±10% of full scale (see Note 1)

10. Airflow (measuring stations): ±5% of full scale
11. Airflow (pressurized spaces): ±3% of full scale
12. Air Pressure (ducts): ±25 Pa (±0.1 in. w.g.)
13. Air Pressure (space): ±3 Pa (±0.01 in. w.g.)
14. Water Pressure: ±2% of full scale (see Note 2)
15. Electrical (A, V, W, Power Factor): ±1% of reading (see Note 3)
16. Carbon Monoxide (CO): ±5% of reading
17. Carbon Dioxide (CO2): ±50 ppm
18. Nitrogen Dioxide: ±5% of reading
19. Note 1: Accuracy applies to 10% - 100% of scale.
20. Note 2: For both absolute and differential pressure.
21. Note 3: Not including Utility(Owner)-supplied meters.

B. Table 2 - Control Stability and Accuracy (Controlled Variable: Control Accuracy: Range of Medium)
   1. Air Pressure: ±50 Pa: (±0.2 in wg), ±3 Pa (±0.01 in wg): 0-1.5 kPa (0-6 in wg), -25 to 25 Pa (-0.1 to 0.1 in wg)
   2. Airflow: ±10% of full scale
   3. Space Temperature: ±1.0ºC (±2.0ºF)
   4. Duct Temperature: ±1.5ºC (±3ºF)
   5. Humidity: ±5% RH
   6. Fluid Pressure: ±10 kPa (±1.5 psi), ±250 Pa (±1.0 in wg): MPa (1-150 psi), 0-12.5 kPa (0-50 in wg) differential

1.09 SUBMITTALS

A. Refer to Division 01 Requirements.

B. Product Submittal Requirements: Provide 11”x17” shop drawings and other submittals on hardware, software, and equipment to be installed or furnished as electronic (pdf) files. Provide submittals within 6 weeks of receipt of approved equipment submittals.

C. Begin no work until submittals have been approved for conformity with design intent.

D. Direct Digital Control System Hardware
   1. Complete bill of materials indicating quantity, manufacturer, model number, and relevant technical data of equipment to be used.
   2. Manufacturer's description and technical data such as performance curves, product specifications, and installation and maintenance instructions for all provided control devices.

3. Wiring diagrams and layouts for each control panel. Show termination numbers.
4. Floor plan schematic diagrams indicating controller locations and comm. layout.

E. Controlled Systems
1. Schematic diagram of each controlled system. Label control points with point names. Graphically show locations of control elements.
2. Schematic wiring diagram of each controlled system. Label control elements and terminals. Where a control element is also shown on control system schematic, use the same name.
3. Instrumentation list (Bill of Materials) for each controlled system. List each control system element in a table.
4. Complete description of control system operation including sequences of operation. Include and reference schematic diagram of controlled system. I/O points and software points specified on Control Drawings. Indicate alarmed and trended points.

F. When manufacturer's cut sheets apply to a product series rather than a specific product, clearly indicate applicable data by highlighting or by other means. Clearly reference covered specification and drawing on each submittal. General catalogs shall not be accepted as cut sheets to fulfill submittal requirements.

G. Project Record Documents. Submit three copies of record (as-built) documents upon completion of installation for approval prior to final completion.

1.10 WARRANTY

A. Refer to Division 01 Requirements.

B. Warranty period shall begin at Date of Substantial Completion.

C. Warrant work as follows:
1. The Contractor warrants to the Owner for a period of one year from date of substantial completion that materials and equipment furnished under the Purchase Order shall be good quality and new, that Contractor’s work shall be free from defects and that the Work shall conform to the requirements of the Purchase Order.

1.11 OWNERSHIP OF PROPRIETARY MATERIAL

A. Project-specific software and documentation shall become Owner's property. This includes, but is not limited to:
1. Graphics.
2. Record drawings.
3. Database.

4. Application programming code.
5. Documentation.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Use new products the manufacturer is currently manufacturing and selling for use in new installations. Do not use this installation as a product test site unless explicitly approved in writing by Owner. Spare parts shall be available for at least five years after completion of this contract.

2.02 COMMUNICATION

A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet internetwork. Controller and operator interface communication shall conform to ANSI/ASHRAE Standard 135, BACnet.

B. Install new wiring and network devices as required to provide a complete and workable control network. Use existing Ethernet backbone for network segments marked ‘existing’ on Control Drawings.

2.03 OPERATOR INTERFACE

A. Communication. Web server, workstation, and controllers shall communicate using BACnet protocol. Web server, workstation, and control network backbone shall communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing as specified in ANSI/ASHRAE 135, BACnet Annex J.

2.04 CONTROLLER SOFTWARE

A. Building and energy management application software shall reside and operate in system controllers. Applications shall be editable through operator workstation, web browser interface, or workstation.

2.05 CONTROLLERS

A. General. Provide Building Controllers (BC), Advanced Application Controllers (AAC), Application Specific Controllers (ASC), Smart Actuators (SA), and Smart Sensors (SS) as required to achieve sequence on Control Drawings. Every device in the system which executes control logic and directly controls HVAC equipment must conform to a standard BACnet Device profile as specified in ANSI/ASHRAE 135, BACnet Annex L. Unless otherwise specified, hardwired actuators and sensors may be used in lieu of BACnet Smart Actuators and Smart Sensors.

B. All interfaces shall be BACnet unless specifically stated otherwise.

2.06 INPUT AND OUTPUT INTERFACE

A. General. Hard-wire input and output points to BCs, AACs, ASCs, or SAs.

B. Protection. Shorting an input or output point to itself, to another point, or to ground shall cause no controller damage. Input or output point contact with up to 24 V for any duration shall cause no controller damage.

2.07 POWER SUPPLIES AND LINE FILTERING

A. Power Supplies. Control transformers shall be UL listed. Furnish Class 2 current-limiting type or furnish over-current protection in primary and secondary circuits for Class 2 service in accordance with NEC requirements. Limit connected loads to 80% of rated capacity.

B. Provide Uninterrupted Power Supply (UPS) in accordance with Control Drawings.

2.08 AUXILIARY CONTROL DEVICES

A. Motorized Control Dampers.

1. Type. Control dampers shall have linear flow characteristics and shall be parallel or opposed-blade type as specified below or as scheduled on drawings.
    a. Outdoor and return air mixing dampers and face-and-bypass dampers shall be parallel-blade and shall direct airstreams toward each other.
    b. Other modulating dampers shall be opposed-blade.
    c. Two-position shutoff dampers shall be parallel or opposed-blade with blade and side seals.
2. Frame. Damper frames shall be 13 gauge galvanized steel channel or 1/8 in. extruded aluminum with reinforced corner bracing.
3. Blades. Damper blades shall not exceed 8 in. in width or 48 in. length. Blades shall be suitable for medium velocity 2000 fpm performance. Blades shall be not less than 16 gauge.
4. Shaft Bearings. Damper shaft bearings shall be as recommended by manufacturer for application, oil impregnated sintered bronze, or better.
5. Seals. Blade edges and frame top and bottom shall have replaceable seals of butyl rubber or neoprene. Side seals shall be spring-loaded stainless steel. Blade seals shall leak no more than 10 cfm per ft2 at 1000 Pa (4 in. w.g.) differential pressure. Blades shall be airfoil type suitable for wide-open face velocity of 1500 fpm.
6. Sections. Damper sections shall not exceed 48 in. - 60 in. Each section shall have at least one damper actuator.
7. Linkages. Dampers shall have exposed linkages.
8. Dampers internal to mechanical equipment will be supplied by the equipment vendor following these guidelines.

B. Electric Damper and Valve Actuators.
   1. Stall Protection. Mechanical or electronic stall protection shall prevent actuator damage throughout the actuator's rotation.
   2. Spring-return Mechanism. Actuators used for power-failure and safety applications shall have an internal mechanical spring-return mechanism or an uninterruptible power supply (UPS).
   3. Signal and Range. Proportional actuators shall accept a 0-10 Vdc or a 0-20 mA control signal and shall have a 2-10 Vdc or 4-20 mA operating range.
   4. Wiring. 24 Vac and 24 Vdc actuators shall operate on Class 2 wiring.
   5. Manual Positioning. Operators shall be able to manually position each actuator when the actuator is not powered. Non-spring-return actuators shall have an external manual gear release. Spring-return actuators with more than 60 in.-lb torque capacity shall have a manual crank.

C. Control Valves.
   1. General. Select body and trim materials in accordance with manufacturer's recommendations for design conditions and service shown.
   2. Type. Provide two way control valves for two-position or modulating service as indicated on control drawings.
   3. Water Valves.
      a. Close-off (Differential) Pressure Rating. Valve actuator and trim shall provide the following minimum close-off pressure ratings.
         1) Two-way: 150% of total system (pump) head.
      b. Ports. Valves providing modulating service shall have equal percentage ports.
      c. Sizing.
         1) Two-position service: line size.
         2) Two-way modulating service: pressure drop less than 3 psi.
      d. Fail Position. Water valves shall fail normally open or closed as follows unless otherwise specified.
         1) Water zone valves: normally open.
         2) Heating water control valves: normally open.
         3) Chilled water control valves: normally closed.
         4) Other applications: as scheduled or as required by sequences of operation.

D. Binary Temperature Devices.

1. Low-Voltage Space Thermostats. Low-voltage space thermostats shall be 24 V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed setpoint adjustment, 55°F-85°F setpoint range, 2°F maximum differential, and vented ABS plastic cover.
2. Line-Voltage Space Thermostats. Line-voltage space thermostats shall be bimetal-actuated, open-contact type or bellows-actuated, enclosed, snap-switch type or equivalent solid-state type, with heat anticipator, UL listing for electrical rating, concealed setpoint adjustment, 55°F-85°F setpoint range, 2°F maximum differential, and vented ABS plastic cover.
3. Low-Limit Thermostats. Low-limit airstream thermostats shall be UL listed, vapor pressure type. Element shall be at least 6 m (20 ft) long. Element shall sense temperature in each 30 cm (1 ft) section and shall respond to lowest sensed temperature. Low-limit thermostat shall be manual reset only.

E. Temperature Sensors.
1. Type. Temperature sensors shall be Resistance Temperature Device (RTD) or thermistor.
2. Duct Sensors. Duct sensors shall be single point or averaging as shown. Averaging sensors shall be a minimum of 5 ft in length per 10 ft^2 of duct cross-section.
3. Immersion Sensors. Provide immersion sensors with a separable stainless steel well. Well pressure rating shall be consistent with system pressure it will be immersed in. Well shall withstand pipe design flow velocities.
4. Space Sensors. Space sensors shall have setpoint adjustment, override switch, display, and communication port as shown.
5. Differential Sensors. Provide matched sensors for differential temperature measurement.

F. Humidity Sensors.
1. Duct and room sensors shall have a sensing range of 20%-80%.
2. Duct sensors shall have a sampling chamber.
3. Outdoor air humidity sensors shall have a sensing range of 20%-95% RH and shall be suitable for ambient conditions of 40°F-170°F.
4. Humidity sensors shall not drift more than 1% of full scale annually.

G. Relays.
1. Control Relays. Control relays shall be plug-in type, UL listed, and shall have dust cover and LED "energized" indicator. Contact rating, configuration, and coil

voltage shall be suitable for application.

H. Current Transmitters.

1. AC current transmitters shall be self-powered, combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 4-20 mA two-wire output. Full-scale unit ranges shall be 10 A, 20 A, 50 A, 100 A, 150 A, and 200 A, with internal zero and span adjustment. Unit accuracy shall be ±1% full-scale at 500 ohm maximum burden.
2. Transmitter shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized.
3. Unit shall be split-core type for clamp-on installation on existing wiring.

I. Current Switches.

1. Current-operated switches shall be self-powered, solid-state with adjustable trip current. Select switches to match application current and DDC system output requirements.

J. Pressure Transducers.

1. Transducers shall have linear output signal and field-adjustable zero and span.
2. Continuous operating conditions of positive or negative pressure 50% greater than calibrated span shall not damage transducer sensing elements.
3. Water pressure transducer diaphragm shall be stainless steel with minimum proof pressure of 150 psi. Transducer shall have 4-20 mA output, suitable mounting provisions, and block and bleed valves.
4. Water differential pressure transducer diaphragm shall be stainless steel with minimum proof pressure of 150 psi. Over-range limit (differential pressure) and maximum static pressure shall be 300 psi. Transducer shall have 4-20 mA output, suitable mounting provisions, and 5-valve manifold.

K. Differential Pressure Switches. Differential pressure switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum) and shall have scale range and differential suitable for intended application and NEMA 1 enclosure unless otherwise specified.

L. Space Sensor Cover.

1. Cover shall prevent tampering, physical damage and unauthorized adjustment of sensor. Low-profile design, constructed of thick, durable polycarbonate complete with airflow openings and key lock protection.
2. Capable of horizontal or vertical mounting.
3. Bapi-guard, or equivilent.

2.09 WIRING AND RACEWAYS

A. General. Provide copper wiring, plenum cable, conduit, and raceways as specified in applicable sections of Division 26.

B. Insulated wire shall use copper conductors and shall be UL listed for 200°F minimum service.

C. Class 2 wiring in concealed, accessible areas shall may be plenum rated, run without raceway.

D. Wall runs for zone sensors, etc. on existing walls may be run in wire mould.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Thoroughly examine project plans for control device and equipment locations. Report discrepancies, conflicts, or omissions to Architect or Engineer for resolution before starting rough-in work.

B. Inspect site to verify that equipment can be installed as shown. Report discrepancies, conflicts, or omissions to Engineer for resolution before starting rough-in work.

C. Examine drawings and specifications for work of others. Report inadequate headroom or space conditions or other discrepancies to Architect/Engineer and obtain written instructions for changes necessary to accommodate work with work of others. BAS Contractor shall perform at his expense necessary changes in specified work caused by failure or neglect to report discrepancies.

3.02 PROTECTION

A. BAS Contractor shall protect against and be liable for damage to work and to material caused by Contractor's work or employees.

B. BAS Contractor shall be responsible for work and equipment until inspected, tested, and accepted. Protect material not immediately installed.

3.03 COORDINATION

A. Site.

1. Assist in coordinating space conditions to accommodate the work of each trade where work will be installed near or will interfere with work of other trades. If installation without coordination causes interference with work of other trades, Contractor shall correct conditions without extra charge.
2. Coordinate and schedule work with other work in the same area and with work dependent upon other work to facilitate mutual progress.

B. Test and Balance.

1. Provide Test and Balance Contractor a single set of necessary tools to interface to control system for testing and balancing.
2. Train Test and Balance Contractor to use control system interface tools.
3. Provide a qualified technician to assist with testing and balancing one of each controller type.
4. Test and Balance Contractor shall return tools undamaged and in working condition at completion of testing and balancing.

C. Life Safety.

1. Duct smoke detectors required for HVAC equipment shutdown are provided under Division 28. Interlock smoke detectors to associated units for shutdown as indicated on Control Drawings.
2. Fire damper and associated control is provided by Fire Alarm Contractor and is not monitored by the BAS.

3.04 GENERAL WORKMANSHIP

A. Install equipment, piping, and wiring or raceway horizontally, vertically, and parallel to walls wherever possible.

B. Provide sufficient slack and flexible connections to allow for piping and equipment vibration isolation.

C. Install equipment in readily accessible locations as defined by National Electrical Code (NEC) Chapter 1 Article 100 Part A.

3.05 FIELD QUALITY CONTROL

A. Work, materials, and equipment shall comply with rules and regulations of applicable local, state, and federal codes and ordinances.

B. Continually monitor field installation for code compliance and workmanship quality.

C. BAS Contractor shall participate in work inspection by authorities having jurisdiction, as required.

3.06 WIRING

A. Control and interlock wiring and installation shall comply with national and local electrical codes, Division 26, and manufacturer's recommendations.

B. NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway as specified by NEC and Division 26.

C. Low-voltage wiring shall meet NEC Class 2 requirements. Subfuse low-voltage power circuits as required to meet Class 2 current limit.

D. NEC Class 2 (current-limited) wires not in raceway but in concealed and accessible locations such as return air plenums shall be UL listed for the intended application.

E. Install wiring in raceway where subject to mechanical damage and at levels below 3 m (10ft) in mechanical, electrical, or service rooms.

F. Install Class 1 and Class 2 wiring in separate raceways. Boxes and panels containing high-voltage wiring and equipment shall not be used for low-voltage wiring except for the purpose of interfacing the two through relays and transformers.

G. Use structural members to support or anchor plenum cables without raceway. Do not use ductwork, electrical raceways, piping, ceiling suspension systems to support or anchor cables.

H. Size raceway and select wire size and type in accordance with manufacturer's recommendations and NEC requirements.

I. Conceal raceways except within mechanical, electrical, or service rooms. Maintain minimum clearance of 15 cm (6 in.) between raceway and high-temperature equipment such as steam pipes or flues.

J. Adhere to requirements in Division 26 where raceway crosses building expansion joints.

K. Flexible metal raceways and liquid-tight flexible metal raceways shall not exceed 3 ft in length and shall be supported at each end. Do not use flexible metal raceway less than ½ in. electrical trade size. Use liquid-tight flexible metal raceways in areas exposed to moisture including chiller and boiler rooms.

L. Install raceway rigidly, support adequately, ream at both ends, and leave clean and free of obstructions. Join raceway sections with couplings and according to code. Make terminations in boxes with fittings. Make terminations not in boxes with bushings.

3.07 COMMUNICATION WIRING

A. Communication wiring shall be low-voltage Class 2 wiring and shall comply with Article 3.7 (Wiring).

B. Install communication wiring in separate raceways and enclosures from other Class 2 wiring.

3.08 INSTALLATION OF SENSORS

A. Install sensors according to manufacturer's recommendations.

B. Mount sensors rigidly and adequately for operating environment.

C. Install room temperature sensors on concealed junction boxes properly supported by wall framing.

D. Air seal wires attached to sensors in their raceways or in the wall to prevent sensor readings from being affected by air transmitted from other areas.

E. Use averaging sensors in mixing plenums and hot and cold decks. Install averaging sensors in a serpentine manner vertically across duct. Support each bend with a capillary clip.

F. Install mixing plenum low-limit sensors in a serpentine manner horizontally across duct. Support each bend with a capillary clip. Provide 1 ft of sensing element for each 1 ft^2 of coil area.

G. Install pipe-mounted temperature sensors in wells. Install liquid temperature sensors with heat-conducting fluid in thermal wells.

H. Smoke detectors, freezestats, high-pressure cut-offs, and other safety switches shall be hard-wired to de-energize equipment as described in the sequence of operation. Switches shall require manual reset. Provide contacts that allow DDC software to monitor safety switch status.

3.09 ACTUATORS

A. General. Mount actuators and adapters according to manufacturer's recommendations.

B. Electric and Electronic Damper Actuators. Mount actuators directly on damper shaft or jackshaft unless shown as a linkage installation. Link actuators according to manufacturer's recommendations.

1. For low-leakage dampers with seals, mount actuator with a minimum 5° travel available for damper seal tightening.
2. To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5° open position, manually close the damper, then tighten linkage.
3. Check operation of damper-actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.
4. Provide necessary mounting hardware and linkages for actuator installation.

C. Valve Actuators. Connect actuators to valves with adapters approved by actuator manufacturer.

3.10 IDENTIFICATION OF HARDWARE AND WIRING

A. Label wiring and cabling, per established Owner requirements and Division 26.

B. Label identifiers shall match record documents.

3.11 CONTROL SYSTEM CHECKOUT AND TESTING

A. Startup Testing. Complete startup testing to verify operational control system before notifying Owner of system demonstration. Provide Owner with schedule for startup

testing. Owner may have representative present during any or all startup testing.

1. Calibrate and prepare for service each instrument, control, and accessory equipment furnished.
2. Verify that control wiring is properly connected and free of shorts and ground faults. Verify that terminations are tight.
3. Enable control systems and verify each input device's calibration. Calibrate each device according to manufacturer's recommendations.
4. Verify that binary output devices such as relays, solenoid valves, two-position actuators and control valves, and magnetic starters, operate properly and that normal positions are correct.
5. Verify that analog output devices such as I/Ps and actuators are functional, that start and span are correct, and that direction and normal positions are correct. Check control valves and automatic dampers to ensure proper action and closure. Make necessary adjustments to valve stem and damper blade travel.
6. Prepare a log documenting startup testing of each input and output device, with technician's initials certifying each device has been tested and calibrated.
7. Verify that system operates according to sequences of operation. Simulate and observe each operational mode by overriding and varying inputs and schedules. Tune PID loops and each control routine that requires tuning.
8. Alarms and Interlocks.
    a. Check each alarm with an appropriate signal at a value that will trip the alarm.
    b. Trip interlocks using field contacts to check logic and to ensure that actuators fail in the proper direction.
    c. Test interlock actions by simulating alarm conditions to check initiating value of variable and interlock action.
9. Provide any recommendation for system modification in writing to the A/E for review. Do not make system modifications, including operating parameters and control settings, without prior approval of Owner.

3.12 CONTROL SYSTEM DEMONSTRATION, ACCEPTANCE, AND COMMISSIONING

A. Demonstration. Prior to acceptance, perform the following performance tests to demonstrate system operation and compliance with specification after and in addition to tests specified in Article 3.17 (Control System Checkout and Testing). Provide Engineer with log documenting completion of startup tests.

1. Owner/Engineer reserves the option to be present to observe and review system demonstration. Notify Owner/Engineer at least 10 days before system demonstration begins.
2. Complete approved checklists and forms for each system as part of system demonstration.
3. Demonstrate actual field operation of each sequence of operation as indicated on Control Drawings. Demonstrate calibration and response of any input and output points requested by Owner/Engineer. Provide and operate test equipment required to prove proper system operation.
4. Tests that fail to demonstrate proper system operation shall be repeated after BAS Contractor makes necessary repairs or revisions to hardware or software to successfully complete each test.
5. Acceptance.
    a. System shall not be accepted until completed demonstration forms and checklists are submitted.
    b. After tests described in this Specification are performed to the satisfaction of and the Owner, the Owner will accept control system as meeting completion requirements. BAS Contractor will provide written statement of any exempted test.
6. Commissioning.
    a. BAS Contractor shall be responsible for participating in commissioning of the Division 25 installed systems. Refer to commisioning specifications for further detail.

3.13 TRAINING

A. Provide on-site training for designated staff of Owner's representatives for a minimum of 8 hours.

B. Training shall include:
1. Explanation of drawings, operations and maintenance manuals.
2. Walk-through of the job to locate control components.
3. Operator workstation and peripherals.
4. DDC controller operation/function.
5. Operator control functions including graphic generation and field panel programming.
6. Operation of wall mounted workstation.
7. Explanation of adjustment, calibration and replacement procedures.

C. Instructors shall be factory-trained and experienced in presenting this material.

D. Perform training using a network of working controllers representative of installed hardware.

3.14 CLEANING

A. Each day clean up debris resulting from work. Remove packaging material as soon as its contents have been removed. Collect waste and place in designated location.

B. On completion of work in each area, clean work debris and equipment. Keep areas free from dust, dirt, and debris.

END OF SECTION 254002

SECTION 260000– ELECTRICAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the requirements for Enhanced Commissioning to be used on this project.

B. Systems to be commissioned include:

1. Lighting controls.

C. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Sections 230000, 220000 and other Division 01 Specification Sections, apply to this Section.

D. Specification 001700a and 001700b contains the Commissioning Plan and Building Envelope Commissioning Plan.

1.2 WORK INCLUDED

A. A third party Commissioning Agent has been engaged by the Owner to administer the commissioning of the building systems.

B. The Contractor shall provide all commissioning services as outlined in this Section; perform all testing, measurements, and inspection outlined in the ‘Commissioning Plan”; and coordinate with the Commissioning Agent.

C. The Commissioning Agent will review all submittals related to the systems to be commissioned after approval and in conjunction with the Engineer of Record.

D. Post Occupancy commissioning is included to be conducted prior to the 10 months after substantial completion.

E. The Contractor shall provide the Commissioning Agent the Operations and Maintenance (O&M) for review and comment.

F. The Contractor shall provide the Commissioning Agent Owner Training Plan for review and comment.

1.3 COMMISSIONING OBJECTIVES

A. To ensure that all building Lighting controls; and interfaces of these systems with other building systems are installed, tested, and are operating in compliance with Contract Documents and within the scope of design requirements.

B. To ensure that all system operation and maintenance personnel are properly instructed to effectively and efficiently operate and maintain the building systems, subsystems, and lighting. To further ensure that they will receive all required manuals and documentation.

C. To ensure the Systems, Operation and Maintenance Manuals accurately reflect the installed equipment and systems.

D. The Commissioning Agent shall provide the following to the Contractor for implementation and execution.

1. Commissioning Plan: The Commissioning Agent shall prepare the Commissioning Plan in accordance with contents as specified herein.

2. Checklists: The Commissioning Agent shall prepare the Pre-Functional and Functional Performance Test Forms, specifically for this project, and edited to suit the equipment and systems installed.

E. The Commissioning Agent shall prepare a Final Commissioning Report containing a compilation of the completed checklists, Issues and Benefits Log, Vendor Equipment Startup Reports, TAB Reports, and DALT Report.

1.4 REFERENCED STANDARDS

A. ASHRAE Guideline 0-2019, “The HVAC Commissioning Process.”

B. NEBB, “Procedural Standards for Building Systems Commissioning.”

C. SMACNA, “HVAC Systems Commissioning Manual.”

1.5 COMMISSIONING TEAM

A. The Contractor shall designate team members from each of the following to participate in the Commissioning Process:

1. General Contractor
2. Electrical Subcontractor

B. The Owner may designate a representative to participate in the Commissioning Process.

C. Each of the team member’s names shall be submitted in writing to the Commissioning Agent for inclusion in the Commissioning Plan. Members of the team cannot be replaced or substituted without the Commissioning Agent and Owners concurrence.

PART 2 - PRODUCTS

(NOT APPLICABLE)

PART 3 - EXECUTION

3.1 IMPLEMENTATION OF THE COMMISSIONING PLAN

A. Sequence of Events

1. The Commissioning Agent shall provide the Commissioning Plan to the Contractor for execution.

2. A kick off meeting attended by all parties will be conducted by the Commissioning Agent.

2. The Commissioning Agent will periodically visit to the job site to observe installation activities. Observations will be documented on site visit reports and the Issues and Benefits log.

3. The Contractor shall maintain the Prefunctional Checklists on the job site. The installing trade Foreman shall sign off on each item as it is completed.

4. All equipment shall be started by qualified technicians and documented on standardized startup forms typically provided by the equipment manufacturer. The startup documentation shall be submitted to the Commissioning Agent for review and inclusion in the final commissioning report.

5. The systems, operation and maintenance manuals shall be submitted to the Commissioning Agent for review.

6. Functional Testing will begin only after all of the items above are complete. Functional commissioning may occur on second shift, if needed to support the building occupancy.

7. The Contractor shall submit the Owner Training plan to the Commissioning Agent for review. Once training is completed, the attendance sign in sheet shall be forwarded to the Commissioning Agent. Individuals with direct experience with the equipment startup and operation shall participate in the training, including the project startup technicians.

8. Post occupancy commissioning will be performed prior to the warranty expiration.

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9. When all of the above items are complete, and all of the items on the Issues and Benefits Log have been resolved, the Commissioning Agent will prepare the Final Commissioning Report. The report will contain the Commissioning Agent's recommendations on final acceptance of the Project.

B. Equipment and Systems Startup:

1. Startup Documentation: Completed startup checklists shall be filled out by the Contractor, and provided to the Commissioning Agent after startup verification of each system, subsystem or each item of equipment. Where available the equipment manufacturer's startup form shall be used for documentation. Startup of each piece of equipment shall be documented in a professional manner on a separate document. The documentation shall contain the company name, address, and signature of the technician.

3.2 FUNCTIONAL PERFORMANCE TESTING

A. The lighting controls shall be tested according to the manufacturers recommendations, and the Functional Checklists included in the Commissioning Plan.

B. Functional performance testing shall not begin until all equipment and systems have had startup verification by the Contractor, acceptance by the Engineer of Record, and acceptance by the local Code Authority.

1. Functional performance test checklists developed by the Commissioning Agent shall be used to document the equipment functional performance tests.

2. Each item of system equipment will be functional performance tested by the Contractor and the results documented by the Contractor at full load.
3. Operation under "abnormal and/or emergency conditions" shall be simulated by the Contractor for equipment and systems, and all safety equipment and control operations verified.

4. Test methods shall be documented and approved by the Commissioning Agent prior to implementation and shall be covered during the Owner's training as well.

5. No equipment test functions or procedures shall be eliminated from the functional performance test unless approved by the Commissioning Agent and the Owner.

6. The startup technicians shall be present during Functional Commissioning of equipment as applicable.

D. Test Documentation: Functional performance test checklists developed by the Commissioning Agent shall be used by the Contractor to document the results of the functional performance testing process.

E. Test Failures: No system or subsystem shall be accepted until all items of equipment in the system have approved and verified functional performance test checklists.

1. When a functional performance test is not approved, the Contractor shall provide a written report to the Commissioning Agent listing the deficiencies causing the test failure, and remedy.

2. After all deficiencies have been corrected; the entire functional performance test for the equipment, system, or subsystem shall be repeated at the discretion of the Commissioning Agent.

3. The Commissioning Agent will continue to monitor the actions to correct the equipment or system deficiencies until an acceptable functional performance test has been accomplished.

F. Deferred Tests: If any checklist or functional performance test cannot be completed for seasonal reasons, lack of occupancy, or for other reasons, a written report shall be sent by the Contractor to the Commissioning Agent indicating when the test will be scheduled.

1. If any checklist or functional performance test cannot be accomplished due to deficiencies outside the scope of the work, the deficiencies shall be resolved and corrected by the appropriate parties before completion of the commissioning process.

G. Control System Verification: The Control Contractor shall provide a field technician on site with a portable control access computer and related test equipment. The date and time of this control system verification testing shall be scheduled in advance with the Commissioning Agent. The field technician shall demonstrate to the Commissioning Agent the accuracy of each physical input point, and the response of each physical output point during each mode of operation identified in the Sequence of Controls.

1. Where equipment is provided with controllers that perform portions of the sequence of operation, the equipment supplier is considered to share the responsibilities of the Control Contractor. The equipment manufacturers authorized startup technician shall participate in the commissioning as described above.

H. A checklist shall be provided by the Contractor for each of the physical hardware points prior to this system verification demonstration, with all identification information and the physical location of each physical input/output device. For input sensors, this checklist shall be completed during the field test to indicate what the actual measured reading was during the verification, verses what the control system indicated it was. For output

devices, this checklist shall indicate what the response actually was verses what it should have been for each mode of operation. Any defective control component shall be replaced, and any programming errors identified shall be corrected and re-demonstrated to the Commissioning Agent.

I. For equipment with programmable controllers, the setup menu input data shall be provided to Commissioning Agent for backcheck during Functional Testing. This data shall be included in the O&M Manual.

3.3 OWNER TRAINING

A. The Contractor shall provide Owner Training as indicated in the Contract Documents. (See section 017823)

3.4 POST OCCUPANY FUNCTIONAL TESTING

A. Post Occupancy functional testing will be performed on the major equipment and building systems to verify system performance under design conditions.

1. The same commissioning team must be assembled for this work.

2. The testing will be reduced scope and focus on thermal performance and identification of issues that have arisen since the construction period.

3.5 COMMISSIONING REPORT

A. The Final Commissioning Report will be prepared by the Commissioning Agent with the following information provided by the Contractor.

1. Site Visit Reports

2. Issues and Benefits Logs

3. Completed Pre-functional Checklists

4. Completed Functional Checklists

5. Startup Reports

6. TAB Report

3.6 ONGOING COMMISSIONING

A. The Commissioning Agent shall provide an Ongoing Commissioning Plan with the Final Commissioning Report. Ongoing Commissioning Plan shall detail the following:

1. Ongoing Commissioning Definitions

2. Systems to be Commissioned

3. Project Planning and Budget

4. Systems Testing & Performance Verification

5. Corrective Action Response

3.7 ACCEPTANCE

A. The Commissioning Agent shall make a recommendation of final acceptance of the project to the Owner.

END OF SECTION 260800

SECTION 260500

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. This Section applies to all Electrical sections.

1.02 JOB CONDITIONS

A. The Contract Documents specify the scope and arrangement of the Work and shall be followed as closely as actual conditions allow.

B. The Contractor shall give consideration to all other trades, and make arrangements to avoid conflicts and interference with other Work, new or existing. Contractor shall coordinate all components of the Work, and provide minor adjustments as required, including offsets, transitions, fittings, and accessories to meet actual conditions.

C. The Contractor shall visit the job site prior to bid date to examine the conditions under which the Work is to be performed. No extra charges shall be paid for providing of Products or furnishing of Work resulting from failure to comply with this requirement.

1.03 CONFORMANCE TO REGULATIONS

A. All Work shall conform to the regulations of the applicable federal, state, and local laws, ordinances and codes.

1.04 REGULATORY REQUIREMENTS

A. All applicable Work shall conform to the requirements of NFPA 70.

B. All Products shall be listed by the Underwriters Laboratories, Inc. (UL), and shall bear the UL label. Where UL labels are not provided from the factory, the Contractor shall be responsible for having the equipment or materials tested by a UL testing firm, acceptable to authority having jurisdiction, to determine suitability of the Product for purpose specified.

1.05 QUALITY ASSURANCE

A. Work shall meet or exceed minimum recommendations of:

1. ANSI - American National Standards Institute
2. ASTM - American Society for Testing Materials
3. AWG - American Wire Gauge
4. ETL - Electrical Testing Lab
5. EIA - Electronic Industries Association

6. IEEE - Institute of Electrical and Electronic Engineers
7. NEC - National Electrical Code, NFPA 70
8. NECA - National Electrical Contractors Association
9. NEMA - National Electrical Manufacturer's Association
10. NFPA - National Fire Protection Association
11. OSHA - Occupational Safety and Health Act
12. UL - Underwriters' Laboratories, Inc.
13. VUSBC - Virginia Uniform Statewide Building Code 2018

B. Reference to the standards of any technical society, organization, or association, or to the laws, ordinances, or codes of governmental authorities shall mean the latest standard, code, or specification adopted, published, and effective on the date of Bid Opening.

C. The specifications, codes, and standards referenced in these specifications (including addenda, amendments, and errata) shall govern in all cases where references thereto are made. In case of conflict between the referenced specifications, the more stringent requirement shall govern unless otherwise permitted by the Architect/Engineer. Major conflicts shall be referred to the Architect/Engineer for resolution.

1.06 MATERIALS AND EQUIPMENT

A. Unless specifically noted otherwise, all materials and equipment furnished for permanent installation in the Work shall conform to applicable standards, be of a current design, new, unused, and undamaged.

B. Individual parts shall be manufactured to standard sizes and gauges so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate equipment shall be interchangeable.

1.07 UTILITIES AND CONNECTIONS

A. Verify location of all existing utilities before laying out and making connections. Report any inconsistencies to Architect/Engineer before commencing Work. Contractor shall be responsible for correcting any errors, and repairing or replacing all materials and equipment damaged as a result of failure to comply with this requirement.

1.08 WIRING DIAGRAMS

A. All electrical equipment shall be provided with complete wiring diagrams showing all power and control connections. The diagrams shall be legible and placed in a clear plastic pouch that is permanently affixed to the equipment.

1.09 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Protect Products from damage, marring, and soiling.

B. Any marring of factory finishes shall be repaired or replaced as necessary to match the original factory finish.

1.10 SUBMITTALS

A. Refer to Division 01 requirements.

B. Sustainability Submittal Requirements: Submit Sustainable Materials Coversheet (SMC) for Sustainability Consultant’s Review.

1. Each material submittal shall include a completed SMC per Section 018115 and accompanying required backup documentation.
2. All products must comply with Sustainable Material Performance Requirements per Section 018120.

C. Submittal Schedule: The Contractor shall submit a Submittal Schedule to the Architect/Engineer for review within 30 days of the Award of Contract. The Architect/Engineer shall review the schedule for content and return with comments or approval. Revise and resubmit as required.

D. General: The Contractor shall submit information, for Architect/Engineer's review, to demonstrate compliance of proposed Products and/or installations with the Contract Documents. This information shall include, but not be limited to catalog data; performance data; noise levels; etc. Proposed Products that are not in compliance with the Contract Documents may be rejected. Information must be submitted on all required Products, including proposed Products that appear to be in compliance with the Contract Documents.

E. Contractor preparation:

1. The Contractor shall review and approve each submittal and coordinated all other related or affected Work before submitting for review. All copies of each submittal shall bear the Contractor's stamp, with signature or initials, certifying review and approval; verification of field dimensions; and coordination with adjacent Work are in compliance with the requirements of the Contract Documents.
2. The Contractor shall identify variations from the requirements of the Contract Documents on all copies of applicable submittals. No extra charges shall be paid for the providing of Products or furnishing of Work required as a result of failure to comply with this requirement.

F. Submittal Format:

1. Each submittal shall be accompanied by a letter of transmittal listing Project Title, Contractor, Subcontractor or supplier, submitted Products, pertinent drawing and detail number, and specification section number, as appropriate.
2. Product data shall be clearly marked to identify the applicable Products or models. Options or modifications required by the Contract Documents shall be clearly identified.
3. Submittals shall be complete with all associated Products. Submittals on portions of a Product or system shall not be reviewed.

G. Architect/Engineer Procedures: Submittals will be reviewed with reasonable promptness. The Contractor shall allow 15 days for review of each submittal. The Architect/Engineer's comments will be indicated on a Submittal Review Comments form, which will be attached to each copy of the submittal. Contractor shall be responsible for distributing copies of reviewed submittals as appropriate.

H. Resubmission: Contractor shall change or correct submittals as required by the Architect/Engineer and resubmit until approved. The Contractor shall identify any changes other than those required by the Architect/Engineer on all copies of the resubmittal.

I. Approval required: The ordering, fabrication and/or installation of Products before approval of all relevant submittals shall be at the Contractor's risk. Any damage to new or existing Work resulting from the installation of unapproved Products shall be repaired or replaced by the Contractor at no additional cost. Payment will not be recommended for any Work that does not have an approved submittal.

1.11 SUBSTITUTIONS

A. Refer to Division 01 requirements.

B. For a Product specified by naming one or more manufacturer and model, and followed with the statement “or approved equal,” the Contractor may submit a Product other than the Product specified by manufacturer and model, that Product shall be considered a Substitute Product and shall comply with the following conditions:

1. The Contractor shall verify the Substitute Product is equal or superior in all respects to the Specified Product.
2. The Contractor shall submit data on the Substitute Product in compliance with the “Submittals” paragraph herein.
3. The Contractor shall be responsible for coordinating the installation of the Substitute Product with all trades. The Contractor shall be responsible for any changes required incorporating the Substitute Product into the Work.

4. The Contractor waives all claims for additional costs related to the Substitute Product that become apparent before, during or after installation.

1.12 OPERATING AND MAINTENANCE MANUAL

A. Refer to Division 01 requirements.

B. General: The Contractor shall submit one copy of the Operation and Maintenance Manual to the Architect/Engineer for review a minimum of 60 days prior to Instruction and Training Sessions. This copy will be returned to the Contractor with Architect/Engineer's comments or approval. The Contractor shall revise and resubmit one copy of the O&M Manual as required. The Contractor shall provide four copies of the approved O&M Manual. Instruction and Training Sessions shall begin 30 days after receipt of the approved O&M Manuals. Refer to “Instruction and Training Sessions” paragraph herein.

C. Manual: Manual file shall include "PROJECT NAME - OPERATION AND MAINTENANCE MANUAL", applicable volume number, and project title. Provide tabs/bookmarks for each product and system. Provide a table of contents for the entire manual, located at the front/

D. Contents: The manual shall consist of three parts as follows:

1. Part 1: Directory listing names, addresses, and telephone numbers of Architect, Engineer, Contractor, Subcontractors, and major equipment suppliers.
2. Part 2: Operation and maintenance instructions including, but not limited to, the following:
    a. General description and specifications of each component and of each system as a whole.
    b. Manufacturer's catalog description of each component supplemented by approved equipment submittals.
    c. Detailed electrical and logic descriptions.
    d. Installation and start-up instructions, including complete calibration procedures for each component and for system as a whole.
    e. Operating instructions including:
        1) Sequence of operation
        2) Shutdown procedure
        3) Emergency operating procedures
    f. Trouble shooting guide with service instructions
    g. Preventive maintenance schedules

h. Parts list with names, addresses, and telephone numbers of local parts suppliers.
i. Names, addresses, and phone numbers of nearest service organizations
j. Interface requirements and capabilities.

3. Part 3: Project documents including, but not limited to, the following:
a. Testing report(s).
b. Certificates
c. Copies of warranties.

E. Quality: The quality of the manual will be checked by the Architect/Engineer for accuracy, completeness and quality of printing. Deficiencies will necessitate resubmittals by the Contractor. Refer to “Submittals” paragraph herein.

1.13 INSTRUCTION AND TRAINING SESSIONS

A. Refer to Division 01 requirements.

B. After all equipment and services are in operation and receipt of the approved Operation and Maintenance Manuals, Instruction and Training Sessions shall be conducted for representatives of the Owner.

C. Instruction Session shall be conducted during the Owner's normal working periods and at times satisfactory to the Owner. Session shall last not less than one 8-hour working day.

D. The Training Session shall address the operation and maintenance of each piece of equipment and of the system as a whole. Preventative maintenance techniques shall be included.

E. Competent, factory-trained service and operating personnel from the appropriate manufacturer(s) shall give instructions and training. The Contractor shall record the names of all personnel present at each Instruction and Training Session and shall forward a copy of the attendance log to the Architect/Engineer within seven days after each session.

1.14 RECORD DRAWINGS

A. Refer to Division 01 requirements.

1.15 WORK SEQUENCE

A. Refer to Division 01 requirements.

1.16 PROJECT/SITE CONDITIONS

A. Install Work in accordance with the Contract Documents unless prevented by Project conditions.

B. When Project/Site conditions require a revision to the Work the Contractor shall prepare drawings to show proposed revision. The drawings shall include revisions to Work specified in other Sections when applicable. Submit drawings to Architect/Engineer for review. The Contractor shall allow a minimum of three business days for the Architect/Engineer to respond to proposed revision. The Contractor shall not proceed with that portion of the Work until a response has been returned.

1.17 WARRANTIES

A. Refer to Division 01 requirements.

B. Warranty periods shall begin from Date of Substantial Completion.

1.18 COMMISSIONING

A. Refer to Division 01 requirements.

B. Start-up of all systems and sub-systems shall be coordinated by the Commissioning Agent. An experienced electrician(s) shall be on site throughout the start-up and commissioning process to coordinate activities and insure that all equipment is functioning as intended.

1.19 CONTRACTOR COORDINATION

A. Nomenclature for final room names and numbers may vary from the construction documents. Final names and numbers used in the shop drawings shall be coordinated with final room names and numbers assigned by the Owner and Architect.

B. Electrical contractor shall coordinate their work with all other trades prior to fabrication of systems and commencement of installation. It shall be the responsibility of the electrical contractor to review the work of other trades (including, but not limited to security, civil, structural, architectural, food service, special equipment, fire alarm, fire suppression, plumbing, HVAC, sound, telecommunications, and security) as it affects their work, and as their work affects other trades, to insure that the construction documents are closely followed and conflicts are avoided. Where discrepancies arise, they shall be referred to the Architect/Engineer for resolution before proceeding with the Work.

PART 2 PRODUCTS

2.01 SUSTAINABLE MATERIAL PERFORMANCE

A. All products must comply with the Sustainable Material Performance requirements per Section 018120.

PART 3 EXECUTION

3.01 GENERAL

A. Unless otherwise noted, install equipment in accordance with manufacturer's printed instructions for application indicated. Maintain copies of manufacturer's printed instructions at the project site.

B. Install, operate, and adjust systems in accordance with the Contract Documents.

C. Wiring, conduit, and other items associated with the electrical system shall not obstruct access to any new or existing electrical equipment and/or mechanical equipment. All electrical equipment shall be installed where it is readily accessible for servicing.

D. A Request For Information (RFI) shall be submitted to the Architect/Engineer for any portion of the Work that the Contractor determines a clarification is required. Prior to submitting a RFI the Contractor shall thoroughly research the Contract Documents to ensure information has not been overlooked. The RFI shall include references to the portion of the Contract Documents that requires a clarification. The Contractor shall allow a minimum of three business days for the Architect/Engineer to respond to the RFI. The Contractor shall not proceed with that portion of the Work until a response has been returned.

E. All Products delivered to the site(s) shall be stored in accordance with the manufacturer's printed instructions. If a manufacturer does not have printed instructions then the Product shall be adequately housed and otherwise protected against damage or corrosion. If any Product stored at the site(s) is not protected as specified herein, the Contractor shall not receive payment for that Product. That Product shall be stored by the Owner at the expense of the Contractor. Any Product damaged as a result of failure to comply with this requirement shall be replaced by the Contractor at no additional cost to the Owner.

3.02 WORKMANSHIP

A. Install Work using procedures defined in NECA Standard of Installation.

3.03 ACCESSIBILITY

A. Wiring, conduit, and other Products associated with the electrical system shall not obstruct access to any other electrical equipment, mechanical equipment, access hatches, doorways, windows, or other portions of the building and its systems. All electrical equipment shall be installed where it is readily accessible for servicing.

3.04 FIRESTOPPING

A. Refer to Division 07 requirements.

B. For all penetrations or openings in or through fire-rated assemblies including, but not limited to, walls, floors, ceilings, shafts, etc. the Contractor will provide approved UL listed "through penetration firestop" systems to ensure integrity of rated assembly. Refer to architectural drawings and details for approved options and confirm final selection with Architect/Engineer before proceeding with this portion of the Work.

3.05 FINISHES

A. Every effort has been made to coordinate the trades involved. This coordination will be the responsibility of all parties involved in both the planning and construction of the project.

B. The Contractor shall be responsible for the careful and complete coordination of all portions of the Work with that of other trades.

1. Center all applicable devices in ceiling tiles as shown and where appropriate.
2. Hang all devices independent of ceiling system.
3. Devices and device plates shall be grouped as shown on the electrical drawings.
4. All applicable devices shall be flush with finished surfaces.

3.06 INSPECTIONS AND TESTS

A. Only persons trained and familiar with this work shall be used for testing and adjusting.

B. See individual Division 26 sections for testing requirements.

C. Documentation:

1. All tests specified shall be completely documented indicating time of day, date, temperature and all pertinent test information.
2. All required documentation of readings indicated above shall be submitted to the Architect/Engineer prior to, and as one of the prerequisites for, final acceptance of the project.

D. All equipment to conduct the tests shall be furnished at the Contractor's expense.

E. Make corrections and adjustments and repeat tests until performance requirements have been met. Submit written reports to Owner.

F. Submit certificate of final inspection and approval from authority having jurisdiction to Architect/Engineer.

G. Architect/Engineer's Right to Retesting:

1. Should the Contractor refuse or neglect to make any tests necessary to demonstrate the integrity of the completed system, the Architect/Engineer may retain the services of an outside consultant to make such tests and perform

necessary corrections and adjustments.

2. The costs for such tests and adjustments shall be deducted from amounts owing to the Contractor and shall not be borne by the Owner or Architect/Engineer.

3.07 CLEANING THE INSTALLATION

A. After the equipment, wiring, and conduit has been proven operational, carefully clean all interiors of cabinets and external parts of each piece of equipment, thoroughly removing all traces of dirt, oil, grease, and other foreign substances or objects.

3.08 COORDINATION WITH FOOD SERVICE CONTRACTOR (FSC)

A. Coordinate work with the requirements of the food service drawings and specifications.

B. All final connections to equipment by Electrical Contractor.

C. All electrical lines shall be extended from rough-in to connection point or points on the fixture by the Electrical Contractor, furnishing all labor and materials.

D. All rough-ins shall be concealed in walls or columns wherever possible.

E. All fabricated equipment shall be completely wired internally, and all electrical outlets and receptacles mounted on or in fabricated equipment shall be furnished and installed by the Food Service Contractor who shall run all lines to suitable terminal boxes or subpanels; starters or disconnect switches by Electrical Contractor. Final connection shall be made by the Electrical Contractor. Where equipment wiring terminates in a junction box, switch, or terminal box, the Electrical Contractor shall make all connections between the branch circuit and equipment wiring. Where terminal is a receptacle, connect branch circuit to receptacle. Where terminal is a sub-panel, connect branch circuit to the mains of the sub-panel. All receptacles shall be furnished by the Electrical Contractor, except those which are built into an item of equipment.

F. All plug-in equipment receptacles shall be polarized. The Electrical Contractor shall provide the appropriate grounding type receptacles for all wall- and floor-mounted outlets to be used for plug-in equipment as noted on the drawings, with characteristics as noted. All plug-in equipment shall have the appropriate cord and plug set furnished and installed by the FSC. The FSC and Electrical Contractor shall coordinate their work so that the receptacles provided will match the specific plugs installed as part of the plug-in equipment, and any changes in cords an plugs or receptacles required in the field will be done at no cost to the Owner.

G. The Electrical Contractor shall interwire equipment components where required, such as, ventilator control panels to ventilators, fans and detergent systems, solenoid valves, and disposer control panels to disposer motors and solenoids.

H. The FSC shall supply, on each motor-driven appliance or electrical heating unit, a suitable control switch or starter of the proper type in accordance with Underwriter's Laboratory requirements wherever such switch or starter is not furnished integrally with the equipment by its manufacturer. All other line switches; safety cut-outs; disconnect switches; control panels; fuse boxes; other controls, fittings, and connections, when not an integral part of the unit, will be furnished and installed by the Electrical Contractor.

I. All conduit, junction boxes, and other fittings for equipment which is freestanding, or open tubular construction, exposed to public view, shall be galvanized steel

J. The Electrical Contractor shall supply power and interconnecting services and all final connections to walk-in refrigeration and freezer compressor/condensers and evaporators solenoid valves and switches required for a complete operating system. Furnish and install a disconnect switch for each compressor. Walk-in refrigerator lights shall be furnished by the FSC and installed and fully connected by the Electrical Contractor. Exposed conduit inside the walk-in compartment is unacceptable.

K. "Sealtite" type flexible conduit shall be used for all flexible conduit installations, depending on code requirements. Junction boxes for equipment requiring flexible conduit should be mounted on rigid conduit at elevations which will limit the total length of the flexible conduit to 24" overall.

L. Sleeve collars shall extend 2" above top of the finished floor. Openings between collar and conduit shall be sealed watertight.

END OF SECTION 260500

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SECTION 260519

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS & CABLES (600 V & LESS)

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.
B. Metal-clad cable.
C. Wiring connectors.
D. Electrical tape.
E. Oxide inhibiting compound.
F. Wire pulling lubricant.
G. Firestop sleeves.

1.02 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2018).
B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2023.
C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010, with Editorial Revision (2020).
D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2020).
E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2017.
F. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2020.
G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
H. NECA 120 - Standard for Installing Armored Cable (AC) and Type Metal-Clad (MC) Cable; 2018.
I. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.
J. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.
K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
L. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

M. UL 267 - Outline of Investigation for Wire-Pulling Compounds; Current Edition, Including All Revisions.

N. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

O. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

P. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

Q. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

R. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
3. Notify Architect/Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

C. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors. Include proposed modifications to raceways, boxes, wiring gutters, enclosures, etc. to accommodate substituted conductors.

D. Field Quality Control Test Reports.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Project Record Documents: Record actual installed circuiting arrangements. Record actual feeder routing.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.07 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect/Engineer and obtain direction before proceeding with work.

B. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 - PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Metal-clad cable is permitted only as follows:

1. Where not otherwise restricted, may be used:

a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.

1) Maximum Length: 6 feet.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Provide new conductors and cables manufactured not more than one year prior to installation.

D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

E. Comply with NEMA WC 70.

F. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

G. Conductors for Grounding and Bonding: Also comply with Section 260526.

H. Conductor Material:

1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
3. Tinned Copper Conductors: Comply with ASTM B33.

I. Minimum Conductor Size:
   a. Exceptions:
      1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
      2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
      3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
      4) Branch circuits for emergency lighting, including illuminated exit signs, shall be 10 AWG minimum.
   2. Feeder and Branch Circuits:
      a. Where conductor sizes are increased for voltage drop or other reasons the equipment grounding conductor shall be increased in size proportionately.
      b. Where conductor sizes are increased for voltage drop they may be reduced in size within 10-feet of termination in order to fit under the lugs available on the overcurrent protective device but not less than the ampacity of the frame size of the overcurrent protective device or equipment terminations/lugs
   3. Control Circuits: 14 AWG.

J. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

K. Conductor Color Coding:
   1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
   2. Color Coding Method: Integrally colored insulation.
      a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
   3. Color Code:
      a. 480Y/277 V, 3 Phase, 4 Wire System:
         1) Phase A: Brown.
         2) Phase B: Orange.

3) Phase C: Yellow.
4) Neutral/Grounded: Gray.

b. 208Y/120 V, 3 Phase, 4 Wire System:
1) Phase A: Black.
2) Phase B: Red.
3) Phase C: Blue.
4) Neutral/Grounded: White.

c. Equipment Ground, All Systems: Green.

d. For control circuits, comply with manufacturer's recommended color code.

2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Description: Single conductor insulated wire.

B. Conductor Stranding:
1. Feeders and Branch Circuits:

C. Insulation Voltage Rating: 600 V.

D. Insulation:
1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
a. Size 4 AWG and Larger: Type XHHW-2.
b. Installed Underground: Type XHHW-2.

2.04 METAL-CLAD CABLE

A. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

B. Conductor Stranding:
1. Size 10 AWG and Smaller: Solid.
2. Size 8 AWG and Larger: Stranded.

C. Insulation Voltage Rating: 600 V.

D. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

E. Provide dedicated neutral conductor for each phase conductor.

F. Grounding: Full-size integral equipment grounding conductor.

G. Armor: Steel, interlocked tape.

H. Provide PVC jacket applied over cable armor.

2.05 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A, 486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 260526.

C. Wiring Connectors for Splices and Taps:

1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.

D. Wiring Connectors for Terminations:

1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
6. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
7. Conductors for Control Circuits: Use crimped terminals for all connections.

E. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

F. Mechanical Connectors: Provide bolted type or set-screw type.

G. Compression Connectors: Provide circumferential type or hex type crimp configuration.

H. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

2.06 ACCESSORIES

A. Electrical Tape:

1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous

temperature environment up to 221 degrees F.

2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
3. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.

B. Wire Pulling Lubricant:
1. Listed and labeled as complying with UL 267.
2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
3. Suitable for use at installation temperature.

C. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for cables and roofing system to be installed; designed to accommodate existing penetrations where applicable.

D. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that raceway installation is complete and supported.

E. Verify that field measurements are as indicated.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

A. Circuiting Requirements:
1. Unless dimensioned, circuit routing indicated is diagrammatic.
2. When circuit destination is indicated without specific routing, determine exact routing required.

3. Arrange circuiting to minimize splices.
4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are shown as separate, combining them together in a single raceway is permitted, under the following conditions:
   a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
   b. Increase size of conductors as required to account for ampacity derating.
   c. Size raceways, boxes, etc. to accommodate conductors.
8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Install metal-clad cable (Type MC) in accordance with NECA 120.

E. Installation in Raceway:
1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
2. Pull all conductors and cables together into raceway at same time.
3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

G. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways,

piping, ductwork, or other systems.

1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.

H. Terminate cables using suitable fittings.

1. Metal-Clad Cable (Type MC):
   a. Use listed fittings.
   b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
   c. Do not use direct-bearing set-screw type fittings for cables with aluminum armor.

I. Install conductors with a minimum of 12 inches of slack at each outlet.

J. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.

K. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

L. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

M. Make wiring connections using specified wiring connectors.

1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
3. Do not remove conductor strands to facilitate insertion into connector.
4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

N. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least

equivalent to unspliced conductors.

1. Dry Locations: Use insulating covers specifically designed for the connectors or electrical tape.
    a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
    a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
    b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
3. Wet Locations: Use heat shrink tubing.

O. Insulate ends of spare conductors using vinyl insulating electrical tape.

P. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

Q. Identify conductors and cables in accordance with Section 260553.

R. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07.

S. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.04 FIELD QUALITY CONTROL

A. Perform inspection, testing, and adjusting in accordance with Division 01.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.
    1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

D. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION 260519

SECTION 260526

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.
B. Conductors for grounding and bonding.
C. Connectors for grounding and bonding.
D. Ground bars.
E. Ground rod electrodes.
F. Ground access wells.

1.02 REFERENCE STANDARDS

A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.
B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2022.
D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.
E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
F. NFPA 780 - Standard for the Installation of Lightning Protection Systems; 2023.
G. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify exact locations of underground metal water service pipe entrances to building.
   2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
   3. Notify Architect/Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
B. Sequencing:
   1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.04 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Field quality control test reports.

E. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Do not use products for applications other than as permitted by NFPA 70 and product listing.

B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

D. Grounding System Resistance:

1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect/Engineer. Precipitation within the previous 48 hours does not constitute normally dry conditions.

2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.

E. Grounding Electrode System:

1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.

a. Provide continuous grounding electrode conductors without splice or joint.

b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.

2. Metal Underground Water Pipe(s):
   a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
   b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
   c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
3. Metal In-Ground Support Structure:
   a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
4. Concrete-Encased Electrode:
   a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
5. Ground Rod Electrode(s):
   a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
   b. Space electrodes not less than 10 feet from each other and any other ground electrode.
   c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
7. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.

a. Ground Bar Size: 1/4 by 4 by 12 inches unless otherwise indicated or required.
b. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

F. Separately Derived System Grounding:
1. Separately derived systems include, but are not limited to:
a. Transformers (except autotransformers such as buck-boost transformers).
b. Generators, when neutral is switched in the transfer switch.
2. Provide grounding electrode conductor to connect derived system grounded conductor to building grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
4. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
5. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.

G. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.

4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
    a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
    b. Metal gas piping.
8. Provide bonding for interior metal air ducts.
9. Provide bonding for metal building frame.
10. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.

H. Communications Systems Grounding and Bonding:
1. Provide bonding jumper in raceway from building grounding electrode system to each communications room or backboard and provide ground bar for termination.
    a. Bonding Jumper Size: As indicated.
    b. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

I. Lightning Protection Systems:
1. Do not use grounding electrode dedicated for lightning protection system for component of building grounding electrode system provided under this section.
2. Provide bonding of building grounding electrode system provided under this section and lightning protection grounding electrode system in accordance with NFPA 70 and NFPA 780.

J. Cable Tray Systems: Also comply with Section 260536.

K. Photovoltaic Systems: Also comply with Section 263100.

L. Pole-Mounted Luminaires: Also comply with Section 265600.

M. Static Control Flooring: Provide bonding of static control flooring provided in accordance with Division 09.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
   1. Provide products listed, classified, and labeled as suitable for the purpose intended.
   2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 260526:
   1. Use insulated copper conductors unless otherwise indicated.

C. Connectors for Grounding and Bonding:
   1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
   2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
   3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
      a. Exceptions:
         1) Use exothermic welded connections for connections to metal building frame.

D. Ground Bars:
   1. Description: Copper rectangular ground bars with mounting brackets and insulators.
   2. Size: As indicated.
   3. Holes for Connections: As indicated or as required for connections to be made.

E. Ground Rod Electrodes:
   1. Comply with NEMA GR 1.
   2. Material: Copper-bonded (copper-clad) steel.
   3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.

F. Ground Access Wells:
   1. Description: Open bottom round or rectangular well with access cover for testing and inspection; suitable for the expected load at the installed location.
   2. Size: As required to provide adequate access for testing and inspection, but not less than minimum size requirements specified.
   3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 10 inches.

4. Cover: Factory-identified by permanent means with word "GROUND".

G. Oxide Inhibiting Compound: Comply with Section 260519.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70.

1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.
2. Indoor Installations: Unless otherwise indicated, install with 4 inches of top of rod exposed.

D. Make grounding and bonding connections using specified connectors.

1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

E. Identify grounding and bonding system components in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. Provide field inspection in accordance with Division 01 requirements.

B. Inspect and test in accordance with NETA ATS except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.13.

D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION 260526

SECTION 260529

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.02 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

D. MFMA-4 - Metal Framing Standards Publication; 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
2. Coordinate work to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
5. Notify Architect/Engineer of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1.04 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems and non-penetrating rooftop supports.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 QUALITY ASSURANCE

A. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

1. Comply with the following. Where requirements differ, comply with most stringent.
    a. NFPA 70.
    b. Requirements of authorities having jurisdiction.
2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
6. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
    a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
    b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.

c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.

d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.

1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
2. Conduit Clamps: Bolted type unless otherwise indicated.

C. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.

D. Metal Channel/Strut Framing Systems:

1. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
2. Comply with MFMA-4.

E. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.

F. Nonpenetrating Rooftop Supports for Low-Slope Roofs:

1. Description: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring attachment to roof structure and not penetrating roofing assembly, with support fixtures as specified.
2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
3. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
4. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.

G. Anchors and Fasteners:

1. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
2. Plastic and lead anchors are not permitted.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that mounting surfaces are ready to receive support and attachment components.

B. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install hangers and supports in accordance with NECA 1.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by Architect/Engineer, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect/Engineer, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Equipment Support and Attachment:

1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.
2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 4 inch high concrete pad constructed in accordance with Section 033000.
5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Conduit Support and Attachment: See Section 260533.13 for additional requirements.

I. Cable Tray Support and Attachment: See Section 260536 for additional requirements.

J. Box Support and Attachment: See Section 260533.16 for additional requirements.

K. Interior Luminaire Support and Attachment: See Sections 265100 and 265101 for additional requirements.

L. Exterior Luminaire Support and Attachment: Also comply with Section 265600.

M. Secure fasteners in accordance with manufacturer's recommended torque settings.

N. Remove temporary supports.

O. Identify independent electrical component support wires above accessible ceilings, where permitted, with color distinguishable from ceiling support wires in accordance with NFPA 70.

3.03 FIELD QUALITY CONTROL

A. Inspect support and attachment components for damage and defects.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 260529

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SECTION 260533.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).
B. Galvanized steel intermediate metal conduit (IMC).
C. Flexible metal conduit (FMC).
D. Liquidtight flexible metal conduit (LFMC).
E. Galvanized steel electrical metallic tubing (EMT).
F. Rigid polyvinyl chloride (PVC) conduit.

1.02 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.
B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.
C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2018.
D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2020.
F. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
G. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.
H. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.
I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
J. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.
K. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
L. UL 360 - Liquid-Tight Flexible Metal Conduit; Current Edition, Including All Revisions.
M. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
N. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.
O. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

P. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

Q. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
5. Notify Architect/Engineer of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

B. Shop Drawings:

1. Include proposed locations of roof penetrations and proposed methods for sealing.

C. Project Record Documents: Record actual routing for conduits installed underground and conduits 2-inch (53 mm) trade size and larger.

1.05 QUALITY ASSURANCE

A. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

C. Protect PVC conduit from sunlight.

PART 2 - PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:

1. Under Slab on Grade: Use galvanized steel rigid metal conduit, galvanized steel rigid metal conduit, rigid PVC conduit, or rigid PVC conduit.
2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit or galvanized steel rigid metal conduit.
3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), or rigid PVC conduit.
4. Where rigid polyvinyl chloride (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC) where emerging from underground.
5. Where rigid polyvinyl (PVC) conduit larger than 2-inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit (RMC) elbows, galvanized steel intermediate metal conduit (IMC) elbows, or concrete-encased PVC elbows for bends.

D. Embedded Within Concrete:

1. Within Slab on Grade: Not permitted.
2. Within Slab Above Ground: Not permitted.
3. Within Concrete Walls Above Ground: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT).

F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel

electrical metallic tubing (EMT).

G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT).

H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC).

I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC).

1. Locations subject to physical damage include, but are not limited to:

a. Where exposed below 8 feet, except within electrical and communication rooms or closets.

K. Exposed, Exterior: Use intermediate metal conduit (IMC) or intermediate metal conduit (IMC).

L. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC).

M. Flexible Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit (FMC).

1. Maximum Length: 6 feet.

N. Flexible Connections to Vibrating Equipment:

1. Dry Locations: Use flexible metal conduit (FMC).
2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).
3. Maximum Length: 6 feet unless otherwise indicated.
4. Vibrating equipment includes, but is not limited to:

a. Transformers.

b. Motors.

2.02 CONDUIT - GENERAL REQUIREMENTS

A. Comply with NFPA 70.

B. Electrical Service Conduits: See Section 262100 for additional requirements.

C. Fittings for Grounding and Bonding: See Section 260526 for additional requirements.

D. Provide conduit, fittings, supports, and accessories required for complete raceway system.

E. Provide products listed, classified, and labeled as suitable for purpose intended.

F. Minimum Conduit Size, Unless Otherwise Indicated:

1. Branch Circuits: 3/4-inch trade size.
2. Branch Circuit Homeruns: 3/4-inch trade size.
3. Control Circuits: 3/4 inch (21 mm) trade size.
4. Flexible Connections to Luminaires: 3/4 inch trade size.
   a. Exception: Where light fixtures will only accept a 1/2" whip.
5. Underground, Exterior: 1-inch trade size.

G. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

B. Fittings:

1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
2. Material: Use steel or malleable iron.
3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.04 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)

A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

B. Fittings:

1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
2. Material: Use steel or malleable iron.
3. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.05 FLEXIBLE METAL CONDUIT (FMC)

A. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.

B. Fittings:

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.

C. Description: Interlocked steel construction.

2.06 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

B. Fittings:

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
2. Material: Use steel or malleable iron.

C. Description: Interlocked steel construction with PVC jacket.

2.07 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

B. Fittings:

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

2.08 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

B. Fittings:

1. Manufacturer: Same as manufacturer of conduit to be connected.
2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.09 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch.

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.

C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

D. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf.

E. Conduit Mechanical Seals:

1. Listed as complying with UL 514B.

2. Specifically designed for sealing conduit openings against water, moisture, gases, and dust.
3. Suitable for sealing around conductors/cables to be installed.

F. Sealing Systems for Concrete Penetrations:
1. Sleeves: Provide water stop ring or cement coating that bonds to concrete to prevent water infiltration.
2. Rate for minimum of 40 psig; suitable for sealing around conduits to be installed.

G. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.

H. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

I. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for conduit/duct arrangement to be installed.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

D. Verify routing and termination locations of conduit prior to rough-in.

E. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install conduit in accordance with NECA 1.

C. Galvanized Steel Rigid Metal Conduit (RMC): Install in accordance with NECA 101.

D. Intermediate Metal Conduit (IMC): Install in accordance with NECA 101.

E. Rigid Polyvinyl Chloride (PVC) Conduit: Install in accordance with NECA 111.

F. Conduit Routing:
1. Unless dimensioned, conduit routing indicated is diagrammatic.
2. When conduit destination is indicated without specific routing, determine exact routing required.

3. Conceal conduits unless specifically indicated to be exposed.
4. Conduits in the following areas may be exposed, unless otherwise indicated:
    a. Electrical rooms.
    b. Mechanical equipment rooms.
    c. Within joists in areas with no ceiling.
5. Unless otherwise approved, do not route exposed conduits:
    a. Across floors.
    b. Across roofs.
    c. Across top of parapet walls.
    d. Across building exterior surfaces.
6. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
7. Arrange conduit to maintain adequate headroom, clearances, and access.
8. Arrange conduit to provide no more than equivalent of four 90-degree bends between pull points.
9. Arrange communications conduits to provide no more than 150 feet between pull points.
10. Route conduits above water and drain piping where possible.
11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
    a. Heaters.
    b. Hot water piping.
    c. Flues.
14. Group parallel conduits in same area on common rack.

G. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 260529.

2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
4. Use nonpenetrating rooftop supports to support conduits routed across rooftops, where approved.
5. Use of wire for support of conduits is not permitted.
6. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with most stringent requirements.

H. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
7. Secure joints and connections to provide mechanical strength and electrical continuity.

I. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Provide suitable sealing system where conduits penetrate exterior wall below grade.

6. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
7. Provide metal escutcheon plates for conduit penetrations exposed to public view.

J. Underground Installation:
1. Provide trenching and backfilling in accordance with Division 31 requirements.
2. Minimum Cover, Unless Otherwise Indicated or Required:
   a. Underground, Exterior: 24 inches.
3. Provide underground warning tape in accordance with Section 260553 along entire conduit length.

K. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with DIvision 03 with minimum concrete cover of 3.5 inches on all sides unless otherwise indicated.
1. Use duct bank spacers to maintain conduit separation.

L. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.

M. Conduit Sealing:
1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
   a. Where conduits enter building from outside.
   b. Where service conduits enter building from underground distribution system.
   c. Where conduits enter building from underground.
   d. Where conduits may transport moisture to contact live parts.
2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:

a. Where conduits pass from outdoors into conditioned interior spaces.
b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

N. Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

O. Provide grounding and bonding; see Section 260526.

P. Identify conduits; see Section 260553.

3.03 FIELD QUALITY CONTROL

A. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

B. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION 260533.13

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SECTION 260533.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

C. Boxes and enclosures for integrated power, data, and audio/video.

D. Floor boxes.

E. Underground boxes/enclosures.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.

E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013 (Reaffirmed 2020).

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. SCTE 77 - Specifications for Underground Enclosure Integrity; 2023.

H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

J. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

K. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate location of floor boxes with Architect prior to installation.
7. Coordinate the work with other trades to preserve insulation integrity.
8. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
9. Notify Architect/Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for outlet and device boxes, junction and pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Project Record Documents: Record actual locations for junction boxes, pull boxes, cabinets and enclosures, and floor boxes.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Keys for Lockable Enclosures: Two of each different key.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 BOXES

A. General Requirements:

1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:

1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use suitable concrete type boxes where flush-mounted in concrete.
4. Use suitable masonry type boxes where flush-mounted in masonry walls.
5. Use raised covers suitable for the type of wall construction and device configuration where required.
6. Do not use "through-wall" boxes designed for access from both sides of wall.
7. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
8. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
9. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
10. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
11. Minimum Box Size, Unless Otherwise Indicated:

a. Wiring Devices: 4 inch square by 2-1/8 inch deep (100 by 54 mm) trade size.
b. Communications Systems Outlets: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size.
c. Ceiling Outlets: 4 inch octagonal or square by 2-1/8 inch deep (100 by 54 mm) trade size.

12. Wall Plates: Comply with Section 262726.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:
a. Indoor Clean, Dry Locations: Type 1, painted steel.
3. Junction and Pull Boxes Larger Than 100 cubic inches:
a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.

D. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gangable boxes may not be used.

E. Floor Boxes:
1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 262726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
2. Use cast iron floor boxes within slab on grade.
3. Use sheet-steel or cast iron floor boxes within slab above grade.
4. Metallic Floor Boxes: Semi-adjustable (with integral means for leveling adjustment prior to concrete pour).
5. Manufacturer: Same as manufacturer of floor box service fittings.

F. Underground Boxes/Enclosures:

1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
2. Size: As indicated on drawings.
3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 24 inches.
4. Provide logo on cover to indicate type of service.
5. Applications:
    a. Sidewalks and Landscaped Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 15 load rating.
    b. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.
6. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.
    a. Combination fiberglass/polymer concrete boxes/enclosures are acceptable.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.
B. Verify that mounting surfaces are ready to receive boxes.
C. Verify that conditions are satisfactory for installation prior to starting work.
D. Verify locations of floor boxes in work areas prior to rough-in.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
D. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
E. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
F. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

G. Box Locations:

1. Unless dimensioned, box locations indicated are approximate.
2. Provide access panels where required. Verify size and location of panels with Architect prior to roughing in equipment requiring access panel.
3. Locate boxes as required for devices installed under other sections or by others.
4. Locate boxes so that wall plates do not span different building finishes.
5. Locate boxes so that wall plates do not cross masonry joints.
6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
    a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
    b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 260533.13.
11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
    a. Concealed above accessible suspended ceilings.
    b. Within joists in areas with no ceiling.
    c. Electrical rooms.
    d. Mechanical equipment rooms.

H. Box Supports:

1. Secure and support boxes in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.

I. Install boxes plumb and level.

J. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

K. Install boxes as required to preserve insulation integrity.

L. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

M. Underground Boxes/Enclosures:
1. Install enclosure on gravel base, minimum 6 inches deep.
2. Flush-mount enclosures located in concrete or paved areas.
3. Mount enclosures located in landscaped areas with top at 1 inch above finished grade.
4. Provide cast-in-place concrete collar constructed in accordance with Division 03, minimum 10 inches wide by 12 inches deep, around enclosures that are not located in concrete areas.

5. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.

N. Install firestopping to preserve fire resistance rating of partitions and other elements.

O. Close unused box openings.

P. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

Q. Provide grounding and bonding in accordance with Section 260526.

R. Identify boxes in accordance with Section 260553.

3.03 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.04 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION 260533.16

SECTION 260533.23

SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface raceway systems.

1.02 RELATED REQUIREMENTS

A. Section 260526 - Grounding and Bonding for Electrical Systems.

B. Section 260529 - Hangers and Supports for Electrical Systems.

C. Section 260533.13 - Conduit for Electrical Systems.

D. Section 260533.16 - Boxes for Electrical Systems.

E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 262726 - Wiring Devices: Receptacles.

G. Section 271000 - Structured Cabling: Voice and data jacks.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 5 - Surface Metal Raceways and Fittings; Current Edition, Including All Revisions.

D. UL 111 - Outline of Investigation for Multioutlet Assemblies; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of raceways with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate rough-in locations of outlet boxes provided under Section 260533.16 and conduit provided under Section 260533.13 as required for installation of raceways provided under this section.
3. Verify minimum sizes of raceways with the actual conductors and components to be installed.
4. Notify Architect/Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install raceways until final surface finishes and painting are complete.

2. Do not begin installation of conductors and cables until installation of raceways is complete between outlet, junction and splicing points.

1.05 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets including dimensions, knockout sizes and locations, materials, fabrication details, finishes, service condition requirements, and accessories.

1. Surface Raceway Systems: Include information on fill capacities for conductors and cables.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this Section with documented experience.

C. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

PART 2 PRODUCTS

2.01 RACEWAY REQUIREMENTS

A. Provide all components, fittings, supports, and accessories required for a complete raceway system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Do not use raceways for applications other than as permitted by NFPA 70 and product listing.

D. SURFACE RACEWAY SYSTEMS

1. Surface Metal Raceways: Listed and labeled as complying with UL 5.

2. Multioutlet Assemblies: Listed and labeled as complying with UL 111.

3. Surface Raceway System:

a. Raceway Type: Two channel, painted steel.

b. Length: As indicated on the drawings.

c. Color: To be selected by Architect.

d. Accessory Device Boxes: Suitable for the devices to be installed; color to match raceway.

e. Integrated Device Provisions:

1) Receptacles:

a) Comply with Section 262726, except for finishes.

b) Configuration: As indicated on the drawings.

c) Color: Match raceway.

d) Spacing: As indicated on the drawings.

2) Communications Outlets:

a) Voice and Data Jacks: As specified in Section 271000.

b) Configuration: As indicated on the drawings.

c) Spacing: As indicated on the drawings.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes and conduit terminations are installed in proper locations and are properly sized in accordance with NFPA 70 to accommodate raceways.

C. Verify that mounting surfaces are ready to receive raceways and that final surface finishes are complete, including painting.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install raceways plumb and level.

D. Secure and support raceways in accordance with Section 260529 at intervals complying with NFPA 70 and manufacturer's requirements.

E. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.

F. Close unused raceway openings.

G. Provide grounding and bonding in accordance with Section 260526.

H. Identify raceways in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. Inspect raceways for damage and defects.

B. Surface Raceway Systems with Integrated Devices: Test each wiring device to verify operation and proper polarity.

C. Correct wiring deficiencies and replace damaged or defective raceways.

3.04 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 PROTECTION

A. Protect installed raceways from subsequent construction operations.

B. Ground and bond raceway under provisions of Section 260526.

END OF SECTION 260533.23

SECTION 260536

CABLE TRAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal cable tray systems:
   1. Metal wire mesh/basket cable tray.
B. Cable trays and accessories.

1.02 REFERENCE STANDARDS

A. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.
B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
C. NEMA BI-50016 - Cable Tray Installation Guidelines; 2024.
D. NEMA VE 1 - Metal Cable Tray Systems; 2017.
E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate arrangement of cable tray with structural members, ductwork, piping, equipment and other potential conflicts. Coordinate work to avoid installation of obstructions within cable tray required clearances.
   2. Coordinate arrangement of cable tray with dimensions and clearance requirements of actual products to be installed.
   3. Coordinate work with placement of supports and anchors required for mounting.
   4. Notify of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
B. Preinstallation Meeting: Convene one week prior to commencing work of this section; require attendance of affected installers. Review proposed routing, sequence of installation, and protection requirements for installed cable tray.
C. Sequencing:
   1. Do not begin installation of cables until installation of associated cable tray run is complete.

1.04 SUBMITTALS

A. Refer to Division 01 requirements.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cable tray system components and accessories. Include dimensions, materials,

fabrication details, finishes, and span/load ratings.

C. Shop Drawings: Include dimensioned plan views and sections indicating proposed cable tray routing, required clearances, and locations and details of supports, fittings, building element penetrations, and equipment connections.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Project Record Documents: Record actual routing of cable tray and locations of supports.

1.05 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with documented experience.

C. Product Evaluation and Listing Organization Qualifications: Organization engaged in evaluation of products and services, including those recognized by OSHA as Nationally Recognized Testing Laboratories (NRTL), and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions and NEMA BI-50016, except do not store cable tray outdoors without cover as permitted in NEMA BI-50016.

B. Handle products carefully to avoid damage to finish.

1.07 COORDINATION

A. Coordinate layout and Installation of cable tray with other installations.

B. Revise locations and elevations from those indicated as required to suit field conditions end as approved by the Architect.

C. Storage and Handling: Avoid breakage, denting and scoring finishes. Damaged products will not be installed, Store cable trays and accessories in original cartons and in clean dry space; protect from weather and construction traffic. Wet materials will be unpacked and dried before storage.

PART 2 PRODUCTS

2.01 CABLE TRAY SYSTEM - GENERAL REQUIREMENTS

A. Provide new cable tray system consisting of required components, fittings, supports, and accessories, as necessary for complete system.

B. Provide products listed, classified, and labeled as suitable for purpose intended.

C. Do not use cable tray for applications other than as permitted by NFPA 70 and product listing/classification.

D. Provide cable tray system and associated components suitable for use at indicated span/load ratings under service conditions at installed location.

E. Unless otherwise indicated, specified span/load ratings are based on safety factor of 1.5 and working load only (i.e., no additional concentrated static load), with ratings for metal cable tray systems in accordance with NEMA VE 1.

F. Unless otherwise indicated, specified load/fill depths and inside widths are nominal values, with values for metal cable tray systems in accordance with NEMA VE 1 including applicable allowable tolerances.

2.02 METAL CABLE TRAY SYSTEMS

A. Comply with NEMA VE 1.

B. Material/Finishes:

1. Zinc Electroplated Steel: Comply with ASTM B633.

C. Metal Wire Mesh/Basket Cable Tray:

1. Material: Zinc-electroplated steel or mill-galvanized before fabrication (pre-galvanized) steel.
2. Tray Depth: 4 inches.
3. Mesh Spacing: 2 by 4 inches.
4. Tray Width: 12 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage cable tray system has been completed.

B. Verify field measurements.

C. Verify dimensions and span/load ratings of cable tray system components.

D. Verify that mounting surfaces are ready to receive cable tray and associated supports.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install cable tray in accordance with NECA 1 (general workmanship) and NEMA BI-50016.

C. Unless otherwise indicated, arrange cable tray to be parallel or perpendicular to building lines.

D. Arrange cable tray to provide required clearances and maintain cable access.

1. Minimum Clearance Above and Adjacent to Cable Tray: 6 inches.

E. Install cable tray plumb and level, with sections aligned and with horizontal runs at specified elevation.

F. Metal Wire Mesh/Basket Cable Tray: Field fabricate fittings in accordance with manufacturer's instructions, using only manufacturer-approved connectors classified for bonding.

1. Inside Radius of Fittings: 12 inches.

G. Cable Tray Movement Provisions:

1. Provide expansion fittings where cable tray is subject to movement, including but not limited to:
   a. Where cable tray crosses structural joints intended for expansion.
   b. Long straight cable tray runs in accordance with NEMA BI-50016.
2. Use expansion guides in lieu of hold-down clamps where prescribed in NEMA BI-50016.
3. Set gaps for expansion fittings in accordance with NEMA BI-50016.

H. Cable and Conductors:

1. Ampacity: As determined by applications listed in NFPA 70.

I. Cable Provisions:

1. Use fixed barrier strips to maintain separation of cables as indicated and as required by NFPA 70.
2. Use drop-out fittings or bushings where cables exit cable tray as required to maintain minimum cable bending radius.
3. Use cable support fittings for long vertical cable tray runs with heavy cables.

J. Provide end closures at unconnected ends of cable tray runs.

K. Cable Tray Support:

1. See Section 260529 for additional requirements.
2. Use manufacturer's recommended hangers and supports, located in accordance with NEMA BI-50016 and manufacturer's requirements, but not exceeding specified span. Provide required support and attachment where not furnished by cable tray manufacturer.
3. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

L. Grounding and Bonding Requirements:

1. Comply with grounding and bonding requirements of NEMA BI-50016.

2. Metal Cable Tray Systems: Use suitable bonding jumpers or classified cable tray connectors to provide electrical continuity. Do not use classified cable tray connectors where cable tray sections have been modified, such as being bent, cut, or reshaped.
3. Provide suitable equipment grounding conductor in each metal cable tray, except where cable tray contains only multiconductor cables with integral equipment grounding conductors. Do not use metal cable tray system as sole equipment grounding conductor.
    a. Minimum Equipment Grounding Conductor Size: 6 AWG copper.
    b. Bond equipment grounding conductor to each metal cable tray section using suitable listed ground clamps. Separate bonding jumpers are not required where properly bonded equipment grounding conductor provides equivalent continuity.

M. Conduit Termination:
1. Use listed cable tray conduit clamps (evaluated for bonding connection) to terminate conduits at cable tray.
2. Provide insulating bushing at conduit termination to protect cables.
3. Provide independent support for conduit.

N. Cable Installation:
1. Install cables in accordance with cable installation requirements of NEMA BI-50016.
2. Use appropriate cable pulling tools, applied to prevent excessive force on cable tray system and maintain minimum cable bending radius.
3. Use cable clamps or cable ties to fasten conductors/cables to vertical and horizontal runs of cable tray
    a. Distance Between Fastening Points for Vertical Runs: 18 inches.
    b. Distance Between Fastening Points for Horizontal Runs: As required to maintain spacing and confine conductor/cable within cable fill area.

O. Penetrations: Install firestopping to preserve fire resistance rating of building elements.

P. Identification Requirements:
1. Use warning labels to identify cable tray with word message "WARNING! Do Not Use As A Walkway, Ladder, Or Support For Personnel. Use Only As A Mechanical Support For Cables, Tubing and Raceways." at maximum intervals of 20 ft.

Q. Install metallic cable tray in accordance with NEMA VE 1.

3.03 FIELD QUALITY CONTROL

A. Inspect cable tray system for damage and defects.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Correct deficiencies and replace damaged or defective cable tray system components.

3.04 ADJUSTING

A. Adjust tightness of mechanical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Remove dirt and debris from cable tray.

B. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.06 PROTECTION

A. Protect cable tray system from subsequent construction operations.

END OF SECTION 260536

SECTION 260553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.
B. Identification nameplates and labels.
C. Wire and cable markers.
D. Voltage markers.
E. Underground warning tape.
F. Warning signs and labels.
G. Field-painted identification of conduit.

1.02 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2023.
B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2023.
C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
D. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.
E. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.
B. Sequencing:
   1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
   2. Do not install identification products until final surface finishes and painting are complete.

1.04 SUBMITTALS

A. Refer to Division 01 requirements.
B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.06 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 - PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:

1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.

a. Switchboards

1) Identify ampere rating.
2) Identify voltage and phase.
3) Use identification nameplate to identify main overcurrent protective device.
4) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.

b. Panelboards

1) Identify ampere rating.
2) Identify voltage and phase.
3) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
4) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
5) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.

c. Transformers:

1) Identify kVA rating.
2) Identify voltage and phase for primary and secondary.
3) Identify power source and circuit number. Include location when not within sight of equipment.
4) Identify load(s) served. Include location when not within sight of equipment.

d. Enclosed switches, circuit breakers, and motor controllers

1) Identify voltage and phase.

2) Identify power source and circuit number. Include location when not within sight of equipment.
3) Identify load(s) served. Include location when not within sight of equipment.

e. Transfer Switches
1) Identify voltage and phase.
2) Identify power source and circuit number for both normal power source and standby power source. Include location when not within sight of equipment.

f. Electricity Meters:
1) Identify load(s) metered.

2. Service Equipment:
a. Use identification nameplate to identify each service disconnecting means.

3. Use voltage marker to identify highest voltage present for each piece of electrical equipment.

4. Use identification label on inside of door at each fused switch to identify required NEMA fuse class and size.

5. Use identification label or handwritten text using indelible marker on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.

6. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".

7. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
a. Service equipment.
b. Elevator control panels.

8. Arc Flash Hazard Warning Labels: Comply with Section 260573.

B. Identification for Conductors and Cables:

1. Color Coding for Power Conductors 600 V and Less: Comply with Section 260519.

2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has

feeders or branch circuits served by more than one nominal voltage system.

3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
   a. At each source and load connection.
   b. Within boxes when more than one circuit is present.
   c. Within equipment enclosures when conductors and cables enter or leave the enclosure.
4. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.

C. Identification for Raceways:
1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet.
2. Use color-coded bands to identify systems other than normal power system for accessible conduits at maximum intervals of 20 feet.
   a. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches wide.
      1) Vinyl Color Coding Electrical Tape: Comply with Section 260519.
   b. Color Code:
      1) Fire Alarm System: Red.
3. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations, and at equipment terminations when source is not within sight.
4. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
5. Use underground warning tape to identify underground raceways.
6. Use voltage markers to identify highest voltage present for wireways at maximum intervals of 20 feet.

D. Identification for Cable Tray: Comply with Section 260536.

E. Identification for Boxes:
1. Use voltage markers to identify highest voltage present.
2. Use color coded boxes to identify systems other than normal power system.

a. Color-Coded Boxes: Field painted in accordance with Division 09 per the following color code.
1) Fire Alarm System: Red. Label as "F/A".
b. For exposed boxes in public areas, do not color code.

3. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
a. For exposed boxes in public areas, use only identification labels.

F. Identification for Devices:
1. Identification for Communications Devices: Comply with Section 271000.
2. Wiring Device and Wallplate Finishes: Comply with Section 262726.
3. Use identification label to identify fire alarm system devices.
a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
4. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.
5. Use identification label or engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.

G. Identification for Luminaires:
1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

H. Identification for Photovoltaic Systems: Comply with Section 263100

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
1. Materials:
a. Indoor Clean, Dry Locations: Use plastic nameplates.
b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.

5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:
   1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
   2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:
   1. Minimum Size: 1 inch by 2.5 inches.
   2. Legend:
      a. System designation where applicable:
         1) Fire Alarm System: Identify with text "FIRE ALARM".
      b. Equipment designation or other approved description.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height:
      a. System Designation: 1 inch.
      b. Equipment Designation: 1/2 inch.
   5. Color:
      a. Normal Power System: White text on black background.
      b. Fire Alarm System: White text on red background.

D. Format for General Information and Operating Instructions:
   1. Minimum Size: 1 inch by 2.5 inches.
   2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height: 1/4 inch.
   5. Color: Black text on white background unless otherwise indicated.

E. Format for Receptacle Identification:
   1. Minimum Size: 3/8 inch by 1.5 inches.
   2. Legend: Power source and circuit number or other designation indicated.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height: 3/16 inch.
   5. Color: Black text on clear background.

F. Format for Control Device Identification:
   1. Minimum Size: 3/8 inch by 1.5 inches.

2. Legend: Load controlled or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

G. Format for Fire Alarm Device Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Designation indicated and device zone or address.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Red text on white background.

2.03 WIRE AND CABLE MARKERS

A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

C. Legend: Power source and circuit number or other designation indicated.

D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

E. Minimum Text Height: 1/8 inch.

F. Color: Black text on white background unless otherwise indicated.

2.04 VOLTAGE MARKERS

A. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

B. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

C. Minimum Size:
1. Markers for Equipment: 1 1/8 by 4 1/2 inches.
2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
3. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
4. Markers for Junction Boxes: 1/2 by 2 1/4 inches.

D. Legend:
1. Markers for Voltage Identification: Highest voltage present.

E. Color: Black text on orange background unless otherwise indicated.

2.05 UNDERGROUND WARNING TAPE

A. Materials: Use foil-backed detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

B. Foil-backed Detectable Type Tape: 6 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.

C. Legend: Type of service, continuously repeated over full length of tape.

D. Color:

1. Tape for Buried Power Lines: Black text on red background.
2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.06 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:

1. Materials:
   a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
3. Minimum Size: 7 by 10 inches unless otherwise indicated.

C. Warning Labels:

1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

B. Degrease and clean surfaces to receive nameplates and labels.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:

1. Surface-Mounted Equipment: Enclosure front.

2. Flush-Mounted Equipment: Inside of equipment door.
3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
4. Branch Devices: Adjacent to device.
5. Interior Components: Legible from the point of access.
6. Conduits: Legible from the floor.
7. Boxes: Outside face of cover.
8. Conductors and Cables: Legible from the point of access.
9. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 12 inch(es) below finished grade.

G. Secure rigid signs using stainless steel screws.

H. Mark all handwritten text, where permitted, to be neat and legible.

3.03 FIELD QUALITY CONTROL

A. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION 260553

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SECTION 260573
POWER SYSTEM STUDIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Short-circuit study.

B. Protective device coordination study.

C. Arc flash and shock risk assessment.

1. Includes arc flash hazard warning labels.

D. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.02 REFERENCE STANDARDS

A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2023.

B. IEEE 141 - IEEE Recommended Practice for Electric Power Distribution for Industrial Plants; 1993 (Reaffirmed 1999).

C. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems; 2001, with Errata (2003).

D. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis; 1997.

E. IEEE 551 - IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems; 2006.

F. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations; 2018, with Errata (2019).

G. NEMA MG 1 - Motors and Generators; 2021.

H. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. NFPA 70E - Standard for Electrical Safety in the Workplace; 2024.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.

2. Notify Architect/Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Submit study reports prior to or concurrent with product submittals.
2. Do not order equipment until matching study reports and product submittals have both been evaluated by Architect/Engineer.
3. Verify naming convention for equipment identification prior to creation of final drawings, reports, and arc flash hazard warning labels (where applicable).

1.04 SUBMITTALS

A. Refer to Division 01 requirements.

B. Study preparer's qualifications.

C. Study reports, stamped or sealed and signed by study preparer.

D. Arc Flash Hazard Warning Label Samples: One of each type and legend specified.

E. Site-specific arc flash hazard warning labels.

F. Field quality control reports.

G. Certification that field adjustable protective devices have been set in accordance with requirements of studies.

H. Project Record Documents: Revise studies as required to reflect as-built conditions.

1. Include hard copies with operation and maintenance data submittals.
2. Include computer software files used to prepare studies with file name(s) cross-referenced to specific pieces of equipment and systems.

1.05 POWER SYSTEM STUDIES

A. Scope of Studies:

1. Perform analysis of new electrical distribution system as indicated on drawings.
2. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).
3. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.
    a. Known Operating Modes:
        1) Utility as source.
        2) Generator as source.

B. General Study Requirements:

1. Comply with NFPA 70.

2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.

C. Data Collection:

1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.
    a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
        1) Obtain up-to-date information from Utility Company.
    b. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 1 code letter designation.
    c. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.
    d. Protective Devices:
        1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).
        2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).
    e. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.
    f. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.

D. Short-Circuit Study:

1. Comply with IEEE 551 and applicable portions of IEEE 141, IEEE 242, and IEEE 399.
2. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:
    a. Maximum utility fault currents.

b. Maximum motor contribution.
c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

3. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.

E. Protective Device Coordination Study:
1. Comply with applicable portions of IEEE 242 and IEEE 399.
2. Analyze alternate scenarios considering known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

F. Arc Flash and Shock Risk Assessment:
1. Comply with NFPA 70E.
2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.
a. Where reasonable, study preparer may assume a maximum clearing time of two seconds in accordance with IEEE 1584, provided that the conditions are such that a worker's egress from an arc flash event would not be inhibited.
3. For equipment with main devices mounted in separate compartmentalized sections, perform calculations on both the line and load side of the main device.
4. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:
a. Maximum and minimum utility fault currents.
b. Maximum and minimum motor contribution.
c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

G. Study Reports:
1. General Requirements:
a. Identify date of study and study preparer.
b. Identify study methodology and software product(s) used.
c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
d. Identify base used for per unit values.

e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.

f. Include conclusions and recommendations.

2. Short-Circuit Study:

a. For each scenario, identify at each bus location:

1) Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).

2) Fault point X/R ratio.

3) Associated equipment short circuit current ratings.

b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.

3. Protective Device Coordination Study:

a. For each scenario, include time-current coordination curves plotted on log-log scale graphs.

b. For each graph include (where applicable):

1) Partial single-line diagram identifying the portion of the system illustrated.

2) Protective Devices: Time-current curves with applicable tolerance bands for each protective device in series back to the source, plotted up to the maximum available fault current at the associated bus.

3) Conductors: Damage curves.

4) Transformers: Inrush points and damage curves.

5) Generators: Full load current, overload curves, decrement curves, and short circuit withstand points.

6) Motors: Full load current, starting curves, and damage curves.

c. For each protective device, identify fixed and adjustable characteristics with available ranges and recommended settings.

1) Circuit Breakers: Include long time pickup and delay, short time pickup and delay, and instantaneous pickup.

2) Include ground fault pickup and delay.

3) Include fuse ratings.

4) Protective Relays: Include current/potential transformer ratios, tap, time dial, and instantaneous pickup.

d. Identify cases where either full selective coordination or adequate protection is not achieved, along with recommendations.

4. Arc Flash and Shock Risk Assessment:

a. For the worst case for each scenario, identify at each bus location:

1) Calculated incident energy and associated working distance.

2) Calculated arc flash boundary.

3) Bolted fault current.

4) Arcing fault current.

5) Clearing time.

6) Arc gap distance.

b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.

1.06 QUALITY ASSURANCE

A. Study Preparer Qualifications: Professional electrical engineer licensed in the State in which the Project is located and with experience in the preparation of studies of similar type and complexity using specified computer software.

1. Study preparer may be employed by manufacturer of electrical distribution equipment.

B. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.

C. Contractor Responsibility: Provide all project-related data needed by study preparer, including equipment, wire sizes, insulation types, conduit types, and actual circuit lengths.

PART 2 - PRODUCTS

2.01 ARC FLASH HAZARD WARNING LABELS

A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.

1. Materials: Comply with Section 260553.

2. Minimum Size: 4 by 6 inches.

3. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.

a. Include orange header that reads "WARNING" unless otherwise indicated.

1) Use read header that reads "DANGER" where incident energy is 40 ca/cm^2 or more.

b. Include the text "Arc Flash and Shock Hazard; Appropriate PPE Required" or approved equivalent.

c. Include the following information:

1) Arc flash boundary.
2) Available incident energy and corresponding working distance.
3) Arc flash incident energy
4) Shock hazard
5) Nominal system voltage.
6) Limited approach boundary.
7) Restricted approach boundary.
8) Equipment identification.
9) Study preparer, report reference, and date calculations were performed.
10) Labels are to comply with current edition of NFPA 70E, NEC 110.15 and OSHA requirements. Labels to comply with ANSI Z535.

2.02 PROTECTIVE DEVICES

A. In addition to requirements specified elsewhere, provide overcurrent protective devices having ratings and settings in accordance with results of this analysis.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install arc flash warning labels in accordance with Section 260553.

3.02 FIELD QUALITY CONTROL

A. Provide the services of field testing agency or equipment manufacturer's representative to perform inspection, testing, and adjusting.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Adjust equipment and protective devices for compliance with studies and recommended settings.

D. Notify Architect/Engineer of any conflicts with or deviations from studies. Obtain direction before proceeding.

E. Submit detailed reports indicating inspection and testing results, and final adjusted settings.

F. Adjust installed protective devices having adjustable settings to conform to requirements determined by the coordination analysis.

G. Submit report showing final adjusted settings of all protective devices.

3.03 CLOSEOUT ACTIVITIES

A. Training: Include as part of the base bid training for Owner's personnel on electrical safety pertaining to arc flash and shock hazards.

1. Use site-specific arc flash and shock risk assessment report as training reference, supplemented with additional training materials as required.
2. Provide minimum of four hours of training.
3. Instructor: Representative of entity performing study.
4. Location: At project site.

END OF SECTION 260573

SECTION 260583
WIRING CONNECTIONS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Electrical connections to equipment.

1.02 REFERENCE STANDARDS

A. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

B. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
2. Determine connection locations and requirements.

B. Sequencing:

1. Install rough-in of electrical connections before installation of equipment is required.
2. Make electrical connections before required start-up of equipment.

1.04 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Provide wiring device manufacturer’s catalog information showing dimensions, configurations, and construction.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.

1. Colors: Comply with NEMA WD 1.
2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

B. Disconnect Switches: As specified in Section 262816.16 and in individual equipment sections.

C. Wiring Devices: As specified in Section 262726.

D. Flexible Conduit: As specified in Section 260533.13.

E. Wire and Cable: As specified in Section 260519.

F. Boxes: As specified in Section 260533.16.

2.02 EQUIPMENT CONNECTIONS

A. Interior light fixtures:

1. Electrical Connection: Flexible metal conduit.

B. Motor-driven equipment:

1. Electrical Connection: Liquidtight flexible metal conduit.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

J. Coolers and Freezers: Cut and seal conduit openings in freezer and cooler walls, floor, and ceilings. Coordinate with Food Service Contractor.

END OF SECTION 260583

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SECTION 260923
LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Occupancy sensors.
B. Digital wall control stations.
C. Graphic wall station (touch screen).
D. Daylighting controls.
E. In-wall interval timers.
F. Outdoor photo controls.
G. Accessories.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.
C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
D. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control; Current Edition, Including All Revisions.
E. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.
F. UL 917 - Clock-Operated Switches; Current Edition, Including All Revisions.
G. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate placement of lighting control devices with millwork, furniture, equipment and other potential conflicts.
   2. Coordinate placement of wall switch occupancy sensors with installed door swings.
   3. Coordinate placement of occupancy sensors with millwork, furniture, equipment and other potential obstructions to motion detection coverage.
   4. Coordinate placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement.
   5. Coordinate lighting control device product selections with luminaire characteristics; see Section 265100 and lighting fixture schedule.

6. Notify Architect/Engineer of conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:

1. Do not install lighting control devices until final surface finishes and painting are complete.

1.04 SUBMITTALS

A. See Division 01 for submittal procedures and additional information.

B. Product Data: Include ratings, operating modes or sequence of functions, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

1. Occupancy/Vacancy Sensors: Include detailed motion detection coverage range diagrams.

C. Shop Drawings:

1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.
2. Daylighting Controls: Provide lighting plan indicating location, model number, and orientation of each photo sensor and associated system component.

D. Field quality control reports.

E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Operation and Maintenance Data: Include detailed information on device programming and setup.

G. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.05 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Maintain at project site one copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with documented experience.

D. Product Evaluation and Listing Organization Qualifications: Organization engaged in evaluation of products and services, including those recognized by OSHA as Nationally Recognized Testing Laboratories (NRTL), and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Store products in clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.07 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.08 WARRANTY

A. See Division 01 for additional requirements.

B. Provide five year manufacturer warranty for all occupancy sensors, power packs, and wall controls.

C. Provide five year manufacturer warranty for utility grade locking receptacle-mounted outdoor photo controls.

D. Provide five year manufacturer warranty for digital load controllers.

PART 2 PRODUCTS

2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for purpose intended.

B. Unless specifically indicated as excluded, provide components necessary for complete operating system including, but not limited to, conduit, wiring, connectors, hardware, and accessories.

2.02 OCCUPANCY SENSORS

A. General Requirements:

1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
2. Sensor Technology:
   a. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using combination of both passive infrared and ultrasonic technologies.
   b. Passive Infrared/Acoustic Dual Technology Occupancy Sensors: Designed to detect occupancy using combination of both passive infrared and audible sound sensing technologies.
3. Provide LED to visually indicate motion detection.
4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence

is detected during adjustable turn-off delay time interval.

5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
6. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.
7. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
8. Sensitivity: Field adjustable.
9. Adaptive Technology: Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.
10. Integral Photocell: For field selectable and adjustable inhibition of automatic turn-on of load when ambient lighting is above selected level.
11. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
12. Load Rating for Line Voltage Occupancy Sensors: As required to control load indicated on drawings.
13. Isolated Relay for Low Voltage Occupancy Sensors: SPDT dry contacts, ratings as required for interface with system indicated.
14. Sensors shall have auxillary relays, contacts or power packs as required for interface with the Building Automation System so as to also control mechanical equipment based upon occupancy.

B. Wall Switch Occupancy Sensors:

1. General Requirements:
    a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
    b. Unless otherwise indicated or required to control load indicated on drawings, provide line voltage units with self-contained relay.
    c. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
    d. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no

occupant presence is detected during delayed-off time interval.

e. Finish: Color to be selected by Architect.

2. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.

a. Passive Infrared/Microphonics dual technlogy is also acceptable.

C. Wall Dimmer Occupancy Sensors:

1. General Requirements:

a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with field of view of 180 degrees, integrated dimming control capability, and no leakage current to load in off mode.

b. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).

c. Manual-Off Override Control Capability: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during delayed-off time interval.

d. Dimmer: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, and listed as complying with UL 1472; type and rating suitable for load controlled.

e. Provide field adjustable dimming preset for occupied state.

f. Finish: Color to be selectedby architect.

D. Ceiling Mounted Occupancy Sensors:

1. General Requirements:

a. Description: Low profile occupancy sensors designed for ceiling installation.

b. Unless otherwise indicated or required to control load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.

c. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.

d. Finish: White unless otherwise indicated.

2. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:

a. Extended Range Sensors: Capable of detecting motion within area of 1,200 square feet at mounting height of 9 feet, with field of view of 360 degrees.

3. Passive Infrared/Acoustic Dual Technology Ceiling Mounted Occupancy Sensors:
   a. Extended Range Sensors: Capable of detecting motion within area of 1,200 square feet at mounting height of 9 feet.

E. Directional Occupancy Sensors:
   1. General Requirements:
      a. Description: Occupancy sensors designed for wall or ceiling mounting, with integral swivel for field adjustment of motion detection coverage.
   2. Passive Infrared (PIR) Directional Occupancy Sensors:
      a. High Bay Sensors: Capable of detecting motion within distance of 50 feet at mounting height of 30 feet.

F. Power Packs for Low-Voltage Occupancy Sensors:
   1. Description: Plenum rated, self-contained low-voltage class 2 transformer and relay compatible with specified low-voltage occupancy sensors for switching of line-voltage loads.
   2. Provide quantity and configuration of power and slave packs with associated wiring and accessories as required to control load indicated on drawings.
   3. Input Supply Voltage: Dual rated for 120/277 V ac.
   4. Load Rating: As required to control load indicated on drawings.

G. Dimming Power Packs for Low Voltage Occupancy Sensors:
   1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
   2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
   3. Input Supply Voltage: Dual rated for 120/277 V ac.
   4. Load Rating: As required to control the load indicated on drawings.
   5. Dimming protocol: As required to control the load indicated on drawings.

H. Accessories:
   1. Where indicated, provide compatible accessory wall switches for manual override control. Switches to match appearance of other lighting controls.

2.03 DIGITAL WALL CONTROL STATIONS

A. Description: Manual controls for on/off, dimming and lighting scene selection compatible with Occupancy and Photosensor control power packs allowing user override of indoor electrical lighting levels.

B. Switch Configuration: As indicated on the drawings.

C. Color: To be selected by Architect.

2.04 GRAPHIC WALL STATION

A. Mounting: Suitable for installation in single-gang switch box.

B. Integral 3.5-inch (88 mm) capacitive full-color touch screen.

C. Power via polarity insensitive Class 2 low-voltage 15 to 24V (dc) power supply.

D. Communication over standard low-voltage network cabling with RJ-45 connectors.

E. User-customizable screen saver utilizing uploaded image file in common file format including jpg, png, gif, bmp, or tif.

F. Capable of configuration of all switches, dimmers, control zones, and lighting preset scenes via password-protected setup screens.

G. Graphic Wall Station Options:

1. Number of Control Zones: Up to 16.
2. Number of Scenes: Up to 16.
3. Profile Scene Duration: User configurable from five minutes to 12 hours.
4. Color: To be selected by Architect.

2.05 DAYLIGHTING CONTROLS

A. System Description: Control system consisting of photo sensors and compatible control modules and power packs, contactors, or relays as required for automatic control of load indicated according to available natural light; capable of integrating with occupancy sensors and manual override controls.

B. Daylighting Control Photo Sensors: Low voltage class 2 photo sensor units with output signal proportional to the measured light level and provision for zero or offset based signal.

1. Sensor Type: Filtered silicon photo diode.
2. Sensor Range:
    a. Indoor Photo Sensors: 5 to 100 footcandles.
3. Finish: White unless otherwise indicated.

C. Dimming Photo Sensors: Photo sensor units with integral controller compatible with specified dimming ballasts, for direct continuous dimming of up to 50 ballasts.

D. Daylighting Control Dimming Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors and with specified dimming ballasts, for both continuous dimming of compatible dimming ballasts and switching of compatible power packs, contactors, or relays in response to changes in measured light levels according to selected settings.
   1. Operation: Unless otherwise indicated, specified load to be continuously brightened as not enough daylight becomes available and continuously dimmed as enough daylight becomes available.
   2. Control Capability: Capable of controlling up to three separately programmable channels, with up to 50 ballasts per channel.
   3. Dimming and Fade Rates: Adjustable from 5 to 60 seconds.
   4. Cut-Off Delay: Selectable and adjustable from 0 to 20 minutes.

E. Power Packs for Low Voltage Daylighting Control Modules:
   1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage daylighting control modules for switching of line voltage loads. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
   2. Input Supply Voltage: Dual rated for 120/277 V ac.
   3. Load Ratings: As required to control the load indicated on drawings.

2.06 IN-WALL INTERVAL TIMERS

A. Digital Electronic In-Wall Interval Timers:
   1. Description: Factory-assembled solid state programmable controller with LCD display, suitable for mounting in standard wall box, and listed and labeled as complying with UL 916 or UL 917.
   2. Program Capability: Designed to turn load off at end of preset time interval.
   3. Time Interval: Field selectable range of presets available up to 12 hours.
   4. Provide field selectable audible and visual indication to warn that end of interval operation is about to turn off load.
   5. Provide power outage backup to retain programming and maintain clock.
   6. Manual override: Capable of both turning load off and resetting timer to original preset time interval.
   7. Switch Configuration: Suitable for use in either SPST or 3-way application.
   8. Contact Ratings: As required to control load indicated on drawings.

2.07 OUTDOOR PHOTO CONTROLS

A. Stem-Mounted Outdoor Photo Controls:

1. Description: Direct-wired photo control unit with threaded conduit mounting stem and field-adjustable swivel base, listed and labeled as complying with UL 773A.
2. Housing: Weatherproof, impact resistant polycarbonate.
3. Photo Sensor: Cadmium sulfide.
4. Provide external sliding shield for field adjustment of light level activation.
5. Light Level Activation: 1 to 5 footcandles turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
6. Voltage: As required to control load indicated on drawings.
7. Failure Mode: Fails to the on position.
8. Load Rating: As required to control load indicated on drawings.
9. Provide accessory wall-mounting bracket where indicated or as required to complete installation.

2.08 ACCESSORIES

A. Where indicated, provide compatible accessory wall switches for manual override control. Switches to match appearance of other lighting controls.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.
B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.
D. Verify that final surface finishes are complete, including painting.
E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.
F. Verify that service voltage and ratings of lighting control devices are appropriate for service voltage and load requirements at location to be installed.
G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.
B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes as required for installation of lighting control devices; see Section 260533.16.

C. Maintain separation of remote-control, signaling, and power-limited circuits.

1. See manufacturer instructions and Section 260519 for control wiring conductors, wiring methods, and identification requirements.

D. Install lighting control devices in accordance with manufacturer's instructions.

E. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

F. Install lighting control devices plumb and level, and held securely in place.

G. Where required and not furnished with lighting control device, provide wall plate; see Section 262726.

H. Provide required supports; see Section 260529.

I. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

J. Identify lighting control devices; see Section 260553.

K. Occupancy Sensor Locations:

1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.

2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

L. Outdoor Photo Control Locations:

1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east,

west, or down.

2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by photo control itself.

M. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into photo control.

N. Daylighting Control Photo Sensor Locations:

1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for proper control of respective room or area based on manufacturer's recommendations for installed devices.

2. Unless otherwise indicated, locate photo sensors for open loop systems to accurately measure the level of daylight coming into space, while minimizing measured amount of lighting from artificial sources.

O. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near sensor location.

P. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.

Q. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.

3.04 FIELD QUALITY CONTROL

A. Inspect each lighting control device for damage and defects.

B. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.

C. Test outdoor photo controls to verify proper operation, including time delays where applicable.

D. Test daylighting controls to verify proper operation, including light level measurements and time delays where applicable. Record test results in written report to be included with submittals.

E. Correct wiring deficiencies and replace damaged or defective conductors, cables, and lighting control devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect/Engineer.

C. Adjust position of directional occupancy sensors to achieve optimal coverage as required.

D. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.

E. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Architect/Engineer.

F. Adjust daylighting controls under optimum lighting conditions after all room finishes, furniture, and window treatments have been installed to achieve desired operation as indicated or as directed by Architect. Record settings in written report to be included with submittals. Readjust controls calibrated prior to installation of final room finishes, furniture, and window treatments that do not function properly as determined by Architect/Engineer.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.07 COMMISSIONING

A. See Division 01 for commissioning requirements.

3.08 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of lighting control devices to Architect/Engineer, and correct deficiencies or make adjustments as directed.

B. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of four hours of training.
3. Instructor: Manufacturer's authorized service representative.
4. Location: At project site.

END OF SECTION 260923

SECTION 262100

LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Electrical service requirements.

1.02 DEFINITIONS

A. Service Point: The point of connection between the facilities of the serving utility and the premises wiring as defined in NFPA 70, and as designated by the Utility Company.

1.03 REFERENCE STANDARDS

A. IEEE C2 - National Electrical Safety Code(R) (NESC(R)); 2023.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Verify the following with Utility Company representative:
    a. Utility Company requirements, including division of responsibility.
    b. Exact location and details of utility point of connection.
2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for electrical service and associated equipment.
3. Coordinate arrangement of service entrance equipment with the dimensions and clearance requirements of the actual equipment to be installed.
4. Notify Architect/Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Arrange for Utility Company to provide permanent electrical service. Prepare and submit documentation required by Utility Company.

C. Preinstallation Meeting: Convene one week prior to commencing work of this section to review service requirements and details with Utility Company representative.

D. Scheduling:

1. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.05 QUALITY ASSURANCE

A. Comply with the following:

1. IEEE C2 (National Electrical Safety Code).
2. NFPA 70 (National Electrical Code).
3. The requirements of the Utility Company.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

PART 2 - PRODUCTS

2.01 ELECTRICAL SERVICE REQUIREMENTS

A. Provide new electrical service consisting of all required conduits, conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.

B. Electrical Service Characteristics:
1. Service Type: Underground.
2. Service Voltage: 480Y/277 V, 3 phase, 60 Hz.

C. Utility Company: Dominion.

D. Division of Responsibility:
1. Pad-Mounted Utility Transformers:
a. Transformer Pads: Furnished and installed by Contractor.
b. Transformers: Furnished and installed by Utility Company.
c. Transformer Grounding Provisions: Furnished and installed by Contractor.
d. Primary:
1) Trenching and Backfilling: Provided by Contractor.
2) Conduits: Furnished and installed by Contractor.
a) Conduit size to be as per utility company requirements.
3) Conductors: Furnished and installed by Utility Company
e. Secondary:
1) Trenching and Backfilling: Provided by Contractor.
2) Conduits: Furnished and installed by Contractor.
3) Conductors: Furnished and installed by Contractor.
2. Metering Provisions:
a. Metering Transformer Cabinets: Furnished and installed by Contractor per Utility Company requirements.
b. Metering Transformers: Furnished and installed by Contractor.
c. Conduits Between Metering Transformers and Meters: Furnished and installed by Contractor..

d. Wiring Between Metering Transformers and Meters: Furnished and installed by Contractor..

e. Communications Conduits for Meters: Furnished and installed by Contractor.

E. Products Furnished by Contractor: Comply with Utility Company requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings and configurations of service entrance equipment are consistent with the indicated requirements.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Verify and mark locations of existing underground utilities.

3.03 INSTALLATION

A. Install products in accordance with manufacturer's instructions and Utility Company requirements.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances and required maintenance access.

D. Provide required trenching and backfilling in accordance with Division 31.

E. Construct cast-in-place concrete pads for utility equipment in accordance with Utility Company requirements and Div 03.

F. Provide required support and attachment components in accordance with Section 260529.

G. Provide grounding and bonding for service entrance equipment in accordance with Section 260526.

H. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 260553.

3.04 PROTECTION

A. Protect installed equipment from subsequent construction operations.

END OF SECTION 262100

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SECTION 262200
LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. General purpose transformers.

1.02 REFERENCE STANDARDS

A. 10 CFR 431, Subpart K - Energy Efficiency Program for Certain Commercial and Industrial Equipment - Distribution Transformers; Current Edition.

B. IEEE C57.96 - IEEE Standard Guide for Loading Dry-Type Distribution and Power Transformers; 2013.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

D. NECA 409 - Standard for Installing and Maintaining Dry-Type Transformers; 2015.

E. NEMA ST 20 - Dry Type Transformers for General Applications; 2021.

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

G. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with placement of supports, anchors, etc. required for mounting.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect/Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Coordination: Coordinate the work with placement of support framing and anchors required for mounting of transformers.

1.04 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Include voltage, kVA, impedance, tap configurations, insulation system class and rated temperature rise, efficiency, sound level, enclosure ratings, outline and support point dimensions, weight, required clearances, service condition requirements, and installed features.

C. Shop Drawings: Provide dimensioned plan and elevation views of transformers and adjacent equipment with all required clearances indicated.

D. Field Quality Control Test Reports.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Maintenance Data: Include recommended maintenance procedures and intervals.

G. Project Record Documents: Record actual locations of transformers.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with documented experience.

C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

1.07 FIELD CONDITIONS

A. Ambient Temperature: Do not exceed 86 degrees F average or 104 degrees F maximum measured during any 24 hour period during and after installation of transformers.

PART 2 - PRODUCTS

2.01 TRANSFORMERS - GENERAL REQUIREMENTS

A. Description: Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed, classified, and labeled

as suitable for the purpose intended.

B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:
   1. Altitude: Less than 3,300 feet.
   2. Ambient Temperature:
      a. Greater than 10 kVA: Not exceeding 104 degrees F.
      b. Less than 10 kVA: Not exceeding 77 degrees F.
   3. Ambient Temperature: Not exceeding 86 degrees F average or 104 degrees F maximum measured during any 24 hour period.

C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.

D. Impregnate core and coil assembly with non-hydroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.

E. Basic Impulse Level: 10 kV.

F. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

G. Isolate core and coil from enclosure using vibration-absorbing mounts.

H. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.

2.02 GENERAL PURPOSE TRANSFORMERS

A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.

B. Primary Voltage: 480 volts delta, 3 phase.

C. Secondary Voltage: 208Y/120 volts, 3 phase.

D. Insulation System and Allowable Average Winding Temperature Rise:
   1. 15 kVA and Larger: Class 220 degrees C insulation system with 150 degrees C average winding temperature rise.

E. Coil Conductors: Continuous copper windings with terminations brazed or welded.

F. Winding Taps:

G. Energy Efficiency: Comply with 10 CFR 431, Subpart K.

H. Sound Levels: Standard sound levels complying with NEMA ST 20

I. Mounting Provisions:

1. 15 kVA through 75 kVA: Suitable for wall, floor, or trapeze mounting.
2. Larger than 75 kVA: Suitable for floor mounting.

J. Transformer Enclosure: Comply with NEMA ST 20.
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
a. Indoor clean, dry locations: Type 1.
2. Construction: Steel.
a. 15 kVA and Larger: Ventilated.
3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
4. Provide lifting eyes or brackets.

K. Accessories:
1. Mounting Brackets: Provide manufacturer's standard brackets.
2. Lug Kits: Sized as required for termination of conductors as indicated on the drawings.

2.03 SOURCE QUALITY CONTROL

A. Factory test transformers according to NEMA ST 20.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.
B. Verify that suitable support frames and anchors are installed where required and that mounting surfaces are ready to receive transformers.
C. Perform pre-installation tests and inspections on transformers per manufacturer's instructions and as specified in NECA 409. Correct deficiencies prior to installation.
D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).
B. Install products in accordance with manufacturer's instructions.
C. Install transformers in accordance with NECA 409 and IEEE C57.94.
D. Use flexible conduit, under the provisions of Section 260533.13, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.
E. Arrange equipment to provide minimum clearances as specified on transformer nameplate and in accordance with manufacturer's instructions and NFPA 70.
F. Install transformers plumb and level.
G. Transformer Support:

1. Provide required support and attachment in accordance with Section 260529, where not furnished by transformer manufacturer.
2. Use integral transformer flanges, accessory brackets furnished by manufacturer, or field-fabricated supports to support wall-mounted transformers.
3. Unless otherwise indicated, mount floor-mounted transformers on properly sized 3 inch high concrete pad constructed in accordance with Division 03.
4. Use trapeze hangers assembled from threaded rods and metal channel (strut) to support suspended transformers. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

H. Provide grounding and bonding in accordance with Section 260526.

I. Remove shipping braces and adjust bolts that attach the core and coil mounting bracket to the enclosure according to manufacturer's recommendations in order to reduce audible noise transmission.

J. Where not factory-installed, install lugs sized as required for termination of conductors as indicated.

K. Identify transformers in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection, testing and adjusting in accordance with Division 01 requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS Sections 7.2.1.1 and 7.2.1.2. Tests and inspections listed as optional are not required.

1. 167 kVA single phase, 500 kVA three phase and smaller:
    a. Perform turns ratio tests at all tap positions.
2. Larger than 167 kVA single phase and 500 kVA three phase:
    a. Perform excitation-current tests on each phase.
    b. Measure the resistance of each winding at each tap connection.
    c. Perform an applied voltage test on all high- and low-voltage windings-to-ground.

3.04 ADJUSTING

A. Measure primary and secondary voltages and make appropriate tap adjustments.

B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from transformer components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 262200

SECTION 262413
SWITCHBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Low-voltage (600 V and less) switchboards and associated accessories for service and distribution applications.

B. Overcurrent protective devices for switchboards.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA 400 - Standard for Installing and Maintaining Switchboards; 2007.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

D. NEMA PB 2 - Deadfront Distribution Switchboards; 2011.

E. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 1000 Volts or Less; 2023.

F. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

I. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

J. UL 891 - Switchboards; Current Edition, Including All Revisions.

K. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.

4. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.
5. Notify Architect/Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for switchboards, enclosures, overcurrent protective devices, and other installed components and accessories.

C. Shop Drawings: Indicate dimensions, voltage, bus ampacities, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
1. Include dimensioned plan and elevation views of switchboards and adjacent equipment with all required clearances indicated.

D. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 2 as production (routine) tests.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Field Quality Control Test Reports.

G. Project Record Documents: Record actual installed locations of switchboards and final equipment settings.

H. Provide minimum 18" x 24" drawing of as-built riser diagram. Provide two framed copies of drawing; locate one adjacent to main switchboard. Provide one unframed copy to Owner.

I. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. Enclosure Keys: Two of each different key.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store switchboards in accordance with manufacturer's instructions, NECA 400, and NEMA PB 2.1.

B. Store in a clean, dry space having a uniform temperature to prevent condensation (including outdoor switchboards, which are not weatherproof until completely and properly installed). Where necessary, provide temporary enclosure space heaters or temporary power for permanent factory-installed space heaters.

C. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

D. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.07 FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Switchboards:

1. Source Limitations: Provide switchboards and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from single supplier.

2.02 SWITCHBOARDS

A. Provide switchboards consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Description: Dead-front switchboard assemblies complying with NEMA PB 2, and listed and labeled as complying with UL 891; ratings, configurations and features as indicated on the drawings.

D. Front-Connected Switchboards:

1. Main Device(s): Panel/group-mounted or individually-mounted.
2. Feeder Devices: Panel/group-mounted.
3. Arrangement: Front accessible only (not rear accessible), rear aligned.

4. Gutter Access: Bolted covers.

E. Service Conditions:
   1. Provide switchboards and associated components suitable for operation under the following service conditions without derating:
      a. Altitude: Less than 6,600 feet.
      b. Ambient Temperature:
         1) Switchboards Containing Molded Case or Insulated Case Circuit Breakers: Between 23 degrees F and 104 degrees F.

F. Short Circuit Current Rating:
   1. Provide switchboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 260573.
   2. Minimum Rating: 65,000 rms symmetrical amperes.

G. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide separate pull section and/or top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.

H. Bussing: Sized in accordance with UL 891 temperature rise requirements.
   1. Through bus (horizontal cross bus) to be fully rated through full length of switchboard (non-tapered). Tapered bus is not permitted.
   2. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
   3. Provide solidly bonded equipment ground bus through full length of switchboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
   4. Phase and Neutral Bus Material: Copper.
   5. Ground Bus Material: Copper.

I. Conductor Terminations: Suitable for use with the conductors to be installed.
   1. Line Conductor Terminations:
      a. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
      b. Main and Neutral Lug Type: Mechanical.
   2. Load Conductor Terminations:
      a. Lug Material: Copper, suitable for terminating copper conductors only.
      b. Lug Type:
         1) Provide mechanical lugs unless otherwise indicated.

J. Enclosures:
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   2. Finish: Manufacturer's standard unless otherwise indicated.

K. Future Provisions:
   1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
   2. Equip distribution sections with full height vertical bussing to accommodate maximum utilization of space for devices.

L. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 264300, list switchboards as a complete assembly including surge protective device.

M. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
   1. Where overcurrent protective devices equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
   2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
      a. Use zero sequence or residual ground fault detection method unless otherwise indicated.
      b. Provide test panel and field-adjustable ground fault pick-up and delay settings.

N. Arc Flash Energy-Reducing Maintenance Switching: For circuit breakers rated 1200 A or higher, provide a local accessory switch with status indicator light that permits selection of a maintenance mode with alternate electronic trip unit settings for reduced fault clearing time.

O. Owner Metering: Comply with Section 262713.

2.03 OVERCURRENT PROTECTIVE DEVICES

A. Circuit Breakers:
   1. Interrupting Capacity:
      a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
      b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

2. Molded Case Circuit Breakers:
    a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489; ratings, configurations, and features as indicated on the drawings.
        1) Provide thermal magnetic circuit breakers unless otherwise indicated.
        2) Provide electronic trip circuit breakers where indicated.
    b. Minimum Interrupting Capacity:
        1) 14,000 rms symmetrical amperes at 480 VAC.
    c. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
        1) Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
    d. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
        1) Provide the following field-adjustable trip response settings:
            a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
    e. Provide the following circuit breaker types where indicated:
        1) 100 Percent Rated Circuit Breakers: Listed for application within the switchboard where installed at 100 percent of the continuous current rating.
        2) Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
    f. Provide the following features and accessories where indicated or where required to complete installation:
        1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.

2.04 SOURCE QUALITY CONTROL

A. Factory test switchboards according to NEMA PB 2, including the following production (routine) tests on each switchboard assembly or component:
    1. Dielectric tests.
    2. Mechanical operation tests.

3. Electrical operation and control wiring tests, including polarity and sequence tests.
4. Ground-fault sensing equipment test.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.
B. Verify that the ratings and configurations of the switchboards and associated components are consistent with the indicated requirements.
C. Verify that mounting surfaces are ready to receive switchboards.
D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide concrete housekeeping pad under the provisions of Division 03.
B. Verify that field measurements are as indicated on shop drawings.

3.03 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Install switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.
C. Arrange equipment to provide required clearances and maintenance access, including accommodations for any drawout devices.
D. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of 1/2 inch between switchboard and wall.
E. Provide required support and attachment in accordance with Section 260529.
F. Install switchboards plumb and level.
G. Unless otherwise indicated, mount switchboards on properly sized 4 inch high concrete pad constructed in accordance with Division 03.
H. Provide grounding and bonding in accordance with Section 260526.
I. Install all field-installed devices, components, and accessories.
J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
K. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed in accordance with Section 260573.
L. Set field-adjustable ground fault protection pickup and time delay settings as required.
M. Provide filler plates to cover unused spaces in switchboards.

N. Identify switchboards in accordance with Section 260553.

3.04 FIELD QUALITY CONTROL

A. See Division 01 for additional requirements.

B. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

C. Before energizing switchboard, perform insulation resistance testing in accordance with NECA 400 and NEMA PB 2.1.

D. Perform field inspection and testing in accordance with Division 01 requirements.

E. Inspect and test in accordance with NETA ATS, except Section 4.

F. Perform inspections and tests listed in NETA ATS, Section 7.1.

G. Molded Case and Insulated Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1for all main circuit breakers and circuit breakers larger than 250 amperes. Tests listed as optional are not required.

H. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.

I. Test shunt trips to verify proper operation.

J. Correct deficiencies and replace damaged or defective switchboards or associated components.

K. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.05 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of switchboard covers and doors.

C. Adjust circuit breaker trip and time delay settings to values indicated.

3.06 CLEANING

A. Clean dirt and debris from switchboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred surfaces to match original factory finish.

C. Remove all dirt and debris from interior of switchboard.

3.07 CLOSEOUT ACTIVITIES

A. Training: Train Owner's personnel on operation, adjustment, and maintenance of switchboard and associated devices.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours of training.
3. Instructor: Manufacturer's authorized representative.
4. Location: At project site.

3.08 PROTECTION

A. Protect installed switchboards from subsequent construction operations.

END OF SECTION 262413

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SECTION 262416
PANELBOARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Power distribution panelboards.

B. Panelboards.

C. Overcurrent protective devices for panelboards.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA 407 - Standard for Installing and Maintaining Panelboards; 2015.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

D. NEMA PB 1 - Panelboards; 2011.

E. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 1000 Volts or Less; 2023.

F. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

J. UL 67 - Panelboards; Current Edition, Including All Revisions.

K. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

L. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.

4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect/Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

D. Field Quality Control Test Reports.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

G. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Panelboard Keys: Two of each different key.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.07 FIELD CONDITIONS

A. Maintain ambient temperature within the following limits during and after installation of panelboards:
   1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Provide panelboards and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from a single supplier.

2.02 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.
B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
   1. Altitude: Less than 6,600 feet.
   2. Ambient Temperature:
      a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
C. Short Circuit Current Rating:
   1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 260573.
   2. Listed series ratings are not acceptable.
D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
F. Bussing: Sized in accordance with UL 67 temperature rise requirements.
   1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
   2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
   1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
      a. Indoor Clean, Dry Locations: Type 1.
   2. Boxes: Galvanized steel unless otherwise indicated.
      a. Provide wiring gutters sized to accommodate the conductors to be installed.
      b. Provide painted steel boxes for surface-mounted panelboards, finish to match fronts.
   3. Fronts:
      a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
      b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
      c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
   4. Lockable Doors: All locks keyed alike unless otherwise indicated.

I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

J. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 264300, list and label panelboards as a complete assembly including surge protective device.

K. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.

L. Load centers are not acceptable.

2.03 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:
   1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
   2. Main and Neutral Lug Type: Mechanical.

C. Bussing:

1. Phase and Neutral Bus Material: Copper.
2. Ground Bus Material: Copper.
3. Provide bolt-on type.
4. Provide thermal magnetic circuit breakers unless otherwise indicated.

D. Enclosures:
1. Provide surface-mounted enclosures unless otherwise indicated.
2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide clear plastic circuit directory holder mounted on inside of door.

2.04 PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicatedon the drawings.

B. Conductor Terminations:
1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
2. Main and Neutral Lug Type: Mechanical.

C. Bussing:
1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
2. Phase and Neutral Bus Material: Aluminum.
3. Ground Bus Material: Aluminum.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:
1. Provide surface-mounted enclosures as indicated.
2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide clear plastic circuit directory holder mounted on inside of door.

2.05 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:
1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489; ratings, configurations, and features as indicatedon the drawings.
2. Interrupting Capacity:

a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
   1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
   2) 14,000 rms symmetrical amperes at 480 VAC.
b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

3. Conductor Terminations:
   a. Provide mechanical lugs unless otherwise indicated.
   b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
   a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
7. Provide the following circuit breaker types where indicated:
   a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
   b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
   c. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
   d. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
8. Do not use tandem circuit breakers.
9. Do not use handle ties in lieu of multi-pole circuit breakers.
10. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.

11. Provide the following features and accessories where indicated or where required to complete installation:
    a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
    b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.

2.06 SOURCE QUALITY CONTROL

A. Factory test panelboards according to NEMA PB 1.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.
B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
C. Verify that mounting surfaces are ready to receive panelboards.
D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).
B. Install products in accordance with manufacturer's instructions.
C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
E. Provide required support and attachment in accordance with Section 260529.
F. Install panelboards plumb.
G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.
H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.
I. Mount floor-mounted power distribution panelboards on properly sized 4 inch high concrete pad constructed in accordance with Division 03.
J. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling.
K. Provide grounding and bonding in accordance with Section 260526.
L. Install all field-installed branch devices, components, and accessories.
M. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.

N. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 260573.

O. Provide filler plates to cover unused spaces in panelboards.

P. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated.Also provide for the following:

1. Fire detection and alarm circuits.
2. Communications equipment circuits.
3. Intrusion detection and access control system circuits.
4. Video surveillance system circuits.

Q. Identify panelboards in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. Perform inspection, testing, and adjusting in accordance with Division 01 requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1for all main circuit breakers and circuit breakers larger than 100 amperes. Tests listed as optional are not required.

D. Test GFCI circuit breakers to verify proper operation.

E. Test shunt trips to verify proper operation.

F. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

G. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.05 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 262416

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SECTION 262713
ELECTRICITY METERING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Equipment for Owner electricity metering:
   1. Single circuit electricity meters.

1.02 REFERENCE STANDARDS

A. ANSI C12.1 - Electric Meters - Code for Electricity Metering; 2022.
B. IEC 62053-21 - Electricity Metering Equipment - Particular Requirements - Part 21: Static Meters for AC Active Energy (Classes 0,5, 1 and 2); 2020.
C. IEC 62053-22 - Electricity Metering Equipment - Particular Requirements - Part 22: Static Meters for AC Active Energy (Classes 0,1S,0,2S and 0,5S); 2020.
D. IEC 62053-23 - Electricity Metering Equipment - Particular Requirements - Part 23: Static Meters for Reactive Energy (Classes 2 and 3); 2020.
E. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2008.
F. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.
H. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.
I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate work to provide equipment suitable for interface with electricity metering systems to be provided.
   2. Coordinate the work with other installers to provide communication lines required for electricity metering system interface.
   3. Notify Architect/Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
B. Preinstallation Meeting: Conduct meeting with facility representative and other related equipment manufacturers to discuss electricity metering system interface requirements.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for electricity metering systems and associated components and accessories. Include

ratings, configurations, standard wiring diagrams, dimensions, service condition requirements, and installed features.

B. Shop Drawings: Include system interconnection schematic diagrams showing all factory and field connections. Include requirements for interface with other systems.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Field Quality Control Test Reports.

E. Project Record Documents: Record actual installed locations of meters and final equipment settings.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with documented expreience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.07 FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

PART 2 - PRODUCTS

2.01 EQUIPMENT FOR OWNER ELECTRICITY METERING

A. Provide microprocessor-based digital electricity metering systems including all instrument transformers, wiring, and connections necessary for measurements specified.

1. Metering to be prrovided at the circuit breaker unless otherwise indicated.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Provide electricity metering systems and associated components compatible with the equipment and associated circuits to be metered.

D. Service Conditions: Provide electricity meters suitable for operation under the service conditions at the installed location.

E. Enclosures:

1. Where not furnished by manufacturer, provide required cabinets and enclosures in accordance with Section 260533.16.
2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    a. Indoor Clean, Dry Locations: Type 1.
3. Finish: Manufacturer's standard unless otherwise indicated.

F. Instrument Transformers:
1. Comply with IEEE C57.13, where applicable.
2. Select suitable ratio, burden, and accuracy as required for connected devices.
3. Current Transformers: Compatible with connected meters; replace meters damaged by connection of incompatible current transformers. Provide shorting terminal blocks for connection of secondaries where applicable.
4. Potential Transformers: Include primary and secondary fuses with disconnecting means.
5. Meters at distribution and branch panelboards may also be mounted integral to the panelboard.

G. Interface with Other Work:
1. Interface with building automation system.

2.02 SINGLE CIRCUIT ELECTRICITY METERS

A. Single Circuit Electricity Meter:
1. Accuracy:
    a. Real/Active Power/Energy: Revenue grade; plus/minus 1.0 percent; complying with ANSI C12.1 and/or IEC 62053-21 Class 1.
    b. Reactive Power/Energy: Plus/minus 2.0 percent, complying with IEC 62053-23 Class 2.
2. Measured Parameters:
    a. Voltage (Volts AC); line-to-line and line-to-neutral; per phase.
    b. Current (Amps); per phase.
    c. Frequency (Hz).
    d. Real/active power (kW); per phase and total of all phases.
    e. Reactive power (kVAR); per phase and total of all phases.
    f. Apparent power (kVA); per phase and total of all phases.
    g. Power factor; per phase and total of all phases.
    h. Real/active energy (kWh).
    i. Reactive energy (kVARh).

j. Apparent energy (kVAh).

k. Power demand; real/active, reactive, and apparent; present and maximum.

3. Data logging.

4. Communications: Compatible with connected systems. Provide all accessories necessary for proper interface.

a. Ethernet Communications: Support for Modbus TCP protocol.

b. Meter to be capable of interfacing with BAS controls.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of metering systems and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive meters.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Provide required support and attachment components in accordance with Section 260529.

D. Provide grounding and bonding in accordance with Section 260526.

E. Provide fuses complying with Section 262813 as required.

F. Identify meters and associated wiring in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Meters: Perform inspections and tests listed in NETA ATS, Section 7.11.2.

C. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10. The dielectric withstand tests on primary windings with secondary windings connected to ground listed as optional are not required.

D. Correct deficiencies and replace damaged or defective metering system components.

E. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.04 ADJUSTING

A. Program system parameters according to requirements of Owner.

3.05 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

A. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Manufacturer's authorized representative.
   4. Location: At project site.

3.07 PROTECTION

A. Protect installed system components from subsequent construction operations.

END OF SECTION 262713

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SECTION 262726
WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Receptacles.

B. Wall plates and covers.

C. Floor box service fittings.

D. Poke-through assemblies.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2016.

C. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (Reaffirmed 2020).

D. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2021.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

G. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

H. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
5. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
6. Notify Architect/Engineer of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:

1. Do not install wiring devices until final surface finishes and painting are complete.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1. Wall Dimmers: Include derating information for ganged multiple devices.

C. Operation and Maintenance Data:

1. Wall Dimmers: Include information on operation and setting of presets.
2. GFCI Receptacles: Include information on status indicators.

D. Project Record Documents: Record actual installed locations of wiring devices.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.01 WIRING DEVICES - GENERAL REQUIREMENTS

A. Provide wiring devices suitable for intended use with ratings adequate for load served.

B. Except where explicitly permitted, substitution of combination switch-and-receptacle devices for separate switches and receptacles is not permitted.

C. Wiring Device Applications:

1. Receptacles Installed Outdoors or in Damp or Wet Locations: Use weather-resistant GFCI receptacles with weatherproof covers.
2. Provide GFCI protection for:
   a. Receptacles installed within 6 feet of sinks.
   b. Receptacles installed in kitchens.
   c. Receptacles serving electric drinking fountains.
3. Flush Floor Service Fittings in Tile Floors: Use tile rings.
4. Flush Floor Service Fittings in Carpeted Floors: Use carpet flanges.

D. Wiring Device Finishes:
   1. Provide wiring device finishes as described below, unless otherwise indicated.
      a. Final selection of all device and wall plate colors shall be by the Architect.
   2. Wiring Devices Installed in Finished Spaces: White with stainless steel wall plate.
   3. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate.
   4. Wiring Devices Installed in Wet or Damp Locations: Gray with weatherproof in-use cover.
   5. Flush Floor Box Service Fittings: White wiring devices with brass cover and ring/flange.
   6. Flush Poke-Through Service Fittings: White wiring devices with brass cover and brass flange.

2.02 RECEPTACLES

A. Manufacturers:
   1. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
   2. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:
   1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
   2. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

D. GFCI Receptacles:
   1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.

a. Provide test and reset buttons of same color as device.

2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.

3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.

E. Locking Receptacles: Industrial specification grade, configuration as indicated on the drawings.

2.03 WALL PLATES AND COVERS

A. Manufacturers:

1. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer.

B. Wall Plates: Comply with UL 514D.

1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.

2. Size: Standard.

3. Screws: Metal with slotted heads finished to match wall plate finish.

C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

D. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.

E. Weatherproof Receptacle Covers for Wet or Damp Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

F. Weatherproof Switch Covers for Wet or Damp Locations: Gasketed, metallic, with externally operable actuating means and corrosion-resistant screws; listed as suitable for use in wet locations.

2.04 FLOOR BOX SERVICE FITTINGS

A. Description: Service fittings compatible with floor boxes provided under Section 260533.16 with components, adapters, and trims required for complete installation.

B. Flush Floor Service Fittings:

1. Single Service Flush Convenience Receptacles:

a. Cover: Rectangular, opening 180 degrees.

b. Configuration: One or two standard duplex receptacle(s) as indicated on the drawings.
c. Devices mounted at an angle inside the box.
d. Basis of Design:Wiremold Evolution series.

2. Dual Service Flush Combination Outlets:
a. Cover: Rectangular, opening 180 degrees.
b. Configuration:
1) One or two standard duplex receptacle(s) as indicated on the drawings.
2) Communications: Two data jacks as per Division 27 standards..
c. Devices mounted at an angle inside the box.
d. Basis of Design:Wiremold Evolution series.

3. Accessories:
a. Tile Rings: Finish to match covers; configuration as required to accommodate specified covers.
b. Carpet Flanges: Finish to match covers; configuration as required to accommodate specified covers.

2.05 POKE-THROUGH ASSEMBLIES

A. Manufacturers:

B. Description: Assembly comprising floor service fitting, poke-through component, fire stops and smoke barriers, and junction box for conduit termination; fire rating listed to match fire rating of floor and suitable for floor thickness where installed.

C. Flush Floor Service Fittings:
1. Single Service Flush Convenience Receptacles:
a. Cover: Round, opening 180 degrees.
b. Configuration: One or two standard duplex receptacle(s) as indicated on the drawings.
c. Basis of Design:Wiremold Evolution series.

2. Dual Service Flush Combination Outlets:
a. Cover: Round, opening 180 degrees..
b. Configuration:
1) Power: One standard convenience duplex receptacle(s).
2) Power: One or two standard duplex receptacle(s) as indicated on the drawings.
3) Communications: Two data jacks as per Division 27 standards..

c. Basis of Design:Wiremold Evolution series.

3. Accessories:

a. Closure Plugs: Size and fire rating as required to seal unused core hole and maintain fire rating of floor.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that floor boxes are adjusted properly.

F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

G. Verify that core drilled holes for poke-through assemblies are in proper locations.

H. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of wiring devices provided under this section.

1. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.

2. Where multiple wall switches or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.

3. Locate wall switches on strike side of door with edge of wall plate 3-6" inches from edge of door frame. Where locations are indicated otherwise, notify Architect/Engineer to obtain direction prior to proceeding with work.

4. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions, except where prohibited by code.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V (depending on phasing, voltage can exceed 300 volts between 120V and 277V devices).

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. If plate clamping terminals are not available, connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

I. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.

J. Install wiring devices plumb and level with mounting yoke held rigidly in place.

K. Install wall switches with OFF position down.

L. Unless noted otherwise, install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left. Where installed in existing buildings, match existing receptacle orientations.

M. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

N. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use. This is not to be used where junction boxes were never required or installed by mistake.

O. Identify wiring devices in accordance with Section 260553.

P. Install poke-through closure plugs in each unused core holes to maintain fire rating of floor.

3.04 FIELD QUALITY CONTROL

A. See Division 01 for additinoal requirements.

B. Inspect each wiring device for damage and defects.

C. Operate each wall switch with circuit energized to verify proper operation.

D. Test each receptacle to verify operation and proper polarity.

E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust dimmer low trims if required to provide satisfactory operation.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION 262726

SECTION 262813
FUSES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Fuses.

B. Spare fuse cabinet.

1.02 REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.

D. UL 248-8 - Low-Voltage Fuses - Part 8: Class J Fuses; Current Edition, Including All Revisions.

E. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses; Current Edition, Including All Revisions.

F. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
    a. Fusible Enclosed Switches: See Section 262816.16.
    b. Fusible Switches for Enclosed Motor Controllers: See Section 262913.
2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
3. Notify Architect/Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.

1. Spare Fuse Cabinet: Include dimensions.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. Extra Fuses: Three set(s) of three for each type and size installed.
2. Fuse Pullers: One set(s) compatible with each type and size installed.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with documented experience.

PART 2 - PRODUCTS

2.01 APPLICATIONS

A. Feeders:
1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.

B. General Purpose Branch Circuits: Class RK1, time-delay.

C. Individual Motor Branch Circuits: Class RK1, time-delay.

D. Elevators: Class J, time-delay or as otherwise recommended by elevator manufacturer.

2.02 FUSES

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

D. Comply with UL 248-1.

E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.

F. Voltage Rating: Suitable for circuit voltage.

G. Class R Fuses: Comply with UL 248-12.

H. Class J Fuses: Comply with UL 248-8.

I. Class L Fuses: Comply with UL 248-10.

J. Provide the following accessories where indicated or where required to complete installation:
1. Fuseholders: Compatible with indicated fuses.
2. Fuse Reducers: For adapting indicated fuses to permit installation in switch designed for fuses with larger ampere ratings.

2.03 SPARE FUSE CABINET

A. Description: Wall-mounted sheet metal cabinet with shelves and hinged door with cylinder lock, suitably sized to store spare fuses and fuse pullers specified.

B. Finish: Manufacturer's standard, factory applied grey finish unless otherwise indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B. Verify that mounting surfaces are ready to receive spare fuse cabinet.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

C. Install spare fuse cabinet in convenient location in main electrical room unless otherwise indicated.

D. Identify spare fuse cabinet in accordance with Section 260553.

END OF SECTION 262813

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SECTION 262816.16
ENCLOSED SWITCHES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Enclosed safety switches.

B. Shunt-trip switches.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

H. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify Architect/Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Include wiring diagrams showing all factory and field connections.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

E. Project Record Documents: Record actual locations of enclosed switches.

F. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.07 FIELD CONDITIONS

A. Maintain ambient temperature between -22 degrees F and 104 degrees F during and after installation of enclosed switches.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Provide enclosed switches and associated components produced by same manufacturer as other electrical distribution equipment used for project and obtained from single supplier.

2.02 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:

1. Altitude: Less than 6,600 feet.
2. Ambient Temperature: Between -22 degrees F and 104 degrees F.

D. Horsepower Rating: Suitable for connected load.

E. Voltage Rating: Suitable for circuit voltage.

F. Short Circuit Current Rating:
1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 260573.
2. Minimum Ratings:
a. Heavy Duty Single Throw Switches Protected by Class R Fuses: 200,000 rms symmetrical amperes.

G. Provide with switch blade contact position that is visible when the cover is open.

H. Fuse Clips for Fusible Switches: As required to accept fuses indicated.
1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

I. Conductor Terminations: Suitable for use with the conductors to be installed.

J. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

K. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

L. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
a. Indoor Clean, Dry Locations: Type 1.
b. Outdoor Locations: Type 3R.
2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.

M. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

N. Heavy Duty Switches:
1. Comply with NEMA KS 1.
2. Conductor Terminations:
a. Provide mechanical lugs unless otherwise indicated.

b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.
   a. Provide means for locking handle in the ON position where indicated.

2.03 SHUNT TRIP SWITCHES

A. Description: Type HD, Heavy Duty, Three-pole, horsepower rated, with integral shunt trip mechanism and Class J fuse block. Lockable handle with capability to accept three padlocks, interlocked with cover in closed position.
   1. Control Circuit: Integral control power transformer, with primary and secondary fuses. Capacity to operate shunt trip, connected pilot light and any other indicating or control devices.
   2. Fire safety interface relay.
   3. Fire alarm voltage monitoring relay.
   4. Ground lug.
   5. Mechanically interlocked auxiliary contact(s) for elevators with battery backup. 15A, 120V rated.

B. Accessories:
   1. Pilot light "on".
   2. Key to test switch.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 260529.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 260526.

H. Provide fuses complying with Section 262813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

I. Identify enclosed switches in accordance with Section 260553.

J. Provide arc flash warning labels in accordance with NFPA 70.

3.03 FIELD QUALITY CONTROL

A. See Division 01 for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 262816.16

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SECTION 262913
ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Enclosed NEMA controllers for low-voltage (600 V and less) applications:
   1. Magnetic motor starters.
   2. Manual motor starters.
   3. Motor-starting switches without overload protection.

B. Control accessories:
   1. Auxiliary contacts.
   2. Pilot devices.
   3. Control power transformers.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

C. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).

D. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices; 2017.

E. NEMA ICS 6 - Industrial Control and Systems: Enclosures; 1993 (Reaffirmed 2016).

F. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

G. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

J. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.

2. Coordinate the work to provide motor controllers and associated overload relays suitable for use with the actual motors to be installed.
3. Coordinate the work to provide controllers and associated wiring suitable for interface with control devices to be installed.
4. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
5. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
6. Notify Architect/Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor controllers, enclosures, overcurrent protective devices, and other installed components and accessories.

C. Shop Drawings: Indicate dimensions, voltage, controller sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Field Quality Control Test Reports.

F. Project Record Documents: Record actual installed locations of controllers and final equipment settings.

1. Include nameplate data of actual installed motors and associated overload relay selections and settings.

G. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with documented experience.

C. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to internal components, enclosure, and finish.

1.07 FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

PART 2 - PRODUCTS

2.01 ENCLOSED CONTROLLERS

A. Provide enclosed controller assemblies consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Description: Enclosed controllers complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; ratings, configurations and features as indicated on the drawings.

D. Service Conditions:

1. Provide controllers and associated components suitable for operation at indicated ratings under the service conditions at the installed location.

E. Short Circuit Current Rating:

1. Provide controllers with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 260573.

F. Conductor Terminations: Suitable for use with the conductors to be installed.

G. Enclosures:

1. Comply with NEMA ICS 6.
2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor Clean, Dry Locations: Type 1 or Type 12.
   b. Outdoor Locations: Type 3R or Type 4.
3. Finish: Manufacturer's standard unless otherwise indicated.

H. Magnetic Motor Starters: Combination type unless otherwise indicated.

1. Combination Magnetic Motor Starters: NEMA ICS 2, Class A combination motor controllers with magnetic contactor(s), externally operable disconnect and overload relay(s).
2. Configuration: Full-voltage non-reversing unless otherwise indicated.
3. Minimum Starter Size: NEMA Size 0.
4. Use of non-standard starter sizes smaller than specified standard NEMA sizes is not permitted.
5. Disconnects: Circuit breaker or disconnect switch type as indicated.
    a. Circuit Breakers: Motor circuit protectors (magnetic-only) unless otherwise indicated or required.
    b. Disconnect Switches: Fusible type unless otherwise indicated.
    c. Provide externally operable handle with means for locking in the OFF position. Provide safety interlock to prevent opening the cover with the disconnect in the ON position with capability of overriding interlock for testing purposes.
    d. Provide auxiliary interlock for disconnection of external control power sources where applicable.
6. Overload Relays: Bimetallic thermal type unless otherwise indicated.
7. Pilot Devices Required:
    a. Furnish local pilot devices for each unit as specified below unless otherwise indicated on drawings.
    b. Single-Speed, Non-Reversing Starters:
        1) Pushbuttons: START-STOP.
        2) Selector Switches: HAND/OFF/AUTO.
        3) Indicating Lights: Red ON, Green OFF.

I. Manual Motor Starters:
1. Description: NEMA ICS 2, Class A manually-operated motor controllers with overload relay(s).
2. Configuration: Non-reversing unless otherwise indicated.
3. Fractional-Horsepower Manual Motor Starters:
    a. Furnish with toggle operator.
    b. Overload Relays: Bimetallic or melting alloy thermal type.
    c. Provide means for locking operator in the OFF position.
    d. Furnish Red ON indicating light.

J. Motor-Starting Switches: Horsepower-rated switches without overload protection; toggle operator.

2.02 OVERCURRENT PROTECTIVE DEVICES

A. Overload Relays:

1. Provide overload relays and, where applicable, associated current elements/heaters, selected according to actual installed motor nameplate data, in accordance with manufacturer's recommendations and NFPA 70; include consideration for motor service factor and ambient temperature correction, where applicable.
2. Inverse-Time Trip Class Rating: Class 20 unless otherwise indicated or required.
3. Bimetallic Thermal Overload Relays:
    a. Interchangeable current elements/heaters.
    b. Adjustable trip; plus/minus 10 percent of nominal, minimum.
    c. Trip test function.
4. Melting Alloy Thermal Overload Relays:
    a. Interchangeable current elements/heaters.

B. Fusible Disconnect Switches:

1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA KS 1, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
2. Fuse Clips: As required to accept indicated fuses.
3. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

C. Circuit Breakers:

1. Interrupting Capacity (not applicable to motor circuit protectors):
    a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
    b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
2. Motor Circuit Protectors:

a. Description: Instantaneous-trip circuit breakers furnished with magnetic instantaneous tripping elements for short circuit protection, but not with thermal inverse time tripping elements for overload protection; UL 489 recognized only for use as part of a listed combination motor controller with overload protection; ratings, configurations, and features as indicated on the drawings.

b. Provide field-adjustable magnetic instantaneous trip setting.

2.03 CONTROL ACCESSORIES

A. Auxiliary Contacts:

1. Comply with NEMA ICS 5.
2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each magnetic motor starter, minimum.

B. Pilot Devices:

1. Comply with NEMA ICS 5; heavy-duty type.
2. Pushbuttons: Unless otherwise indicated, provide momentary, non-illuminated type with flush button operator; normally open or normally closed as indicated or as required.
3. Indicating Lights: Push-to-test type unless otherwise indicated.
4. Provide LED lamp source for indicating lights and illuminated devices.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings of enclosed controllers are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed controllers.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install controllers in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 260529.

E. Install enclosed controllers plumb and level.

F. Provide grounding and bonding in accordance with Section 260526.

G. Install all field-installed devices, components, and accessories.

H. Provide fuses complying with Section 262813 for fusible switches as indicated.

I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

J. Select and install overload heater elements in motor controllers to match installed motor characteristics.

K. Identify enclosed controllers in accordance with Section 260553.

L. Coordinate control requirements for all controllers with equipment provided and with mechanical and controls contractors.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Division 01 requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Motor Starters: Perform inspections and tests listed in NETA ATS, Section 7.16.1.1. Tests listed as optional are not required.

1. Verify motor-running protection.
2. Perform insulation-resistance tests on all control wiring with respect to ground.

D. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

E. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1for circuit breakers larger than 100 amperes. Tests listed as optional are not required.

F. Correct deficiencies and replace damaged or defective enclosed controllers or associated components.

G. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from controller enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of controllers to Owner, and correct deficiencies or make adjustments as directed.

3.07 PROTECTION

A. Protect installed enclosed controllers from subsequent construction operations.

END OF SECTION 262913

SECTION 262923

VARIABLE-FREQUENCY MOTOR CONTROLLERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Variable-frequency motor controllers for low-voltage (600 V and less) AC motor applications.

B. Overcurrent protective devices for motor controllers, including overload relays.

1.02 REFERENCE STANDARDS

A. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).

E. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices; 2017.

F. NEMA ICS 6 - Industrial Control and Systems: Enclosures; 1993 (Reaffirmed 2016).

G. NEMA ICS 7 - Industrial Control and Systems: Adjustable-Speed Drives; 2020.

H. IEEE 519 - Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems

I. NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable-Speed Drive Systems; 2022.

J. NEMA ICS 7.2 - Application Guide for AC Adjustable Speed Drive Systems; 2021.

K. NEMA ICS 61800-2 - Adjustable Speed Electrical Power Drive Systems, Part 2: General Requirements-Rating Specifications for Low Voltage Adjustable Frequency AC Power Drive Systems; 2005.

L. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

M. NEMA MG 1 - Motors and Generators; 2021.

N. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

O. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

P. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

Q. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

R. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

S. UL 61800-5-1 - Standard for Adjustable Speed Electrical Power Drive Systems - Part 5-1: Safety Requirements – Electrical, Thermal, and Energy (Ed. 2); Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate work to avoid placement of ductwork, piping, equipment, and other obstructions within dedicated equipment spaces and working clearances required by NFPA 70.
2. Coordinate work to provide motor controllers suitable for use with motors.
3. Coordinate work to provide controllers and associated wiring suitable for interface with control devices.
4. Coordinate arrangement of electrical equipment with dimensions and clearance requirements.
5. Verify with manufacturer that conductor terminations are suitable for use with conductors.
6. Notify Architect/Engineer of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor controllers, enclosures, overcurrent protective devices, and other installed components and accessories.

C. Shop Drawings: Indicate dimensions, voltage, controller sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series-rated systems.

D. Derating Calculations: Indicate ratings adjusted for applicable service conditions.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Field quality control test reports.

G. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
   1. Include contact information for entity providing contract maintenance and trouble call-back service.

H. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.

I. Project Record Documents: Record actual installed locations of controllers and final equipment settings.
   1. Include nameplate data of actual installed motors and associated overload relay selections and settings.

J. Maintenance Materials: Furnish following for Owner's use in maintenance of project.
   1. See Division 01 for additional provisions.
   2. Air Filters: Two of each different type.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store in clean, dry space. Maintain factory wrapping or provide additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to internal components, enclosure, and finish.

1.07 FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

1.08 WARRANTY

A. Provide minimum five-year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

B. Warranty periods shall begin from Date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Provide variable-frequency motor controllers and associated components produced by single manufacturer and obtained from single supplier.

2.02 VARIABLE-FREQUENCY MOTOR CONTROLLERS

A. Provide variable-frequency motor control system consisting of required controller assemblies, operator interfaces, control power transformers, instrumentation and control wiring, sensors, accessories, system programming, etc. as necessary for complete operating system.

B. Provide products listed, classified, and labeled as suitable for purpose intended.

C. Variable-Frequency Motor Controller:

1. Configuration: Packaged controller with across-the-line bypass.
2. Rectifier/Converter: IGBT-based active front end type.
3. Control Method: Vector; open-loop, without feedback.
4. Filtering: Provide input/line reactor and output/load reactor.

D. Controller Assemblies: Comply with NEMA ICS 7, NEMA ICS 7.1, and NEMA ICS 61800-2; list and label as complying with UL 61800-5-1 or UL 508A as applicable.

E. Provide controllers selected for actual installed motors and coupled mechanical loads in accordance with NEMA ICS 7.2, NEMA MG 1 Part 30, and recommendations of manufacturers of both controller and load, where not in conflict with specified requirements; considerations include, but are not limited to:

1. Motor type (e.g., induction, reluctance, and permanent magnet); consider NEMA MG 1 design letter or inverter duty rating for induction motors.
2. Motor load type (e.g., constant torque, variable torque, and constant horsepower); consider duty cycle, impact loads, and high inertia loads.
3. Motor nameplate data.
4. Requirements for speed control range, speed regulation, and braking.
5. Motor suitability for bypass starting method, where applicable.

F. Devices on Load Side of Controller: Suitable for application across full controller output frequency range.

G. Operating Requirements:

1. Input Voltage Tolerance: Plus/minus 10 percent of nominal.
2. Input Frequency Tolerance: Plus/minus 5 percent of nominal.
3. Efficiency: Minimum of 96 percent at full speed and load.
4. Input Displacement Power Factor: Minimum of 0.96 throughout speed and load range.
5. Overload Rating:
   a. Variable Torque Loads: Minimum of 110 percent of nominal for 60 seconds.

b. Constant Torque Loads: Minimum of 150 percent of nominal for 60 seconds.

H. Power Conversion System: Microprocessor-based, pulse width modulation type.
1. Diode-based, 6-pulse type unless otherwise indicated.

I. Control System:
1. Provide microprocessor-based control system for automatic control, monitoring, and protection of motors. Include sensors, wiring, and connections necessary for functions and status/alarm indications specified.
2. Provide integral operator interface for controller programming, display of status/alarm indications, fault reset, and local control functions including motor run/stop, motor forward/reverse selection, motor speed increase/decrease, and local/remote control selection.
3. Control Functions:
a. Control Method: Selectable vector and scalar/volts per hertz unless otherwise indicated.
b. Adjustable acceleration and deceleration time; linear and S-curve ramps; selectable coast to stop.
c. Selectable braking control; DC injection or flux braking.
d. Adjustable minimum/maximum speed limits.
e. Adjustable pulse width modulation switching carrier frequency.
f. Adjustable motor slip compensation.
g. Selectable autorestart after noncritical fault; programmable number of time delay between restart attempts.
h. PID Control: Provide integral PID controller employing feedback for closed-loop control where indicated or required.
i. Selectable frequency-skipping; minimum of three independently adjustable bands.
j. Firefighter's Override: Provide firefighter's override capability where fans are used for active smoke control or post-fire smoke removal; upon activation of designated input, operate motor at designated speed without regard to noncritical faults and other inputs; operational in both drive and bypass modes where applicable.
k. Safety Interlock: Provide permissive run safety interlock capability where indicated or required; upon activation of designated input, stop and prevent operation of motor; operational in both drive and bypass modes

where applicable.

4. Status Indications:
    a. Motor run/stop status.
    b. Motor forward/reverse status.
    c. Local/remote control status.
    d. Output voltage.
    e. Output current.
    f. Output frequency.
    g. DC bus voltage.
    h. Motor speed.
5. Protective Functions/Alarm Indications:
    a. Overcurrent.
    b. Motor overload.
    c. Undervoltage.
    d. Overvoltage.
    e. Controller overtemperature.
    f. Input/output phase loss.
    g. Output short circuit protection.
    h. Output ground fault protection.
6. Inputs:
    a. Digital Input(s): Three.
    b. Analog Input(s): Two.
7. Outputs:
    a. Analog Output(s): One.
    b. Relay Output(s): Two.
8. Communications: Compatible with connected systems. Provide accessories necessary for proper interface.
    a. Drives shall be able to communicate the Building Automation System, through Siemens FLN.
    b. Coordinate communications requirements with Controls Contractor.
9. Features:
    a. Password-protected security access.
    b. Event log.

J. Power Conditioning/Filtering:

1. Provide DC link choke or input/line reactor for each controller unless otherwise indicated or required.

K. Packaged Controllers: Controllers factory-mounted in separate enclosure with externally operable disconnect and specified accessories.

1. Disconnects: Circuit breaker or disconnect switch type.
   a. Provide externally operable handle with means for locking in OFF position. Provide safety interlock to prevent opening cover with disconnect in ON position with capability of overriding interlock for testing purposes.
   b. Provide auxiliary interlock for disconnection of external control power sources where applicable.
2. Provide door-mounted remote operator interface.
3. Packaged Controllers with Bypass: Provide contactors and controls to enable removal of variable-frequency controller from circuit.
   a. Bypass Method: Manual, unless otherwise indicated.
   b. Bypass Configuration: 3-contactor type, with contactors for bypass, drive output, and drive input.
   c. Bypass Motor Starting Method: Full-voltage (across-the-line) with overload relay, unless otherwise indicated or required.
   d. Overload Relays: Solid state or bimetallic thermal type.
4. Pilot Devices Required:
   a. Furnish local pilot devices for each unit as specified below unless otherwise indicated on drawings, except where equivalent function is provided by remote operator interface.
   b. Packaged Controllers with Bypass:
      1) Bypass Mode Selector Switch: DRIVE/OFF/BYPASS.
      2) Motor Control Selector Switch: HAND/OFF/AUTO.
      3) Indicating Lights: For drive/bypass mode status, drive/bypass run status, and drive/bypass fault status.

L. Service Conditions:

1. Provide controllers and associated components suitable for operation under following service conditions without derating:
   a. Altitude: Less than 3,300 feet.
   b. Ambient Temperature: Between 32 degrees F and 104 degrees F.

2. Provide controllers and associated components suitable for operation at indicated ratings under service conditions at installed location.

M. Short Circuit Current Rating:

1. Provide controllers with listed short circuit current rating not less than available fault current at installed location as determined by short circuit study performed in accordance with Section 260573.
2. Provide line/input reactors where specified by manufacturer for required short circuit current rating.
3. Listed series ratings are not acceptable.

N. Conductor Terminations: Suitable for use with conductors to be installed.

O. Enclosures:

1. Comply with NEMA ICS 6.
2. NEMA 250 Environment Type or Equivalent IEC 60529 Rating: Unless otherwise indicated, as specified for following installation locations:
   a. Indoor Clean, Dry Locations: Type 1 or Type 12.
   b. Outdoor Locations: Type 3R or Type 4.
3. Finish: Manufacturer's standard unless otherwise indicated.
4. Cooling: Forced air or natural convection as determined by manufacturer.

P. Interface with Other Work:

1. Provide products compatible with other systems requiring interface with controllers.
2. Interface with building automation system.

2.03 OVERCURRENT PROTECTIVE DEVICES

A. Overload Relays:

1. Provide overload relays and, where applicable, associated current elements/heaters selected for actual installed motor nameplate data, in accordance with manufacturer's recommendations and NFPA 70; include consideration for motor service factor and ambient temperature correction, where applicable.
2. Comply with NEMA ICS 2.
3. Inverse-Time Trip Class Rating: Class 20 unless otherwise indicated or required.
4. Trip-free operation.
5. Visible trip indication.
6. Resettable.

a. Employ manual reset unless otherwise indicated.
b. Do not employ automatic reset with two-wire control.

7. Bimetallic Thermal Overload Relays:
   a. Interchangeable current elements/heaters.
   b. Adjustable trip; plus/minus 10 percent of nominal, minimum.
   c. Trip test function.
8. Solid State Overload Relays:
   a. Selectable inverse-time trip class rating; available ratings of Class 10, 20, and 30, minimum.
   b. Adjustable full load current.
   c. Phase loss protection.
   d. Phase imbalance protection.
   e. Ambient temperature insensitive.
   f. Thermal memory.
   g. Trip test function.
   h. Provide isolated alarm contact.

B. Fusible Disconnect Switches:
1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA KS 1, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated or as required.
2. Fuse Clips: As required to accept indicated fuses.
3. Provide externally operable handle with means for locking in OFF position. Provide means for locking switch cover in closed position. Provide safety interlock to prevent opening of cover with switch in ON position with capability of overriding interlock for testing purposes.

C. Circuit Breakers:
1. Motor Circuit Protectors:
   a. Description: Instantaneous-trip circuit breakers furnished with magnetic instantaneous tripping elements for short circuit protection, but not with thermal inverse time tripping elements for overload protection; UL 489 recognized only for use as part of listed combination motor controller with overload protection; ratings, configurations, and features as indicated or as required.
   b. Provide field-adjustable magnetic instantaneous trip setting.

2.04 ACCESSORIES

A. Auxiliary Contacts:
   1. Comply with NEMA ICS 5.
   2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each bypass motor starter, minimum.

B. Pilot Devices:
   1. Comply with NEMA ICS 5; heavy-duty type.
   2. Pushbuttons: Unless otherwise indicated, provide momentary, nonilluminated type with flush button operator; normally open or normally closed as indicated or as required.
   3. Selector Switches: Unless otherwise indicated, provide maintained, nonilluminated type with knob operator; number of switch positions as indicated or as required.
   4. Indicating Lights: Push-to-test type unless otherwise indicated.
   5. Provide LED lamp source for indicating lights and illuminated devices.

C. Control Power Transformers:
   1. Size to accommodate burden of contactor coil(s) and connected auxiliary devices, plus 25 percent spare capacity.
   2. Include primary and secondary fuses.

2.05 SOURCE QUALITY CONTROL

A. Factory test controllers in accordance with NEMA ICS 61800-2.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.
B. Verify that ratings of controllers are consistent with indicated requirements.
C. Verify that mounting surfaces are ready to accept controllers.
D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install controllers in accordance with NECA 1 (general workmanship).
B. Install in accordance with NEMA ICS 7.1 and manufacturer's instructions.
C. Do not exceed manufacturer's recommended maximum cable length between controller and motor.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required support and attachment in accordance with Section 260529.

F. Install controllers plumb and level.

G. Provide grounding and bonding in accordance with Section 260526.

H. Install field-installed devices, components, and accessories.

I. Provide fuses complying with Section 262813 for fusible switches as indicated.

J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

K. Set field-adjustable settings of controllers and associated components according to installed motor requirements, in accordance with recommendations of manufacturers of controller and load.

L. Identify controllers in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. Provide services of manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's reports with submittals.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.17. Insulation-resistance test on control wiring listed as optional is not required.

D. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

E. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for circuit breakers larger than 100 amperes. Tests listed as optional are not required.

F. Packaged Controllers with Bypass: Test for proper operation in both drive and bypass modes.

G. Test for proper interface with other systems.

H. Correct deficiencies and replace damaged or defective controllers or associated components.

I. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from controller enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of controllers to Owner, and correct deficiencies or make adjustments as directed.

B. Training: Train Owner's personnel on operation, adjustment, and maintenance of controllers and associated devices.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours of training.
3. Instructor: Manufacturer's authorized representative.
4. Location: At project site.

3.07 PROTECTION

A. Protect installed controllers from subsequent construction operations.

END OF SECTION 262923

SECTION 263100
PHOTOVOLTAIC COLLECTORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Photovoltaic system requirements.
B. Photovoltaic modules.
C. Photovoltaic module mounting system.
D. Photovoltaic combiner boxes.
E. Photovoltaic inverters.
F. Charge controllers.

1.02 REFERENCE STANDARDS

A. IEC 61215-1 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 1: Test Requirements; 2021, with Corrigendum.
B. IEC 61215-1-1 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 1-1: Special Requirements for Testing of Crystalline Silicon Photovoltaic (PV) Modules; 2021.
C. IEC 61215-1-2 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 1-2: Special Requirements for Testing of Thin-Film Cadmium Telluride (CdTe) Based Photovoltaic (PV) Modules; 2021, with Amendment (2022).
D. IEC 61215-1-3 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 1-3: Special Requirements for Testing of Thin-Film Amorphous Silicon Based Photovoltaic (PV) Modules; 2021, with Amendment (2022).
E. IEC 61215-1-4 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 1-4: Special Requirements for Testing of Thin-Film Cu(In,GA)(S,Se)2 Based Photovoltaic (PV) Modules; 2021, with Amendment (2022).
F. IEC 61215-2 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 2: Test Procedures; 2021.
G. IEC 61215 - Crystalline Silicon Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval; International Electrotechnical Commission; 2005.
H. IEC 61646 - Thin-Film Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval; 2008.
I. IEEE 1547 - IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces; 2018, with Amendment (2020).
J. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

K. NECA 412 - Standard for Installing and Maintaining Photovoltaic (PV) Power Systems; 2012.

L. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

M. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. UL 790 - Standard for Standard Test Methods for Fire Tests of Roof Coverings; Current Edition, Including All Revisions.

O. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

P. UL 1699B - Outline of Investigation for Photovoltaic (PV) DC Arc-Fault Circuit Protection; Current Edition; Current Edition, Including All Revisions.

Q. UL 1699B - Outline of Investigation for Photovoltaic (PV) DC Arc-Fault Circuit Protection; Current Edition, Including All Revisions.

R. UL 1703 - Flat Plate Photovoltaic Modules and Panels; Current Edition, Including All Revisions.

S. UL 1741 - Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources; Current Edition, Including All Revisions.

T. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment or other potential obstructions within the spaces dedicated for photovoltaic system components.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Roof-Mounted Arrays: Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
4. Notify Architect/Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Preinstallation Meeting: Convene one week prior to commencing work of this section; require attendance of all affected installers. Include adequate instruction on the electrical hazards associated with photovoltaic systems and appropriate safety procedures to be followed.

C. Rebates and Incentives: Prepare and submit documentation as required for Owner to secure funds from available federal, state, and utility company rebate and incentive programs. Notify Owner of any time constraints affecting program qualification.
   1. Include copies of documentation with submittals.

D. Utility Interconnection:
   1. Prepare and submit documentation as required for securing utility interconnection agreement between Owner and Utility Company.
   2. Preinstallation Meeting: Convene one week prior to commencing work of this section to review interconnection requirements and details with Utility Company representative.
   3. Coordinate with Utility Company to provide utility metering suitable for system requirements.
   4. Arrange for inspections and secure permits necessary to obtain Utility Company approval of system.

1.04 SUBMITTALS

A. See Division 01 for additional requirements.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product. Include ratings, configurations, standard wiring diagrams, outline and support point dimensions, finishes, weights, service condition requirements, and installed features.

C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, attachment locations and details, and proposed size, type, and routing of conduits and cables. Include system interconnection schematic diagrams showing all factory and field connections.
   1. Include proposed locations of roof penetrations and proposed methods for sealing.

D. Design Data:
   1. Include structural calculations, certified by structural engineer, for equipment and mounting system.
   2. Include electrical calculations for array and associated equipment other than the basis of design products and configuration.

E. Certify that work of this section does not void roof warranty.

F. Installer's Qualifications: Include evidence of compliance with specified requirements.

G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage,

handling, protection, examination, preparation, installation, and operation of product.

H. Manufacturer’s detailed field testing procedures.

I. Manufacturer's detailed startup procedures.

J. Rebate and incentive documentation.

K. Field quality control test reports.

1. Include manufacturer's field reports.

L. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.

M. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

N. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

1.05 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with Utility Company requirements for interconnection.

C. Structural Designer Qualifications: Registered structural engineer licensed in the State in which the Project is located.

D. Electrical Designer Qualifications: Registered electrical engineer licensed in the State in which the Project is located experienced in the design of photovoltaic systems.

E. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

F. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience with photovoltaic systems of similar size, type, and complexity.

G. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.07 WARRANTY

A. See Division 01 for additional warranty requirements.

B. Specified warranties indicate minimum requirements. Provide additional warranties or extended warranty periods where required to qualify for rebate and incentive programs.

C. Photovoltaic Modules:

1. Provide manufacturer warranty guaranteeing minimum 90 percent of rated power output for 10 years and minimum 80 percent of rated power output for 20 years.

D. Photovoltaic Module Mounting System: Provide minimum 10 year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

E. Photovoltaic Combiner Boxes: Provide minimum five year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

F. Photovoltaic Inverters: Provide minimum five year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

G. Charge Controllers: Provide minimum five year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 PHOTOVOLTAIC SYSTEM REQUIREMENTS

A. Provide complete photovoltaic system consisting of photovoltaic modules and associated balance of system components necessary for connection to facility electrical system.

B. System Description:

1. Photovoltaic array is roof-mounted in location indicated on the drawings.
2. Orientation of array is as indicated on the drawings.
3. System includes interconnection with utility grid (grid-tied system).
   a. Utility metering configuration: Net metering.
4. System does not include battery storage system.

C. Capacity:

1. Total Nominal Rated Power Output of Array: Equal to or greater than the rated output of the basis of design array.
2. Nominal Rated Power Output of Individual Modules: Equal to or greater than the rated output of the basis of design module.

D. Size:

1. Array: Designed to fit within the area designated on the drawings.

E. Appearance:
   1. Arrange array such that modules are aligned with uniform spacing.
   2. Make no alterations affecting appearance of building exterior or interior without approval of Architect/Engineer.
   3. Final determination of acceptable appearance is by Architect/Engineer.

F. Provide photovoltaic system and associated components suitable for wind loads, snow loads, seismic loads, and other structural design considerations of the installed location.

G. Provide photovoltaic system and associated components suitable for continuous operation under the service conditions at the installed location.

H. Provide products listed, classified, and labeled as suitable for the purpose intended.

I. Provide photovoltaic system and associated components that qualify for available federal, state, and utility company rebate and incentive programs.

J. Unless specifically indicated to be excluded, provide all required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for a complete operating system.

K. DC Arc Fault Circuit Protection: Provide DC photovoltaic arc-fault protection devices listed as complying with UL 1699B as required for compliance with NFPA 70.

L. Rapid Shutdown of Photovoltaic Systems on Buildings: Provide listed equipment arranged to provide rapid shutdown in accordance with NFPA 70.

M. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

N. Arrange array to provide adequate access to rear of string(s) for maintenance.

O. Arrange array to minimize shading during peak production periods.

P. Roof-Mounted Arrays:
   1. Arrange array such that normal roof drainage is not affected.
   2. Arrange array to maintain required safety clearances from edges of roof as indicated.
   3. Arrange array to maintain access and clearance requirements for other roof-mounted equipment.
   4. Arrange array to avoid spanning of expansion joints.

2.02 PHOTOVOLTAIC MODULES

A. Acceptable Module Types: Either crystalline silicon or thin film modules complying with specified requirements will be considered for this project.

B. General Requirements:

1. Photovoltaic Modules: Factory assembled; consisting of photovoltaic cells, frame, junction box, cables for series connection, and bypass diodes for shade tolerance; rated for 600 V DC; complying with IEC 61215-1 and IEC 61215-2 and listed as complying with UL 1703.
2. Crystalline Silicon Photovoltaic Modules: Comply with IEC 61215-1-1.
3. Thin Film Photovoltaic Modules: Comply with IEC 61215-1-2, IEC 61215-1-3, or IEC 61215-1-4 as applicable.
4. Frame: Anodized aluminum.
5. Factory-Installed Junction Box: Weatherproof, with factory-installed terminals and bypass diodes.
6. Factory-Installed Cables: Type USE-2 or listed photovoltaic (PV) wire with polarized locking connectors.
7. Fire Resistance Rating: UL 790, Class equal to or better than required fire rating of roof.
8. Unless otherwise indicated, specified module performance characteristics are rated under Standard Test Conditions (STC).

2.03 BALANCE OF SYSTEM COMPONENTS

A. Photovoltaic Module Mounting System:
   1. Provide complete mounting system compatible with modules to be installed and suitable to properly install them in the location indicated, including all necessary hardware and accessories.
   2. Support Structure and Associated Hardware Materials: Use aluminum, galvanized steel, or stainless steel.
   3. Roof-Mounted Arrays:
      a. Acceptable System Types: Only non-penetrating systems are acceptable. Penetrating systems will not be considered for this project.
      b. Provide system compatible with the roof at the installed location.
      c. Module Tilt Angle: As required to provide maximum energy production for installed location.
      d. Provide minimum clearance of 3 inches between roof and module for air circulation and drainage.

B. Photovoltaic Combiner Boxes:
   1. Provide combiner box(es) for termination of strings as indicated or as required for the array configuration installed.

2. Combiner Boxes: Rated for 600 V DC; current ratings suitable for connected strings; equipped with fuseholders; listed as complying with UL 1741.
3. Fuseholders: Touch-safe; suitable to accept fuses indicated.
4. Number of Input Circuits: As indicated or as required for termination of strings, with minimum of 25 percent spare capacity for future expansion.
5. Enclosure: NEMA 250, Type 3R, unless otherwise indicated.

C. Photovoltaic Inverters:
1. Provide inverter(s) as indicated or as required for connection of the photovoltaic array DC system to the AC system indicated.
2. Inverters: Suitable for the requirements of the connected array; output configuration compatible with connected system; listed as complying with UL 1741; furnished with the following features:
a. Maximum power point tracking (MPPT).
b. LCD display.
c. Integral AC disconnect.
d. Integral DC disconnect.
3. Grid-Tied Inverters: Comply with IEEE 1547, including over/under grid voltage and frequency protection, and anti-islanding protection to automatically disconnect upon loss of utility power and to remain disconnected until utility power restoration has been maintained for five minutes.
4. Total Harmonic Distortion: Less than five percent.
5. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
a. Indoor Clean, Dry Locations: Type 1.
b. Outdoor Locations: Type 3R.

D. Enclosed Switches, in Addition to Requirements of Section 262816.16:
1. Switches for DC System: Rated for 600 V DC.
2. Switches Connected to Supply Side of Service Disconnecting Means: Listed and labeled as suitable for use as service equipment according to UL 869A.

E. Charge Controllers: Suitable for the requirements of the connected battery storage system; no readily accessible user adjusting means; listed as complying with UL 1741.

F. Surge Protective Devices, in Addition to Requirements of Section 264300:
1. Surge Protective Devices for DC System:
a. Rated for 600 V DC.

b. Listed and labeled as complying with UL 1449, Type 1.

c. Surge Current Rating: Not less than 50 kA per mode.

d. UL 1449 Nominal Discharge Current (I-n): 20 kA.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings and configurations of system components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive system components.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Use open circuiting, short circuiting, or opaque covering to disable modules, array or portions of array prior to installation and service.

B. Roof-Mounted Arrays: Protect roof and adjacent roof-mounted items from damage.

3.03 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install photovoltaic system in accordance with NECA 412.

D. Provide required support and attachment in accordance with Section 260529.

E. Mount equipment such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor, ground, or working platform.

F. Circuiting Requirements. in Addition to Requirements of Section 260519:

1. Wiring Methods:

a. Unless otherwise indicated, use exposed module factory-installed cables (not routed inside building) for module interconnections.

b. Unless otherwise indicated, use exposed type USE-2/RHH/RHW-2 single-conductor cable or listed photovoltaic wire (not routed inside building) for wiring between string(s) and combiner box(es).

c. Unless otherwise indicated, use type THHN/THWN-2 single-conductor building wire in suitable raceway for wiring between combiner box(es) and point of interconnection.

d. Secure exposed cables in accordance with NFPA 70. Where possible, conceal behind array.

e. Install cables in suitable raceway where readily accessible or where required by authority having jurisdiction.

f. Use suitable twist-on insulated spring connectors, mechanical connectors, or compression connectors for photovoltaic circuit splices and taps.

2. Photovoltaic DC System Conductor Color Code:

a. Negative Grounded System:

1) Positive: Red.

2) Negative/Grounded: White.

b. Positive Grounded System:

1) Positive/Grounded: White.

2) Negative: Black.

c. Ungrounded System:

1) Positive: Red.

2) Negative: Black.

3. Maintain separation of photovoltaic and non-photovoltaic circuits in accordance with NFPA 70.

G. Grounding and Bonding Requirements, in Addition to Requirements of Section 260526:

1. Ensure that there is only one AC System bonding connection between grounding system and grounded/neutral conductor, including external connections and connections internal to equipment.

H. Identification Requirements, in Addition to Those Specified in Section 260553:

1. Color for Photovoltaic System Identification Nameplates and Labels: Black text on yellow background, unless otherwise required by NFPA 70 or authorities having jurisdiction.

2. Use identification nameplate or means of identification acceptable to authority having jurisdiction to identify the presence of multiple power sources and the location of main service disconnecting means and each photovoltaic system disconnecting means. Locate at main service disconnecting means and at each photovoltaic system disconnecting means. Verify format and descriptions with authorities having jurisdiction.

3. Use identification nameplate to identify each photovoltaic system disconnecting means with text "PV SYSTEM DISCONNECT".

4. Use identification nameplate or identification label to identify systems equipped with rapid shutdown and associated rapid shutdown switch(es). Format, descriptions, and locations to comply with NFPA 70 and requirements of authorities having jurisdiction.
5. Use identification nameplate or identification label to identify the information required by NFPA 70 for marking of direct-current photovoltaic power sources. Locate at each DC disconnect means requiring marking.
    a. Rated maximum power-point current (operating current).
    b. Rated maximum power-point voltage (operating voltage).
    c. Maximum system voltage.
    d. Short-circuit current.
6. Use identification nameplate or identification label to identify the interactive system point of interconnection at the disconnecting means as a power source and with the rated AC output current and the nominal operating AC voltage.
7. Use warning labels to identify electrical hazards for photovoltaic system disconnecting means. Include the word message "Warning - Electric Shock Hazard; Terminals on the line and load sides may be energized in the open position" or approved equivalent.
8. Use wire and cable markers to identify photovoltaic system source, output, and inverter circuit conductors at all points of termination, connection, and splices.
9. Use voltage markers, identification labels, stenciled text, or suitable permanent marking approved by authority having jurisdiction to identify exposed raceways, cable trays, pull boxes, junction boxes, and conduit bodies with the text "Warning: Photovoltaic Power Source" at maximum intervals of 10 feet in accordance with NFPA 70.

3.04 FIELD QUALITY CONTROL

A. See Division 01 for additional requirements.
B. See article "SYSTEM STARTUP" below for additional requirements related to testing and inspection.
C. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.
D. Inspection and testing to include, at a minimum:
    1. Inspect each system component for damage and defects.

2. Verify that equipment enclosures, boxes, and associated connections installed outdoors are weatherproof.
3. Verify proper wiring connections have been made and check for conductor continuity. Verify proper polarity.
4. Verify tightness of mechanical and electrical connections are according to manufacturer's recommended torque settings.
5. Perform insulation resistance tests.
    a. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.
6. Measure and record ambient conditions, including date and time, ambient temperature, cell temperature, solar irradiance in the module plane, and wind speed.
7. Measure and record open circuit voltage of each string.
8. Measure and record voltages at the inverter AC and DC inputs.
9. Measure and record operating current for each string, sub-array, and array.
10. Measure and record AC output power.
11. Perform inverter functional test.
    a. Grid-Tied Inverters: Include simulation of loss of utility power and subsequent power restoration.

E. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

F. Diagnostic Period: After successful completion of inspections and tests, operate system in normal mode for at least 14 days without any system or equipment malfunctions.
1. Record all system operations and malfunctions.
2. If a malfunction occurs, start diagnostic period over after correction of malfunction.

G. Submit detailed reports indicating inspection and testing results and corrective actions taken.

H. Repair roof or adjacent roof-mounted items damaged as a result of work of this section.

3.05 SYSTEM STARTUP

A. Provide services of a manufacturer's authorized representative to assist in performing system startup. Include manufacturer's detailed startup procedures with submittals.

B. Obtain Owner's approval prior to performing system startup.

C. Grid-Tied Systems: Obtain Utility Company's approval prior to performing system startup.

D. Prepare and start system in accordance with manufacturer's instructions.

3.06 CLEANING

A. Clean modules using only methods recommended by manufacturer to avoid scratches and other damage. Clean exposed surfaces on other components to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.07 COMMISSIONING

A. See Division 01 for Commissioning requirements.

3.08 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.

B. Training: Train Owner's personnel on operation, adjustment, and maintenance of photovoltaic system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of four hours of training.
3. Instructor: Manufacturer's authorized representative.
4. Location: At project site.

3.09 PROTECTION

A. Protect installed products from subsequent construction operations.

END OF SECTION 263100

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SECTION 263213
ENGINE GENERATORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Packaged engine generator system and associated components and accessories:
   1. Engine and engine accessory equipment.
   2. Alternator (generator).
   3. Generator set control system.
   4. Generator set enclosure.

1.02 REFERENCE STANDARDS

A. ASTM D975 - Standard Specification for Diesel Fuel; 2023a.
B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
C. NECA/EGSA 404 - Standard for Installing Generator Sets; 2014.
D. NEMA MG 1 - Motors and Generators; 2021.
E. NFPA 30 - Flammable and Combustible Liquids Code; 2024.
F. NFPA 37 - Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines; 2024, with Amendment.
G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
H. NFPA 110 - Standard for Emergency and Standby Power Systems; 2025.
I. UL 142 - Steel Aboveground Tanks for Flammable and Combustible Liquids; Current Edition, Including All Revisions.
J. UL 1236 - Battery Chargers for Charging Engine-Starter Batteries; Current Edition, Including All Revisions.
K. UL 2200 - Stationary Engine Generator Assemblies; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate compatibility of generator sets to be installed with work provided under other sections or by others.
      a. Transfer Switches: See Section 263600.
   2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment or other potential obstructions within the spaces dedicated for engine generator system.

3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.
4. Coordinate the work to provide electrical circuits suitable for the power requirements of the actual auxiliary equipment and accessories to be installed.
5. Notify Architect/Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Preinstallation Meeting: Convene one week before starting work of this section; require attendance of all affected installers.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features. Include alternator starting capabilities, engine fuel consumption rates, and cooling, combustion air, and exhaust requirements.
1. Include generator set sound level test data.
2. Include characteristic trip curves for overcurrent protective devices upon request.
3. Include alternator thermal damage curve upon request.

B. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing all factory and field connections.

C. Derating Calculations: Indicate ratings adjusted for applicable service conditions.

D. Fuel Storage Tank Calculations: Indicate maximum running time for generator set configuration provided.

E. Generator load calculations: Provide calculations verifying that proposed generator is adequately sized for loads served.

F. Specimen Warranty: Submit sample of manufacturer's warranty.

G. Evidence of qualifications for installer.

H. Evidence of qualifications for maintenance contractor (if different entity from installer).

I. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

J. Manufacturer's factory emissions certification.

K. Manufacturer's certification that products meet or exceed specified requirements.

L. Source quality control test reports.

M. Provide NFPA 110 required documentation from manufacturer, including but not limited to:
   1. Certified prototype tests.
N. Manufacturer’s detailed field testing procedures.
O. Field quality control test reports.
P. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
   1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.
Q. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.
R. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.
S. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Fuses: One of each type and size.
   2. Extra Filter Elements: One of each type, including fuel, oil and air.

1.05 QUALITY ASSURANCE

A. Comply with the following:
   1. NFPA 70 (National Electrical Code).
   2. NFPA 110 (Standard for Emergency and Standby Power Systems); meet requirements for Level 1 system.
   3. NFPA 37 (Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines).
   4. NFPA 30 (Flammable and Combustible Liquids Code).
B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with documented experience.
   1. Authorized service facilities located within 200 miles of project site.
C. Installer Qualifications: Company specializing in performing the work of this section with documented experience with engine generator systems of similar size, type, and complexity; manufacturer's authorized installer.
D. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.
   1. Contract maintenance office located within 200 miles of project site.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store generator sets in accordance with manufacturer's instructions and NECA/EGSA 404.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's instructions to avoid damage to generator set components, enclosure, and finish.

1.07 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.08 WARRANTY

A. Provide minimum two year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Furnish engine generator sets and associated components and accessories produced by a single manufacturer and obtained from a single supplier.

2.02 PACKAGED ENGINE GENERATOR SYSTEM

A. Provide new engine generator system consisting of all required equipment, sensors, conduit, boxes, wiring, piping, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. System Description:

1. Application: Emergency/standby.
2. Configuration: Single packaged engine generator set operated independently (not in parallel).

D. Packaged Engine Generator Set:

1. Type: Diesel (compression ignition).
2. Power Rating: As indicated on drawings, standby.
3. Voltage: As indicated on drawings.

4. Main Line Circuit Breakers:
    a. Type: Thermal magnetic.
    b. Trip Rating: As indicated on drawings.
    c. Breaker sizes as indicated on the drawings.
    d. Features:
        1) Shunt trip for all breakers.

E. Generator Set General Requirements:
1. Prototype tested in accordance with NFPA 110 for Level 1 systems.
2. Factory-assembled, with components mounted on suitable base.
3. List and label engine generator assembly as complying with UL 2200.
4. Power Factor: Unless otherwise indicated, specified power ratings are at 0.8 power factor for three phase voltages and 1.0 power factor for single phase voltages.
5. Provide suitable guards to protect personnel from accidental contact with rotating parts, hot piping, and other potential sources of injury.
6. Main Line Circuit Breakers: Provide factory-installed line side connections with suitable lugs for load side connections.

F. Service Conditions: Provide engine generator system and associated components suitable for operation under the service conditions at the installed location.

G. Starting and Load Acceptance Requirements:
1. Cranking Method: Cycle cranking complying with NFPA 110 (15 second crank period, followed by 15 second rest period, with cranking limiter time-out after 3 cycles), unless otherwise required.
2. Cranking Limiter Time-Out: If generator set fails to start after specified cranking period, indicate overcrank alarm condition and lock-out generator set from further cranking until manually reset.
3. Start Time: Capable of starting and achieving conditions necessary for load acceptance within 10 seconds (NFPA 110, Type 10).
4. Maximum Load Step: Supports 100 percent of rated load in one step.

H. Exhaust Emissions Requirements:
1. Comply with federal (EPA), state, and local regulations applicable at the time of commissioning; include factory emissions certification with submittals.
2. Do not make modifications affecting generator set factory emissions certification without approval of manufacturer and Engineer. Where such modifications are made, provide field emissions testing as necessary for

certification.

I. Sound Level Requirements:

1. Do not exceed 76dBA when measured at 23 feet from generator set in free field (no sound barriers) while operating at full load; include manufacturer's sound data with submittals.
2. Comply with applicable noise level regulations.

2.03 ENGINE AND ENGINE ACCESSORY EQUIPMENT

A. Provide engine with adequate horsepower to achieve specified power output at rated speed, accounting for alternator efficiency and parasitic loads.

B. Engine Fuel System - Diesel (Compression Ignition):

1. Fuel Source: Diesel, ASTM D975 No. 2-D or approved cold weather diesel blends.
2. Fuel Storage: Sub-base fuel tank.
3. Engine Fuel Supply: Provide engine-driven, positive displacement fuel pump with replaceable fuel filter(s), water separator, check valve to secure prime, manual fuel priming pump, and relief-bypass valve. Provide fuel cooler where recommended by manufacturer.
4. Engine Fuel Connections: Provide suitable, approved flexible fuel lines for coupling engine to fuel source.
5. Sub-Base Fuel Tank:
   a. Provide sub-base mounted, double-wall fuel tank with secondary containment; listed and labeled as complying with UL 142.
   b. Tank Capacity: Size for minimum of 48 hours of continuous engine generator operation at 100 percent rated load, but not larger than permissible by applicable codes.
   c. Features:
      1) Direct reading fuel level gauge.
      2) Normal atmospheric vent.
      3) Emergency pressure relief vent.
      4) Fuel fill opening with lockable cap.
      5) Dedicated electrical conduit stub-up area.
      6) Low fuel level switch.
      7) Leak detection switch; located within secondary containment interstitial space for detection of primary tank fuel leak.

C. Engine Starting System:

1. System Type: Electric, with DC solenoid-activated starting motor(s).
2. Battery(s):
    a. Battery Type: Lead-acid.
    b. Battery Capacity: Size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature; capable of providing cranking through two complete periods of cranking limiter time-outs without recharging.
    c. Provide battery rack, cables, and connectors suitable for the supplied battery(s); size battery cables according to manufacturer's recommendations for cable length to be installed.
3. Battery-Charging Alternator: Engine-driven, with integral solid-state voltage regulation.
4. Battery Charger:
    a. Provide dual rate battery charger with automatic float and equalize charging modes and minimum rating of 10 amps; suitable for maintaining the supplied battery(s) at full charge without manual intervention.
    b. Capable of returning supplied battery(s) from fully discharged to fully charged condition within 24 hours, as required by NFPA 110 for Level 1 applications while carrying normal loads.
    c. Listed as complying with UL 1236.
    d. Furnished with integral overcurrent protection; current limited to protect charger during engine cranking; reverse polarity protection.
    e. Provide integral DC output ammeter and voltmeter with five percent accuracy.
    f. Provide alarm output contacts as necessary for alarm indications.

D. Engine Speed Control System (Governor):
1. Single Engine Generator Sets (Not Operated in Parallel): Provide electronic isochronous governor for controlling engine speed/alternator frequency.
2. Frequency Regulation, Electronic Isochronous Governors: No change in frequency from no load to full load; plus/minus 0.25 percent at steady state.

E. Engine Lubrication System:
1. System Type: Full pressure, with engine-driven, positive displacement lubrication oil pump, replaceable full-flow oil filter(s), and dip-stick for oil level indication. Provide oil cooler where recommended by manufacturer.

F. Engine Cooling System:

1. System Type: Closed-loop, liquid-cooled, with unit-mounted radiator/fan and engine-driven coolant pump; suitable for providing adequate cooling while operating at full load under worst case ambient temperature.
2. Fan Guard: Provide suitable guard to protect personnel from accidental contact with fan.
3. Ducted Radiators: Where ducted radiator air discharge is to be field-installed, provide suitable radiator duct flange/adapter.
4. Coolant Heater: Provide thermostatically controlled coolant heater to improve starting under cold ambient conditions; size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature.

G. Engine Air Intake and Exhaust System:
1. Air Intake Filtration: Provide engine-mounted, replaceable, dry element filter.
2. Engine Exhaust Connection: Provide suitable, approved flexible connector for coupling engine to exhaust system.
3. Exhaust Silencer: Provide critical grade or better exhaust silencer with sound attenuation not less than basis of design; select according to manufacturer's recommendations to meet sound performance requirements, where specified.

2.04 ALTERNATOR (GENERATOR)

A. Alternator: 4-pole, 1800 rpm (60 Hz output) revolving field, synchronous generator complying with NEMA MG 1; connected to engine with flexible coupling; voltage output configuration as indicated, with reconnectable leads for 3 phase alternators.

B. Exciter:
1. Exciter Type: Brushless; provide permanent magnet generator (PMG) excitation system; self-excited (shunt) systems are not permitted.
2. PMG Excitation Short-Circuit Current Support: Capable of sustaining 300 percent of rated output current for 10 seconds.
3. Voltage Regulation (with PMG excitation): Plus/minus 0.5 percent for any constant load from no load to full load.

C. Temperature Rise: Comply with UL 2200.

D. Insulation System: NEMA MG 1, Class H; suitable for alternator temperature rise.

E. Enclosure: NEMA MG 1, drip-proof.

F. Total Harmonic Distortion: Not greater than five percent.

2.05 GENERATOR SET CONTROL SYSTEM

A. Provide microprocessor-based control system for automatic control, monitoring, and protection of generator set. Include sensors, wiring, and connections necessary for functions/indications specified.

B. Control Panel:

1. Control Panel Mounting: Unit-mounted unless otherwise indicated; vibration isolated.
2. Generator Set Control Functions:
    a. Automatic Mode: Initiates generator set start/shutdown upon receiving corresponding signal from remote device (e.g. automatic transfer switch).
    b. Manual Mode: Initiates generator set start/shutdown upon direction from operator.
    c. Reset Mode: Clears all faults, allowing generator set restart after a shutdown.
    d. Emergency Stop: Immediately shuts down generator set (without time delay) and prevents automatic restarting until manually reset.
    e. Cycle Cranking: Programmable crank time, rest time, and number of cycles.
    f. Time Delay: Programmable for shutdown (engine cooldown) and start (engine warmup).
    g. Voltage Adjustment: Adjustable through range of plus/minus 5 percent.
3. Generator Set Status Indications:
    a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
    b. Current (Amps): For each phase.
    c. Frequency (Hz).
    d. Real power (W/kW).
    e. Reactive power (VAR/kVAR).
    f. Apparent power (VA/kVA).
    g. Power factor.
    h. Duty Level: Actual load as percentage of rated power.
    i. Engine speed (RPM).
    j. Battery voltage (Volts DC).
    k. Engine oil pressure.
    l. Engine coolant temperature.
    m. Engine run time.

n. Generator powering load (position signal from transfer switch).

4. Generator Set Protection and Warning/Shutdown Indications:
   a. Comply with NFPA 110; configurable for NFPA 110 Level 1 or Level 2, or NFPA 99 systems including but not limited to the following protections/indications:
      1) Overcrank (shutdown).
      2) Low coolant temperature (warning).
      3) High coolant temperature (warning).
      4) High coolant temperature (shutdown).
      5) Low oil pressure (warning).
      6) Low oil pressure (shutdown).
      7) Overspeed (shutdown).
      8) Low fuel level (warning).
      9) Low coolant level (warning/shutdown).
      10) Generator control not in automatic mode (warning).
      11) High battery voltage (warning).
      12) Low cranking voltage (warning).
      13) Low battery voltage (warning).
      14) Battery charger failure (warning).
   b. In addition to NFPA 110 requirements, provide the following protections/indications:
      1) High AC voltage (shutdown).
      2) Low AC voltage (shutdown).
      3) High frequency (shutdown).
      4) Low frequency (shutdown).
      5) Overcurrent (shutdown).
      6) Fuel tank leak (warning), where applicable.
   c. Provide contacts for local and remote common alarm.
   d. Provide lamp test function that illuminates all indicator lamps.
5. Other Control Panel Features:
   a. Event log.
   b. Communications Capability: Compatible with Owner's BAS. Provide all accessories necessary for proper interface.
      1) Coordinate components necessary to communicate with BAS via BACnet IP with the controls contractor.

c. Remote monitoring capability via PC.

C. Remote Annunciator:

1. Remote Annunciator Mounting: Wall-mounted; Provide flush mounted annunciator.
2. Generator Set Status Indications:
   a. Generator powering load (via position signal from transfer switch).
   b. Communication functional.
3. Generator Set Warning/Shutdown Indications:
   a. Comply with NFPA 110; configurable for NFPA 110 Level 1 or Level 2, or NFPA 99 systems including but not limited to the following indications:
      1) Overcrank (shutdown).
      2) Low coolant temperature (warning).
      3) High coolant temperature (warning).
      4) High coolant temperature (shutdown).
      5) Low oil pressure (shutdown).
      6) Overspeed (shutdown).
      7) Low fuel level (warning).
      8) Low coolant level (warning/shutdown).
      9) Generator control not in automatic mode (warning).
      10) High battery voltage (warning).
      11) Low cranking voltage (warning).
      12) Low battery voltage (warning).
      13) Battery charger failure (warning).
   b. Provide audible alarm with silence function.
   c. Provide lamp test function that illuminates all indicator lamps.

D. Remote Emergency Stop: Provide approved red, mushroom style remote emergency stop button where indicated or required by authorities having jurisdiction.

2.06 GENERATOR SET ENCLOSURE

A. Enclosure Type: Sound attenuating, weather protective.

B. Enclosure Material: Steel or aluminum.

C. Hardware Material: Stainless steel.

D. Color: Manufacturer's standard.

E. Access Doors: Lockable, with all locks keyed alike.

F. Openings: Designed to prevent bird/rodent entry.

G. External Drains: Extend oil and coolant drain lines to exterior of enclosure for maintenance service.

H. Sound Attenuating Enclosures: Line enclosure with non-hydroscopic, self-extinguishing sound-attenuating material.

I. Utilize an upward discharging radiator hood.

J. Exhaust Silencers: Where exhaust silencers are mounted within enclosure in main engine compartment, insulate silencer to minimize heat dissipation as necessary for operation at rated load under worst case ambient temperature.

K. Enclosure Lighting: Provide a DC lighting system package pre-wired from the factory.

2.07 SOURCE QUALITY CONTROL

A. Perform production tests on generator sets at factory to verify operation and performance characteristics prior to shipment. Include certified test report with submittals.

B. Generator Set production testing to include, at a minimum:

1. Operation at rated load and rated power factor.
2. Single step load pick-up.
3. Transient and steady state voltage and frequency performance.
4. Operation of safety shutdowns.

C. Diesel Fuel Storage Tanks: Perform pressurized leak test prior to shipment.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of generator sets and auxiliary equipment are consistent with the indicated requirements.

C. Verify that rough-ins for field connections are in the proper locations.

D. Verify that mounting surfaces are ready to receive equipment.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install generator sets and associated accessories in accordance with NECA/EGSA 404.

D. Arrange equipment to provide minimum clearances and required maintenance access.

E. Unless otherwise indicated, mount generator set on properly sized, minimum 6 inch high concrete pad constructed in accordance with Section 033000.

F. Provide required support and attachment in accordance with Section 260529.

G. Use manufacturer's recommended oil and coolant, suitable for the worst case ambient temperatures.

H. Provide engine exhaust piping in accordance with Division 23 where not factory installed.

I. Install exhaust silencer in accordance with Division 23 where not factory installed.

J. Provide grounding and bonding in accordance with Section 260526.

K. Identify system wiring and components in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. Provide services of a manufacturer's authorized representative to prepare and start systems and perform inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.

B. Notify Owner and Architect/Engineer at least two weeks prior to scheduled inspections and tests.

C. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

D. Provide all equipment, tools, and supplies required to accomplish inspection and testing, including load bank and fuel.

E. Preliminary inspection and testing to include, at a minimum:

1. Inspect each system component for damage and defects.
2. Verify tightness of mechanical and electrical connections are according to manufacturer's recommended torque settings.
3. Check for proper oil and coolant levels.

F. Prepare and start system in accordance with manufacturer's instructions.

G. Perform acceptance test in accordance with NFPA 110.

H. Inspection and testing to include, at a minimum:

1. Verify compliance with starting and load acceptance requirements.
2. Verify voltage and frequency; make required adjustments as necessary.
3. Verify phase sequence.
4. Verify control system operation, including safety shutdowns.
5. Verify operation of auxiliary equipment and accessories (e.g. battery charger, heaters, etc.).

6. Perform load tests in accordance with NFPA 110 (1.5 hour building load test followed by 2 hour full load test).

I. Provide field emissions testing where necessary for certification.

J. Sound Level Tests: Measure sound levels for compliance with specified requirements. Identify and report ambient noise conditions.

K. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

L. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.04 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.

B. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of four hours of training.
3. Instructor: Manufacturer's authorized representative.
4. Location: At project site.

C. After successful acceptance test and just prior to Substantial Completion, replace air, oil, and fuel filters.

3.06 PROTECTION

A. Protect installed engine generator system from subsequent construction operations.

END OF SECTION 263213

SECTION 263600
TRANSFER SWITCHES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Transfer switches for low-voltage (600 V and less) applications and associated accessories:
   1. Automatic transfer switches.
   2. Includes service entrance rated transfer switches.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.
B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.
C. NEMA ICS 10 Part 1 - Industrial Control and Systems Part 1: Electromechanical AC Transfer Switch Equipment; 2020.
D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.
E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
F. NFPA 110 - Standard for Emergency and Standby Power Systems; 2025.
G. UL 1008 - Transfer Switch Equipment; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate compatibility of transfer switches to be installed with work provided under other sections or by others.
      a. Engine Generators: See Section 263213.
   2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
   3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   4. Coordinate the work with placement of supports, anchors, etc. required for mounting.
   5. Notify Architect/Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features.
   1. Where applicable, include characteristic trip curves for overcurrent protective devices upon request.

B. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing all factory and field connections.

C. Specimen Warranty: Submit sample of manufacturer's warranty.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

E. Manufacturer's certification that products meet or exceed specified requirements.

F. Manufacturer’s detailed field testing procedures.

G. Field quality control test reports.

H. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
   1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.

I. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.

J. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

K. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1.05 QUALITY ASSURANCE

A. Comply with the following:
   1. NFPA 70 (National Electrical Code).
   2. NFPA 110 (Standard for Emergency and Standby Power Systems); meet requirements for Level 1 system.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
   1. Authorized service facilities located within 200 miles of project site.

C. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with power transfer systems of similar size, type, and complexity; manufacturer's authorized installer.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store transfer switches in accordance with manufacturer's instructions.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's instructions to avoid damage to transfer switch components, enclosure, and finish.

1.07 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.08 WARRANTY

A. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 - PRODUCTS

2.01 TRANSFER SWITCHES

A. Provide complete power transfer system consisting of all required equipment, conduit, boxes, wiring, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Applications:

1. Neutral Switching (Single Phase, Three Wire and Three Phase, Four Wire Systems):

a. Unless otherwise indicated or required, provide neutral switching:

1) Where the alternate/emergency source is a separately derived system.

D. Construction Type: Only "breaker type" (enclosed contact) transfer switches are acceptable. Do not use "contactor type" (open contact) transfer switches.

E. Automatic Transfer Switch:

1. Transfer Switch Type: Automatic transfer switch.
    a. ATS-MAIN to be service entrance rated.
2. Transition Configuration: Open-transition (no neutral position), utilizing in-phase monitor.
3. Voltage: As indicated on the drawings.
4. Ampere Rating: As indicated on the drawings.
5. Neutral Configuration: Switched neutral.
6. Load Served: As indicated on the drawings.
7. Primary Source: As indicated on the drawings.
8. Alternate Source: As indicated on the drawings.

F. Comply with NEMA ICS 10 Part 1, and list and label as complying with UL 1008 for the classification of the intended application (e.g. emergency, optional standby).

G. Do not use double throw safety switches or other equipment not specifically designed for power transfer applications and listed as transfer switch equipment.

H. Load Classification: Classified for total system load (any combination of motor, electric discharge lamp, resistive, and tungsten lamp loads with tungsten lamp loads not exceeding 30 percent of the continuous current rating) unless otherwise indicated or required.

I. Switching Methods:
    1. Open Transition:
        a. Provide break-before-make transfer without a neutral position that is not connected to either source, and with interlocks to prevent simultaneous connection of the load to both sources.
        b. Where in-phase transfer is indicated, utilize in-phase monitor to initiate transfer when phase angle difference between sources is near zero to limit in-rush currents.
    2. Neutral Switching: overlapping neutral (make before break).
    3. Obtain control power for transfer operation from line side of source to which the load is to be transferred.

J. Service Conditions: Provide transfer switches suitable for continuous operation at indicated ratings under the service conditions at the installed location.

K. Enclosures:
    1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
        a. Indoor Clean, Dry Locations: Type 1 or Type 12.

2. Finish: Manufacturer's standard unless otherwise indicated.

L. Short Circuit Current Rating:

1. Withstand and Closing Rating: Provide transfer switches, when protected by the supply side overcurrent protective devices to be installed, with listed withstand and closing rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 260573.

M. Automatic Transfer Switches:

1. Description: Transfer switches with automatically initiated transfer between sources; electrically operated and mechanically held.
2. Control Functions:
    a. Automatic mode.
    b. Test Mode: Simulates failure of primary/normal source.
    c. Voltage and Frequency Sensing:
        1) Undervoltage sensing for each phase of primary/normal source; adjustable dropout/pickup settings.
        2) Undervoltage sensing for alternate/emergency source; adjustable dropout/pickup settings.
        3) Underfrequency sensing for alternate/emergency source; adjustable dropout/pickup settings.
    d. Outputs:
        1) Contacts for engine start/shutdown (except where direct generator communication interface is provided).
        2) Auxiliary contacts; one set(s) for each switch position.
    e. Adjustable Time Delays:
        1) Engine generator start time delay; delays engine start signal to override momentary primary/normal source failures.
        2) Transfer to alternate/emergency source time delay.
        3) Retransfer to primary/normal source time delay.
        4) Engine generator cooldown time delay; delays engine shutdown following retransfer to primary/normal source to permit generator to run unloaded for cooldown period.
    f. In-Phase Monitor (Open Transition Transfer Switches): Monitors phase angle difference between sources for initiating in-phase transfer.

g. Engine Exerciser: Provides programmable scheduled exercising of engine generator selectable with or without transfer to load; provides memory retention during power outage.

3. Status Indications:
   a. Connected to alternate/emergency source.
   b. Connected to primary/normal source.
   c. Alternate/emergency source available.
   d. Primary/normal source available.
4. Other Features:
   a. Event log.
   b. Communications Capability: Compatible with Owner's BAS. Provide all accessories necessary for proper interface.
      1) Coordinate components necessary to communication with BA
   c. Remote monitoring capability via PC.
5. Automatic Sequence of Operations:
   a. Upon failure of primary/normal source for a programmable time period (engine generator start time delay), initiate starting of engine generator where applicable.
   b. When alternate/emergency source is available, transfer load to alternate/emergency source after programmable time delay.
   c. When primary/normal source has been restored, retransfer to primary/normal source after a programmable time delay. Bypass time delay if alternate/emergency source fails and primary/normal source is available.
   d. Where applicable, initiate shutdown of engine generator after programmable engine cooldown time delay.

N. Interface with Other Work:
   1. Interface with engine generators as specified in Section 263213.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.
B. Verify that the ratings and configurations of transfer switches are consistent with the indicated requirements.
C. Verify that rough-ins for field connections are in the proper locations.
D. Verify that mounting surfaces are ready to receive transfer switches.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Arrange equipment to provide minimum clearances and required maintenance access.

D. Provide required support and attachment in accordance with Section 260529.

E. Install transfer switches plumb and level.

F. Unless otherwise indicated, mount floor-mounted transfer switches on properly sized 3 inch high concrete pad constructed in accordance with Section 033000.

G. Provide grounding and bonding in accordance with Section 260526.

H. Identify transfer switches and associated system wiring in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

A. Refer to Division 01 for additional requirements.

B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's detailed testing procedures and field reports with submittals.

C. Prepare and start system in accordance with manufacturer's instructions.

D. Automatic Transfer Switches:

1. Inspect and test in accordance with NETA ATS, except Section 4.
2. Perform inspections and tests listed in NETA ATS, Section 7.22.3. The insulation-resistance tests listed as optional are not required.

E. Provide additional inspection and testing as required for completion of associated engine generator testing as specified in Section 263213.

F. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

G. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.04 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.05 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of transfer switches to Owner, and correct deficiencies or make adjustments as directed.

B. Training: Train Owner's personnel on operation, adjustment, and maintenance of transfer switches.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of four hours of training.
   3. Instructor: Manufacturer's authorized representative.
   4. Location: At project site.

C. Coordinate with related generator demonstration and training as specified in Section 263213.

3.06 PROTECTION

A. Protect installed transfer switches from subsequent construction operations.

END OF SECTION 263600

SECTION 264113

LIGHTNING PROTECTION FOR STRUCTURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Strike (air) terminals and interconnecting conductors.

B. Grounding and bonding for lightning protection.

1.02 REFERENCE STANDARDS

A. NFPA 780 - Standard for the Installation of Lightning Protection Systems; 2023.

B. UL 96 - Lightning Protection Components; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination with Concrete Work: Coordinate the embedding of lightning protection components in concrete.

B. Coordination with Roofing Work: Ensure adequate attachment of strike terminals and conductors without damage to roofing.

C. Preinstallation Meeting: Convene a meeting at least at least two weeks prior to commencement of any work affected by lightning protection system requirements to discuss prerequisites and coordination required by other installers; require attendance by representatives of installers whose work will be affected.

1.04 SUBMITTALS

A. Refer to Division 01 requirements.

B. Shop Drawings: Indicate location and layout of air terminals, grounding electrodes, and bonding connections to structure and other metal objects. Include terminal, electrode, and conductor sizes, and connection and termination details.

1. Where conductors or grounds are to be embedded or concealed in other construction, submit shop drawings at least 30 days prior to start of construction.
2. If concrete-encased grounds are to be used and are not shown in Contract Documents, provide sufficient data to determine concrete encasement dimensions and location.
3. Include data on actual ground resistance determined by field measurement in accordance with NFPA 780.
4. Include engineering analysis of equalization of potential to metal bodies within the structure.
5. Include access panels, test holes, and disconnecting means for maintenance.

C. Product Data: Provide dimensions and materials of each component, indication of testing agency listing, and installation instructions.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Installation Certification: Submit copy of certification agency's approval.

F. Operation and Maintenance Data: Provide recommended inspection and testing plan, including recommended intervals, to achieve periodic maintenance as recommended in NFPA 780; provide customized plan reflecting actual installation configuration with specific installed components identified.

G. Project Record Documents: Record actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors in project record documents.

H. Certification: Provide master label for system and all installed elements.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in lightning protection equipment with documented experience.

B. Designer Qualifications: Person or entity, employed by installer, who specializes in lightning protection system design with documented experience.

C. Installer Qualifications: Capable of providing the specified certification of the installed system.

D. Installer Qualifications: Company specializing in lightning protection system design with documented experience.

E. Field Quality Control Testing Agency Qualifications: Firm capable of and experienced in grounding and bonding testing with documented experience and minimum of three project references.

F. Products: Listed, classified, and labeled as suitable for the purpose intended.

G. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.01 LIGHTNING PROTECTION SYSTEM

A. Lightning Protection System: Provide complete system complying with NFPA 780, including air terminals, bonding, interconnecting conductors and grounding electrodes.

1. Provide system that protects:

a. The entire structure.

2. Coordinate with other grounding and bonding systems specified.
3. Determine ground resistance by field measurement.
4. Provide copper, bronze, or stainless steel components, except where aluminum is allowed by NFPA 780.
5. Provide disconnecting means and access panels or similar devices to allow complete periodic inspection and testing as described by NFPA 780 Annex D.
6. Provide system certified by Underwriters Laboratories or the Lightning Protection Institute.

B. Strike Terminals: Provide strike (air) terminals on the following:

1. Roofs.
2. Penthouse roofs.
3. Parapets.
4. Roof mounted equipment.

2.02 COMPONENTS

A. All Components: Complying with applicable requirements of UL 96.
B. Strike (Air) Terminals: Copper, solid with bases suitable for parapet, roof and equipment installation/mounting.
C. Grounding Rods: Solid copper or copper-clad steel.
D. Ground Plate: Copper.
E. Conductors: Copper cable.
F. Connectors and Splicers: Bronze.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated on shop drawings.
B. Coordinate work with installation of roofing and exterior and interior finishes.

3.02 INSTALLATION

A. Install in accordance with referenced system standards and as required for specified certification.
B. Connect conductors using mechanical connectors or exothermic welding process; protect adjacent construction elements and finishes from damage.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection in accordance with Division 01.
B. Perform visual inspection as specified in NFPA 780 as if this were a periodic follow-up inspection.

C. Perform continuity testing as specified in NFPA 780 as if this were testing for periodic maintenance.

D. Obtain the services of the specified certification agency to provide inspection and certification of the lightning protection system, including performance of any other testing required by that agency.

END OF SECTION 264113

SECTION 264300
SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Surge protective devices for service entrance locations.

B. Surge protective devices for branch panelboard locations.

1.02 ABBREVIATIONS AND ACRONYMS

A. EMI/RFI: Electromagnetic Interference/Radio Frequency Interference.

B. SPD: Surge Protective Device.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.

C. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems; 2021.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate size and location of overcurrent device compatible with the actual surge protective device and location to be installed. Notify Architect/Engineer of any conflicts or deviations from Contract Documents to obtain direction prior to ordering equipment.

1.05 SUBMITTALS

A. Refer to Division 01 requirements.

B. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.

C. Shop Drawings: Include wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.

D. Certificates: Manufacturer's documentation of listing for compliance with the following standards:

1. UL 1449.

E. Field Quality Control Test Reports.

F. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

G. Operation and Maintenance Data: Include information on status indicators and recommended maintenance procedures and intervals.

H. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

I. Project Record Documents: Record actual connections and locations of surge protective devices.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with documented experience.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in accordance with manufacturer's written instructions.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. Manufacturer's Warranty: Provide minimum ten year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.

B. Exclude surge protective devices from any clause limiting warranty responsibility for acts of nature, including lightning, stated elsewhere.

PART 2 - PRODUCTS

2.01 SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS

A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings.

B. Unless otherwise indicated, provide field-installed, externally-mounted or factory-installed, internally-mounted SPDs.

C. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.

D. Protected Modes:

1. Wye Systems: L-N, L-G, N-G, L-L.

E. UL 1449 Voltage Protection Ratings (VPRs):

1. 208Y/120V System Voltage: Not more than 700 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.
2. 480Y/277V System Voltage: Not more than 1,500 V for L-N, L-G, and N-G modes and 2,000 V for L-L mode.

F. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.

G. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

1. Indoor clean, dry locations: Type 1.

H. Mounting for Field-installed, Externally Mounted SPDs: Unless otherwise indicated, as specified for the following locations:

1. Provide surface-mounted SPD where mounted in non-public areas or adjacent to surface-mounted equipment.

I. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.

1. Switchboards: See Section 262413.
2. Panelboards: See Section 262416.

2.02 SURGE PROTECTIVE DEVICES FOR SERVICE ENTRANCE LOCATIONS

A. Surge Protective Device:

1. Protection Circuits: Field-replaceable modular or non-modular.
2. Surge Current Rating: Not less than 160 kA per mode/320 kA per phase.
3. UL 1449 Nominal Discharge Current (I-n): 20 kA.
4. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
5. Diagnostics:
    a. Protection Status Monitoring: Provide indicator lights to report the protection for each phase.

b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
c. Remote Status Monitoring: Provide Form C dry type contacts (normally open and normally closed) for remote annunciation of status.
d. Surge Counter: Provide surge event counter with manual reset button, surge count retention upon power loss, and six digit LCD display that indicates quantity of surge events.

6. Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch or not direct bus connected.
7. Locate service entrance surge protective device at distribution switchboard DSB.

2.03 SURGE PROTECTIVE DEVICES FOR BRANCH PANELBOARD LOCATIONS

A. Surge Protective Device:

1. Protection Circuits: Field-replaceable modular or non-modular.
2. Surge Current Rating: Not less than 60 kA per mode/120 kA per phase.
3. Repetitive Surge Current Capacity: Not less than 2,000 impulses.
4. UL 1449 Nominal Discharge Current (I-n): 20 kA.
5. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
6. Diagnostics:
   a. Protection Status Monitoring: Provide indicator lights to report the protection status for each phase.
   b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.
   c. Remote Status Monitoring: Provide Form C dry type contacts (normally open and normally closed) for remote annunciation of status.
   d. Surge Counter: Provide surge event counter with manual reset button, surge count retention upon power loss, and six digit LCD display that indicates quantity of surge events.
7. Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch or not direct bus connected.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.

C. Verify that electrical equipment is ready to accept connection of the SPD and that installed overcurrent device is consistent with requirements of drawings and manufacturer's instructions.

D. Verify system grounding and bonding is in accordance with Section 260526, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Unless indicated otherwise, connect service entrance surge protective device on load side of service disconnect main overcurrent device.

E. Provide conductors with minimum ampacity as required by NFPA 70 and as required by NFPA 70.

F. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be reasonably rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.

G. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 260526 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.

H. Disconnect SPD prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPD connected.

3.03 FIELD QUALITY CONTROL

A. Perform inspection, testing, and adjusting in accordance with Division 01 requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS Section 7.19.1.

D. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

3.04 CLEANING

A. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 264300

SECTION 265100
INTERIOR LIGHTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.

B. Exit signs.

C. Ballasts and drivers.

D. LED luminaires and drivers.

1.02 REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices; current edition.

B. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 1989 (Corrigendum 2019).

C. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2019.

D. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

F. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2006.

G. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2023.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

J. UL 1598 - Luminaires; Current Edition, Including All Revisions.

K. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.

2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other

potential conflicts installed under other sections or by others.

3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
4. Notify Architect/Engineer of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.04 SUBMITTALS

A. Refer to Division 01 requirements.

B. Shop Drawings:

1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
2. Provide photometric calculations where luminaires are proposed for substitution.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

1. LED Luminaires:
   a. Include estimated useful life, calculated based on IES LM-80 test data.
   b. Include IES LM-79 test report upon request.

D. Field quality control reports.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

G. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with documented experience.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting) and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.07 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.08 WARRANTY

A. Refer to Division 01 requirements.

B. Provide five year manufacturer warranty for all LED luminaires, including drivers.

C. Provide 10-year pro-rata warranty for batteries for self-powered exit signs.

PART 2 - PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Substitutions: Refer to Division 01 requirements.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Recessed Luminaires:

1. Ceiling Compatibility: Comply with NEMA LE 4.
2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.

H. LED Luminaires:

1. Components: UL 8750 recognized or listed as applicable.

2. Tested in accordance with IES LM-79 and IES LM-80.
3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

I. LED Tape Lighting Systems: Provide all power supplies, drivers, cables, connectors, channels, covers, mounting accessories, and interfaces as necessary to complete installation.
1. LED Tape - General Requirements:
a. Listed.
b. Designed for field cutting in accordance with listing.
c. Wet Location Applications: IEC 60529, IP 68 (waterproof) rated.

J. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

2.03 EXIT SIGNS

A. Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.
1. Number of Faces: Single- or double-face as indicated or as required for installed location.
2. Directional Arrows: As indicated or as required for installed location.

B. Powered Exit Signs: Internally illuminated with LEDs unless otherwise indicated.
1. Self-Powered Exit Signs:
a. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
b. Battery: Sealed, maintenance-free, nickel cadmium unless otherwise indicated.
c. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
d. Provide low-voltage disconnect to prevent battery damage from deep discharge.

2.04 BALLASTS AND DRIVERS

A. Dimmable LED Drivers:
1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.

2. Control Compatibility: Fully compatible with the dimming controls to be installed.
    a. Daylighting Controls: See Section 260923.
    b. Lighting Controls: See Section 290923.

2.05 LED LUMINAIRES AND DRIVERS

A. General:

1. Comply with IES LM-79-08 Approved Method for measuring lumen maintenance of LED light sources.
2. Comply with IES LM-80-08 Approved Method for electrical and photometric measurement of SSL product.
3. Comply with In-Situ testing for more reliable results.
4. LED’s shall be Restriction of Hazardous Substances Directive (RoHS) compliant.
5. LED arrays shall be sealed, high performance, long life type; inimum 70% rated output at 50,000 hours.
6. LED luminaires shall deliver a minimum of 60 lumens per watt.
    a. LED’s shall be “Bin No. 1” quality.
7. Drivers shall be solid state and accept 120 through 277 VAC at 60 Hz input.
8. The LED light source shall be fully dimmable with use of compatible dimmers switch designated for low voltage loads.
9. Luminaires shall have internal thermal protection.
10. Luminaires shall not draw power in the off state. Luminaires with integral occupancy, motion, photo-controls, or individually addressable luminaires with external control and intelligence are exempt from this requirement. The power draw for such luminaires shall not exceed 0.5 watts when in the off state.
11. Luminaires shall not draw power in the off state.
    a. Luminaires with integral occupancy, motion, photo-controls, or individually addressable luminaires with external control and intelligence are exempt from this requirement. The power draw for such luminaires shall not exceed 0.5 watts when in the off state.
12. Color spatial uniformity shall be within 0.004 of CIE 1976 diagram.
13. Color maintenance over rated life shall be within 0.007 of CIE 1976.
14. Luminaire manufacturers shall adhere to device manufacturer guidelines, certification programs, and test procedures for thermal management.

15. LED package(s)/module(s)/array(s) used in qualified luminaires shall deliver a minimum 70% of initial lumens, when installed in-situ, for a minimum of 50,000 hours
16. Luminaires shall be fully accessible from below ceiling plane for changing drivers, power supplies and arrays.
17. LED drivers shall include the following features unless otherwise indicated.
    a. Minimum efficiency: 85% at full load.
    b. Minimum Operating Ambient Temperature: -4 degrees F (-20 degrees C).
    c. Input Voltage: 120 - 277V (±10%) at 60 Hz.
    d. Integral short circuit, open circuit, and overload protection.
    e. Power Factor: > 0.95.
    f. Total Harmonic Distortion: < 20%.
    g. Comply with FCC 47 CFR Part 15.

B. LED Downlights
1. Housing, LED driver, and LED module shall be products of the same manufacturer.

C. LED Troffers
1. LED drivers, modules, and reflector shall be accessible, serviceable, and replaceable from below the ceiling.
2. Housing, LED driver, and LED module shall be products of the same manufacturer.

D. Power Supplies and Drivers
1. Power Factor: 0.90 or higher
2. Maximum driver case temperature not to exceed driver manufacturer recommended in-situ operation.
3. Output operating frequency: 60 Hz.
4. Interference: EMI and RFI compliant with FCC 47 CFR Part 15.
5. Total Harmonic Distortion Rating: 20% Maximum.
6. Meet electrical and thermal conditions as described in LM-80 Section 5.0.7.
7. Primary Current: Confirm primary current with Drawings.
8. Secondary Current: Confirm secondary current specified by individual luminaire manufacturers.
9. Compatibility: Certified by manufacturer for use with individually specified luminaire and individually specified control components.

10. Solid-state control components to be integral or external per each specified luminaire.
11. Remote control gear to be enclosed in Class 1, Class 2, or NEMA 3R enclosures as required.

2.06 ACCESSORIES

A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.
B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.
C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.
D. Aircraft Cable Support: Use cable, anchorages, and intermediate supports recommended by fixture manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.
B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
C. Verify that suitable support frames are installed where required.
D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.
B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of luminaires provided under this section.
B. Perform work in accordance with NECA 1 (general workmanship).
C. Install products in accordance with manufacturer's instructions.
D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting).
E. Provide required support and attachment in accordance with Section 260529.
F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

G. Suspended Ceiling Mounted Luminaires:
   1. Do not use ceiling tiles to bear weight of luminaires.
   2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
   3. Secure surface-mounted and recessed luminaires to building structure.
   4. Secure pendant-mounted luminaires to building structure.
   5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
   6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gauge, connected from opposing corners of each recessed luminaire to building structure.

H. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.
   2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.

I. Suspended Luminaires:
   1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
   2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
   3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet between supports.
   4. Install canopies tight to mounting surface.

J. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

K. Locate ceiling luminaires as indicated on reflected ceiling plan.

L. Install accessories furnished with each luminaire.

M. Bond products and metal accessories to branch circuit equipment grounding conductor.

N. Exit Signs:
   1. Unless otherwise indicated, connect unit to unswitched power from circuit indicated. Bypass local switches, contactors, or other lighting controls.

3.04 FIELD QUALITY CONTROL

A. Inspect each product for damage and defects.

B. Operate each luminaire after installation and connection to verify proper operation.

C. Test self-powered exit signs and emergency lighting inverters and emergency batteries/drivers to verify proper operation upon loss of normal power supply.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect/Engineer.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect/Engineer. Secure locking fittings in place.

B. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect/Engineer or authority having jurisdiction.

3.06 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting) and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of luminaires to Architect/Engineer, and correct deficiencies or make adjustments as directed.

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 265100

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SECTION 265600
EXTERIOR LIGHTING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Exterior luminaires and accessories.

B. Poles and accessories.

1.02 REFERENCE STANDARDS

A. AASHTO LTS - Standard Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals; 2013, with Editorial Revision (2022).

B. IES LM-63 - Approved Method: IES Standard File Format for the Electronic Transfer of Photometric Data and Related Information; 2019.

C. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).

D. IES LM-79 - Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products; 2019.

E. IES LM-80 - Approved Method: Measuring Maintenance of Light Output Characteristics of Solid-State Light Sources; 2021.

F. IES RP-8 - Recommended Practice: Lighting Roadway and Parking Facilities; 2022.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2023.

H. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2000 (Reaffirmed 2006).

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 1598 - Luminaires; Current Edition, Including All Revisions.

K. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
2. Notify Architect/Engineer of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.04 SUBMITTALS

A. Refer to Division 01 requirements.

B. Shop Drawings:
   1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
   2. Provide photometric calculations where luminaires are proposed for substitution.
   3. Provide sealed/signed structural calculations for fixture pole base.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
   1. LED Luminaires:
      a. Include estimated useful life, calculated based on IES LM-80 test data.
      b. Include IES LM-79 test report upon request.
   2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.

D. Field Quality Control Reports.
   1. Include test report indicating measured illumination levels.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

F. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.07 WARRANTY

A. Provide five year manufacturer warranty for all LED luminaires, including drivers.

PART 2 - PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

H. LED Luminaires:

1. Components: UL 8750 recognized or listed as applicable.
2. Tested in accordance with IES LM-79 and IES LM-80.
3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

I. LED Luminaire Components: UL 8750 recognized or listed as applicable.

J. Exposed Hardware: Stainless steel.

2.03 POLES

A. All Poles:

1. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.
2. Structural Design Criteria:
   a. Comply with AASHTO LTS.
   b. Wind Load: Include effective projected area (EPA) of luminaire(s) and associated supports and accessories to be installed.
   c. Dead Load: Include weight of proposed luminaire(s) and associated supports and accessories.

d. Include structural calculations demonstrating compliance with submittals.

3. Material: As indicated in the fixture schedule on the drawings.
4. Shape: As indicated in the fixture schedule on the drawings.
5. Finish: Match luminaire finish, unless otherwise indicated.
6. Mounting: Install on concrete foundation, height as indicated on the drawings, unless otherwise indicated.
7. Unless otherwise indicated, provide with the following features/accessories:
   a. Top cap.
   b. Handhole.
   c. Anchor bolts with leveling nuts or leveling shims.
   d. Anchor base cover.

B. Metal Poles: Provide ground lug, accessible from handhole or transformer base.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.
B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
C. Verify that suitable support frames are installed where required.
D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.
B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).
B. Install products in accordance with manufacturer's instructions.
C. Install luminaires in accordance with NECA/IESNA 501.
D. Provide required support and attachment in accordance with Section 260529.
E. Pole-Mounted Luminaires:
   1. Foundation-Mounted Poles:
      a. Provide cast-in-place concrete foundations for poles as indicated, in accordance with Division 03.

1) Install anchor bolts plumb per template furnished by pole manufacturer.
2) Position conduits to enter pole shaft.

b. Install foundations plumb.
c. Install poles plumb, using leveling nuts or shims as required to adjust to plumb.
d. Tighten anchor bolt nuts to manufacturer's recommended torque.
e. Install non-shrink grout between pole anchor base and concrete foundation, leaving small channel for condensation drainage.
f. Install anchor base covers or anchor bolt covers as indicated.

2. Grounding:
   a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
   b. Provide supplementary ground rod electrode as specified in Section 260526 at each pole bonded to grounding system as indicated.
3. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.
4. Installnon-breakaway in-line fuse holders and fuses complying with Section 262813 in pole handhole for each ungrounded conductor.

F. Install accessories furnished with each luminaire.
G. Bond products and metal accessories to branch circuit equipment grounding conductor.

3.04 FIELD QUALITY CONTROL

A. Inspect each product for damage and defects.
B. Perform field inspection, testing, and adjusting in accordance with Division 01.
C. Operate each luminaire after installation and connection to verify proper operation.
D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect/Engineer.
E. Measure illumination levels at night with calibrated meters to verify compliance with performance requirements. Record test results in written report to be included with submittals.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect/Engineer. Secure locking fittings in place.

3.06 CLEANING

A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of luminaires to Architect/Engineer, and correct deficiencies or make adjustments as directed.

B. Just prior to Substantial Completion, replace all lamps that have failed.

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 265600

SECTION 271000
STRUCTURED CABLING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Communications system design requirements.
B. Communications pathways.
C. Copper cable and terminations.
D. Fiber optic cable and interconnecting devices.
E. Communications equipment room fittings.
F. Communications outlets.
G. Communications identification.
H. Cabling and pathways inside building(s).
I. Distribution frames, cross-connection equipment, enclosures, and outlets.
J. Grounding and bonding the telecommunications distribution system.

1.02 REFERENCE STANDARDS

A. BICSI N1 - Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure, 1st Edition; 2019.
B. ICEA S-83-596 - Indoor Optical Fiber Cable; 2021.
C. CEA-310 - Cabinets, Racks, Panels, and Associated Equipment; Consumer Electronics Association; Revision E, 2005.
D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
E. TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set; 2023.
F. TIA-568.3 - Optical Fiber Cabling and Components Standard; 2022e.
G. TIA-569 - Telecommunications Pathways and Spaces; 2019e, with Addendum (2022).
H. TIA-598 - Optical Fiber Cable Color Coding; 2014d, with Addendum (2018).
I. TIA-568-C.1 - Commercial Building Telecommunications Cabling Standard; Telecommunications Industry Association; Rev C, 2009 (with Addenda; 2012).
J. TIA-568-C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards; 2009, with Addendum (2016).
K. TIA-569-D - Telecommunications Pathways and Spaces; 2015d, with Addendum (2016).
L. TIA-598-D - Optical Fiber Cable Color Coding; 2014d.

M. TIA-606 - Administration Standard for Telecommunications Infrastructure; 2021d.

N. TIA-607 - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises; 2019d, with Addendum (2021).

O. TIA-606-B - Administration Standard for Telecommunications Infrastructure; Rev B, 2012 (with Addenda; 2015).

P. TIA-607-C - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises; 2015c, with Addendum (2017).

Q. ANSI/J-STD-607 - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications; Rev A, 2002.

R. UL 444 - Communications Cables; Current Edition, Including All Revisions.

S. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

T. UL 1651 - Fiber Optic Cable; Current Edition, Including All Revisions.

U. UL 1863 - Communications-Circuit Accessories; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate requirements for service entrance and entrance facilities with Communications Service Provider.
2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for communications equipment.
3. Coordinate arrangement of communications equipment with the dimensions and clearance requirements of the actual equipment to be installed.
4. Notify Architect/Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. See Division 01 for additional submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

1. Storage and handling requirements and recommendations.
2. Installation methods.

C. Shop Drawings: Show compliance with requirements on isometric schematic diagram of network layout, showing cable routings, telecommunication closets, rack and enclosure layouts and locations, service entrance, and grounding, prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).

D. Manufacturer Qualifications.

E. Evidence of qualifications for installer.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

G. Test Plan: Complete and detailed plan, with list of test equipment, procedures for inspection and testing, and intended test date; submit at least 60 days prior to intended test date.

H. Field Test Reports.

I. Project Record Documents: Prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).

1. Record actual locations of outlet boxes and distribution frames.
2. Show as-installed color coding, pair assignment, polarization, and cross-connect layout.
3. Identify distribution frames and equipment rooms by room number on drawings.

J. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of project record documents.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: At least 3 years experience manufacturing products of the type specified.

B. Installer Qualifications: A company having at least 3 years experience in the installation and testing of the type of system specified, and:

1. Employing a BICSI Registered Communications Distribution Designer (RCDD).
2. Supervisors and installers factory certified by manufacturers of products to be installed.
3. Employing experienced technicians for all work; show at least 3 years experience in the installation of the type of system specified, with evidence from at least 2 projects that have been in use for at least 18 months; submit project name, address, and written certification by user.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Keep stored products clean and dry.

1.07 WARRANTY

A. Correct defective Work within a 2 year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cabling and Equipment:
   1. General Cable Technologies Corporation: www.generalcable.com/#sle.
   2. Panduit.

2.02 SYSTEM DESIGN

A. Provide a complete permanent system of cabling and pathways for voice and data communications, including cables, conduits and wireways, pull wires, support structures, enclosures and cabinets, and outlets.
   1. Comply with TIA-568 (SET) (cabling) and TIA-569 (pathways) (commercial standards).
   2. Provide fixed cables and pathways that comply with NFPA 70 and TIA-607 and are UL listed or third party independent testing laboratory certified.
   3. Provide connection devices that are rated for operation under conditions of 32 to 140 degrees F at relative humidity of 0 to 95 percent, noncondensing.

2.03 PATHWAYS

A. Conduit: See section 260533.13
B. Cable Trays: See Section 260536.
C. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

2.04 COPPER CABLE AND TERMINATIONS

A. Provide cables with lead content less than 300 parts per million.
B. Copper Horizontal Cable: TIA/EIA-568 Cat 6a solid conductor unshielded twisted pair (UTP), 24 AWG, 100 ohm; 4 individually twisted pairs; covered with blue jacket and complying with all relevant parts of and addenda to latest edition of TIA/EIA-568 and UL 444.
   1. GenSPEED 10 CAT6a plenum or superior.
   2. The maximum cable length for any individual run must not exceed 90 meters.
C. Copper Cable Terminations: Terminate CAT 6a Ethernet AT BOTH ENDS using Panduit MiniCom cabling system components.
D. Jacks and Connectors: Modular RJ-45, non-keyed, terminated with 110-style insulation displacement connectors (IDC); high impact thermoplastic housing; suitable for and complying with same standard as specified horizontal cable; UL 1863 listed.
   1. Performance: 500 mating cycles.

2. Voice and Data Jacks: 8-position modular jack, color-coded for both T568A and T568B wiring configurations.

2.05 FIBER OPTIC CABLE

A. Provide cables with lead content less than 300 parts per million.

B. Fiber Optic Backbone Cable:

1. Description: Tight buffered, non-conductive fiber optic cable complying with TIA-568.3, TIA-598, ICEA S-83-596 and listed as complying with UL 444 and UL 1651.

2. Cable Type: Single mode, six-strand.

a. All newly installed fiber optic cable shall be of ITU-T G.653.D or superior specification. This cable is generally referred to as low or no water-peak, wideband or enhanced single-mode fiber optic cable.

b. The cable shall be plenum rated and be of the tight buffer type.

3. Cable Applications:

a. Connect IDF to MDF via one six-strand single mode cable.

b. All fiber shall be left without termination with at least thirty (30) feet of cable slack at the defined installation endpoints.

4. Cable Jacket Color:

a. Single-Mode Fiber (OS1/OS2): Yellow.

2.06 IDF/MDF ROOMS

A. Division of Responsibility:

1. Owner will:

a. Identify the wiring closet(s) to which all room, access point, and any other type of drops originate.

b. Provide all switches and related powered infrastructure hardware in the wiring closets.

c. Provide the building schema as necessary.

2. Contractor will:

a. Install necessary backing board affixed to wall.

b. Provide and install racking hardware. Racks shall be of open frame 24-inch depth and of adequate height to accommodate all anticipated cabling plus 1-RU of additional space for switching equipment for every 48 ports of Panduit Minicom RU plates. An additional equivalent space as the total calculated above shall be provided in the rack for expansion purposes.

c. Provide and install Panduit Minicom patch panels.

d. Cleanly route the ethernet cabling into the racks and patch panels.
e. Terminate all new Ethernet wiring drops in the wiring closet.
f. Snap the Panduit minicom modules into an existing patch panel when provided by the owner.
g. Leave a minimum of 3’ to 6’ cable slack at the patch bay to allow for repositioning.
    1) Label the terminated Ethernet drop using the building schema.
    2) Label will be near the terminated end of the wire in the closet.
    3) Label will match the opposing end label.

2.07 COMMUNICATIONS OUTLETS

A. Outlet Boxes: Comply with Section 260533.16.
    1. Provide depth as required to accommodate cable manufacturer's recommended minimum conductor bend radius.
    2. Minimum Size, Unless Otherwise Indicated:
        a. Data or Combination Voice/Data Outlets: 4 inch square by 2-1/8 inch deep (100 by 54 mm) trade size.

B. Wall Plates:
    1. Comply with system design standards and UL 514C.
    2. Accepts modular jacks/inserts.
    3. Capacity: Two drops unless oterwise indicated on the Drawings.
    4. Wall Plate Material/Finish - Flush-Mounted Outlets: High impact thermoplastic, color to be selected.
    5. Product(s):
        a. Double gang faceplate: Panduit #CBIW-2G.
        b. Minicom module insert: Panduit #CHF2IW-X.
        c. Blank large inserts: Panduit # CHB2IW-X.
        d. VGA insert, pluggable: Panduit #CHD15HDCIWY.
        e. VGA termination type (to run cable withou ends): Panduit #CHD15HDSCIWY.
        f. Minicom dual size VGA termination type: Panduit #CMD15HDIWY.
        g. HDMI minicom: Panduit #CMHDIIW.
        h. Stereo jack coupler minicom: Panduit #CM35MSCIWY.
        i. Stereo jack wired minicim: Panduit #CM35MSSIWY.
        j. USB minicom: Panduit #CMUSBAAIW.
        k. Minicom blanks: Panduit #CMBIW-X.

I. Cat6 minicom: Panduit #CJ688TGIW.

2.08 IDENTIFICATION PRODUCTS

A. Comply with TIA-606.

B. Comply with TIA-606-B.

C. Comply with Section 260553.

2.09 ENCLOSURES

A. Backboards: Interior grade plywood without voids, 3/4 inch thick; UL-labeled fire-retardant.

1. Do not paint over UL label.

B. Equipment Racks and Cabinets: CEA-310 standard 19 inch wide component racks.

1. Floor Mounted Racks: 16 gage steel construction with corrosion resistant finish; vertical and horizontal cable management channels, top and bottom cable troughs, and grounding lug.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Comply with latest editions and addenda of TIA-568 (SET) (cabling), TIA-569 (pathways), TIA-607 (grounding and bonding), BICSI N1, NFPA 70, and SYSTEM DESIGN as specified in PART 2.

B. Comply with Communication Service Provider requirements.

C. Grounding and Bonding: Perform in accordance with TIA-607 and NFPA 70.

1. Ground all racks.

D. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Division 07.

E. The contractor will identify and protect cable runs that are traversing the work zone to other areas of the building.

F. The Contractor shall be responsible for replacing any wiring that is inadvertently cut or damaged during construction.

3.02 INSTALLATION OF PATHWAYS

A. Install pathways with the following minimum clearances:

1. 48 inches from motors, generators, frequency converters, transformers, x-ray equipment, and uninterruptible power systems.

2. 12 inches from power conduits and cables and panelboards.

3. 6 inches from flues, hot water pipes, and steam pipes.

B. Conduit:

1. Do not install more than 2 (two) 90 degree bends in a single horizontal cable run.
2. Leave pull cords in place where cables are not initially installed.
3. Conceal conduit within finished walls and ceilings, except where specifically indicated to be exposed.
    a. Conduit may remain exposed to view in mechanical rooms, electrical rooms, and telecommunications rooms.
    b. Where exposed to view, install parallel with or at right angles to ceilings, walls, and structural members.

C. Outlet Boxes:
1. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of telecommunications outlets provided under this section.
    a. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
    b. Provide minimum of 24 inches horizontal separation between flush mounted outlet boxes installed on opposite sides of fire rated walls.
    c. Locate outlet boxes so that wall plate does not span different building finishes.
    d. Locate outlet boxes so that wall plate does not cross masonry joints.

D. Grounding and Bonding: Perform in accordance with ANSI/J-STD-607 and NFPA 70.

E. Firestopping: Seal openings around pathway penetrations through fire-rated walls, partitions, floors, and ceilings in accordance with Division 07.

3.03 INSTALLATION OF EQUIPMENT AND CABLING

A. Cabling:
1. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair use bend radius of not less than 4 times cable diameter.
2. Do not over-cinch or crush cables.
3. Do not exceed manufacturer's recommended cable pull tension.
4. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.

B. Service Loops (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly:
1. At Distribution Frames - Optical Fiber: 360 inches.

2. At Outlets - Copper: 12 inches.

C. Copper Cabling:
   1. For 4-pair cables in conduit, do not exceed 25 pounds pull tension.

D. Fiber Optic Cabling:
   1. Prepare for pulling by cutting outer jacket for 10 inches from end, leaving strength members exposed. Twist strength members together and attach to pulling eye.
   2. Support vertical cable at intervals as recommended by manufacturer.

E. Floor-Mounted Racks and Enclosures: Permanently anchor to floor in accordance with manufacturer's recommendations.

F. Ethernet Drops:
   1. The contractor should use Panduit Minicom faceplates and snap-in modules.
   2. Each classroom drop should have a minimum of 6” of slack to support moving the jack around in the box or replacing damaged ends.

G. Wireless Access Points:
   1. At a minimum, all room overhead Wireless Access Point (WAP) locations should have two drops, each having approximately 25’ or enough slack to reach the furthest wall at typical electrical outlet height from the installed access point location.
   2. MiniCom jack terminations are required on both ends. RJ-45 connectors must not be crimped directed to cable ends.
   3. In the event the total cable run risks exceeding the 90-meter maximum distance threshold, the additional WAP slack may be shortened to meet requirement for that run.
   4. Acoustical Ceilings: Contractor shall label WAP runs at both ends and tie off above the dropped ceiling grid.
   5. Open ceilings: Contractor shall install a duplex or quad box with a faceplate to accept the drops.
   6. Contractor will assist Owner staff with mounting of access points.

H. Identification:
   1. Use wire and cable markers to identify cables at each end.
   2. Use manufacturer-furnished label inserts, identification labels, or engraved wallplate to identify each jack at communications outlets with unique identifier.
   3. Use identification nameplate to identify cross-connection equipment, equipment racks, and cabinets.

4. Each new data drop will be labeled on the faceplate in accordance with the building schema and match the corresponding label in the wiring closet.

I. Field-Installed Labels: Comply with TIA/EIA-606 using encoded identifiers.

1. Cables: Install color coded labels on both ends.
2. Outlets: Label each jack on its face plate as to its type and function, with a unique numerical identifier.

3.04 FIELD QUALITY CONTROL

A. See Division 01 for additional requirements.

B. Comply with inspection and testing requirements of specified installation standards.

C. Visual Inspection:

1. Inspect cable jackets for certification markings.
2. Inspect cable terminations for color coded labels of proper type.
3. Inspect outlet plates and patch panels for complete labels.

D. Testing - Copper Cabling and Associated Equipment:

1. Category 5e and Above Links: Perform tests for wire map, length, attenuation, NEXT, and propagation delay.
2. The Contractor will be responsible for testing and certifying every cable drop they install prior to acceptance by Owner.

E. Final Testing: After all work is complete, including installation of telecommunications outlets, and telephone dial tone service is active, test each voice jack for dial tone.

END OF SECTION 271000

SECTION 273000
TWO-WAY COMMUNICATION SYSTEM

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. An IP-based two-way communication system at applicable elevator lobbies.

B. REFERENCE STANDARDS

1. NECA 1 - Standard for Good Workmanship in Electrical Construction .
2. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
3. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements

C. ADMINISTRATIVE REQUIREMENTS

1. Coordination:
   a. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
   b. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   c. Coordinate the work with placement of supports, anchors, etc. required for mounting.
   d. Notify Architect/Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.02 PERFORMANCE REQUIREMENTS

A. The IP Command Center is to be located as idicated on the drawings. IP Call Boxes are to be located at elevator landings on each floor, where indicated on the drawings.

B. The IP Command Center must be capable of connecting to an existing Network and providing inputs for the IP Call Boxes. Visual indicators on the IP Command Center allow rescue personnel to know which IP Call Box needs assistance. The IP Command Center must allow rescue personnel to speak to each IP Call Box individually. The IP Command Center must include both a handset and speakerphone to communicate back to the IP Call Boxes.

C. The emergency communication hardware shall comply with the Americans with Disabilities Act (ADA). The IP Call Box shall have the ability to be programmed with up to 2 emergency phone numbers (either both off-site or Base Station and off-site). Upon activation of the emergency push button, a call will be automatically placed to the IP Command Center. If no one answers at the IP Command Center, the IP Call

Box must dial a secondary location outside the building to activate two-way off-site person to person voice communications.

1.03 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features

B. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing all factory and field connections

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.

D. Field quality control test reports.

E. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store transfer switches in accordance with manufacturer's instructions.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's instructions to avoid damage to transfer switch components, enclosure, and finish.

1.05 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.06 WARRANTY

1. The IP Command Center and IP Call Boxes shall be warranted for a period of two years.

PART 2 - PRODUCTS

2.01 TWO-WAY COMMUNICATIONS SYSTEM

A. Provide complete system consisting of all required equipment, conduit, boxes, wiring, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated

2.02 SYSTEM COMPONENTS

A. The IP Command Center (2500 series) shall include both the Base Station and Distribution Module. The Base Station must have a powder coated steel housing (surface or flush mount) or be desk mounted, include a black handset with coil cord, and be powered from the Distribution Module.

B. Distribution Module must be a surface mount enclosure, include connections for the IP Call Boxes, and power the Base Station. The Distribution Module shall be powered from 120vac power with a battery backup that provides power for a minimum of 4 hours (RATH® part # RP7700104).

C. The IP Call Boxes must be in full compliance with the ADA. IP Call Boxes require a hands-free speakerphone with an LED to indicate status of call.

D. The IP Call Boxes shall be an ADA compliant and vandal resistant speakerphone.

E. The IP Call Boxes must allow the programming in of a specific location message of the unit. This allows rescue personnel to know the location of the activated IP Call Box.

F. Standard IP Call Box features:

1. Two number programming (either both off-site or Base Station and off-site).
2. Operating temperature of between -40˚F to +150˚F (-40˚ to + 65˚ C).
3. On-site programmable.
4. Powered from PoE at 802.3af or separate battery backed up 12v source.
5. EEPROM memory to protect programming.

G. The IP Call Boxes are to be located no higher than 48” front reach or 54” side reach to the center of the push button above ground level to ensure conformance with the ADA requirements.

H. The IP Call Boxes must have a Braille face plate to ensure conformance with the ADA requirements.

I. The IP Command Center must provide an audible and visual indicator that an IP Call Box has been activated.

J. The 120vac Power Supply must be capable of supplying power to a minimum of one Base Station and one Distribution Module.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that rough-ins for field connections are in the proper locations.

C. Verify that mounting surfaces are ready to receive transfer switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Arrange equipment to provide minimum clearances and required maintenance access.

D. System shall be in compliance with all state and local electrical codes.

E. The IP Command Center is to be mounted on a flat surface.

F. The IP Call Boxes are to be flush mounted.

3.03 ELECTRICAL

A. The IP Command Center is to be powered by the Distribution Module. The IP Call Boxes are to be powered by PoE at 802.3af or a separate battery backed up 12v source.

B. The Distribution Module shall be powered by the Power Supply (RATH® part # RP7700104). It shall require 120vac power and provide battery backup capable of providing a minimum of 4 hours of electrical backup in case of building power failure.

C. The Base Station shall connect to the Distribution Module with a single wire pair.

D. Each IP Call Box shall connect to a local Network Switch directed to the Command Center Distribution Module. Wiring from the IP Call Box to the Network Switch shall be a minimum of Cat 5e or 6. If CI cable is required, utilize RATH® cable part # RP6600300M4.

E. Monitor of system integrity is as per NFPA 72.

3.04 COMMUNICATIONS

A. The IP Call Boxes shall be hands-free and be a push-button-once to talk system. Once the button has been pushed, the IP Call Box will call the Base Station. If no answer at the Base Station, it will automatically call a preprogrammed emergency number. The IP Call Box must be capable of being programmed with up to 2 emergency phone numbers (either both off-site or Base Station and off-site).

B. The IP Call Box shall have location message capability. The IP Call Box must have a minimum 18 second recordable message capability, programmable to play 1 or 2 times. IP Call Box shall notify called party of the location of the call upon being received at the emergency dispatch center.

C. The IP Call Box shall be capable of allowing the called party to replay the location message if necessary to ensure an understanding of the caller location.

D. If system is not attended to 24 hours a day, the IP Call Box must dial a secondary location outside the building to activate two-way off-site person to person voice communications.

E. Once call has been made (button pushed), the call can only be terminated by the called party.

F. The IP Call Box must have a red LED that will light up upon push of the button. The light shall be a solid color when the IP Call Box is activated and will flash when call has been answered.

G. The IP Call Box must be capable of being programmed and reprogrammed on-site.

3.05 SIGNAGE

A. System shall consist of a minimum of one 120/277vac edge light sign, and a “location” and “instruction” sign to clearly indicate location of designated area. A tactile sign with raised letter and Braille shall be located at entrance to area.

B. Graphics

1. IP Command Center must include wording identifying the location of each IP Call Box and light an LED when a particular IP Call Box has been activated.
2. The IP Call Box wording must include “Emergency Phone”, International Phone symbol, and raised Braille lettering.

3.06 CABLING

A. Builsing is fully sprinklered. Cabling for two-way communication system shall meet the applicable requirements for pathway survivability. Cabling installation shall consist of one or more of the following:

1. 2 hour fire-rated circuit integrity (CI) cable or fire resistive cable.
2. 2 hour fire-rated cable system (electrical circuit protective system(s)).
3. 2 hour fire-rated enclosure or protected area.

3.07 FIELD QUALITY CONTROL

A. Refer to Division 01 for additional requirements.

B. Prepare and start system in accordance with manufacturer's instructions.

C. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

D. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.08 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.09 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of transfer switches to Owner, and correct deficiencies or make adjustments as directed.

3.10 PROTECTION

A. Protect installed transfer switches from subsequent construction operations.

END OF SECTION 273000

SECTION 275116
PUBLIC ADDRESS

EMERGENCY MESSAGING,

NETWORK END-POINT SPECIFICATION

PART 1 - GENERAL

1.01 GENERAL

A. All materials, unless otherwise specified, shall be new, free from any defects, and of the best quality of their respective kinds. All like materials used shall be of the same manufacture, model, and quality, unless otherwise specified.

B. Contractor shall do all necessary cutting and drilling of present walls, floors, ceilings, etc., for the installation of new work; but no structural work shall be cut, unless specifically shown on drawings and/or approved by the Owner. All exposed building surfaces damaged by installation or removal of electrical work shall be patched and finished in the same materials and manner as adjacent areas by this Contractor.

1.02 RACEWAYS AND CABLES

A. Electrical work will conform to the National Electric Code and applicable local ordinances.

B. All 125-volt electrical conductors shall be installed in galvanized electrical metallic tubing with compression type fittings and couplings, minimum 3/4" size conduit.

C. All low-voltage wires and cables concealed in walls shall be run in EMT conduits from flush outlet boxes to above accessible ceilings. Provide conduits where cables penetrate firewalls above ceilings.

D. All EMT entering boxes shall be served with insulating throat connectors and locknuts.

E. No raceway shall be located in proximity of hot water lines or excessive heat.

F. Use Cast "C" clamps, "U" straps, or ring hangers attached to rods, and/or brackets fastened to structure.

G. No perforated straps or tie wires permitted for supporting raceways.

H. Use wire ties for supporting low voltage cables run concealed above ceilings. Do not run cables loose on ceiling tiles. Support from structure above. Group cables in bundles.

I. Tie mounts, plates, and anchors shall be used.

J. Ground all electrical apparatus in accordance with the National Electric Code.

1.03 QUALITY ASSURANCE

A. Manufactures: Firms regularly engaged in manufacture of integrated communication systems, time keeping systems, and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for no less than five years.

B. Installer's Qualifications: Firms with at least five years of successful installation experience with projects utilizing integrated communications systems and equipment similar to that required for this project.

C. All items of equipment including wire and cable shall be designed by the manufacturer to function as a complete system and shall be accompanied by the manufacturer's complete service notes and drawings detailing all interconnections.

D. The Contractor shall be an established communications and electronics Contractor that has had and currently maintains a locally run and operated business for at least five years. The Contractor shall be a duly authorized distributor of the equipment supplied with full manufacturer's warranty privileges.

E. The Contractor shall show satisfactory evidence, upon request, that they maintain a fully equipped service organization capable of furnishing adequate inspection and service to the system. The Contractor shall maintain at their facility the necessary spare parts in the proper proportion as recommended by the manufacturer to maintain and service the equipment being supplied.

F. Except where specifically noted otherwise, all equipment supplied shall be the standard product of a single manufacturer of known reputation and experience in the industry. The Contractor shall have attended the manufacturer’s installation and service school and upon request must show proof of attending such a school.

1.04 SCOPE OF WORK

A. Furnish and install all materials, labor, equipment, permits, etc., to provide communications system as described herein and illustrated on the drawings for a complete operating system.

B. All manufactured articles, material, and equipment shall be applied, installed connected, erected, used, cleaned, adjusted, and conditioned as recommended by the manufacturers, or as indicated in their published literature, unless specifically herein specified to the contrary.

C. All work shall be performed by competent professionals and executed in a neat and professional manner providing a thorough and complete installation. Work shall be properly protected during construction, including the shielding of soft or fragile

materials. At completion, the installation shall be thoroughly cleaned and all tools, equipment, obstructions, or debris present as a result of this portion of work shall be removed from the premises.

D. Program the operational characteristics matching the operation described herein, adjusting for call routing, transfers, priorities, and volume levels.

E. The Contractor shall provide a minimum of eight hours of in-service training with this system. These sessions shall be broken into segments, which will facilitate the training of individuals in the operation of this system. Operator Manuals and User Guides shall be provided at the time of this training.

1.05 SUMMARY

A. Work Included. The scope of work of this section consists of the design, installation, and programming of all materials to be furnished under this SECTION, and without limiting the generality thereof, consists of providing all labor, materials, equipment, plant, transportation, appurtenances, and services necessary and/or incidental to properly complete all work as shown on the drawings, as described in the specifications, or as reasonable inferred from either or, in the opinion of the Architect and Owner, as being required and in general, is as follows:

1. Supervised Network Intercom and Paging System, including but not limited to:
    a. Supervised network amplifiers, back boxes, and all equipment, cabling and support required to interface the public address system to the Owner’s telephone system via SIP Trunk Interface.
    b. Cabling to support the Public Address System (NOTE: category 5/6 cable must conform to Owner guidelines. Coordinate with Owner prior to submission for approval).
    c. Master and secondary clock system, clocks and cabling. Elapsed time indicator control panels where shown on the drawings.
    d. Supervised network PA override signal to local sound systems. Coordinate with 27 40 00 contractor.
    e. Supervised network emergency messaging display/clock capable of receiving and scrolling up to 64 character long custom messages without affecting or replacing display of time segments, and coded messages simultaneous with plain text message (displacement to time segments permissible for coded messages).
    f. Desktop Software

g. Interactive Graphical User Interface (IGUI) supporting a pictorial view of architectural room locations on a map, and controlling intercom functions including zone or all page, dynamic zone assignments, answering intercom call-ins, selecting and distributing program sources to any and all zones. IGUI will also annunciate, locate and indicate loss of communication to all supervised network devices including speakers, amplifiers, emergency messaging display/clocks, and notification switches.

h. Emergency communication shall be initiated by the local console or from a centrally located district office via a District Wide Emergency Communication platform (included in this contract). Emergency communication shall include but not be limited to, pre-recorded audio, live audio, emergency textual message display activation, computer pop-up notification, SMS Text message, and email.

i. Management of Mass Notification Operations such as Lockdown, Evacuation and other Emergency conditions in the facility through the use of Management software and associated GUI.

1.06 SUBMITTALS

A. Submit the shop drawings, product data, and quality control submittals specified below at the same time as a package.

B. Shop Drawings: Composite wiring and/or schematic diagrams of the complete system as proposed to be installed. Drawing shall include relative position of all major components, typical connections, field components, accessories, and cable types.

C. Product Data: Include catalogue data sheets, manufacturer’s default specifications, user operation guides, and bill of materials.

D. Quality control shall include the following:

1. Name, address, and telephone number of the nearest fully equipped service organization.
2. Submit a certificate of completion of installation and service training from the system manufacturer.
3. Submit a list of comparable completed projects. Furnish the name, address, telephone number, and contact name of end user.

E. Field test reports.

F. Record Drawings showing installed locations of all components.

PART 2 - PRODUCTS

2.01 GENERAL DESCRIPTION OF NETWORK INTERNAL COMMUNICATION SYSTEM

A. Supply and install a complete supervised network based intercom system. Field wiring shall be CAT 5E or CAT 6 cable, control wiring for power distributions and very long runs, and utilize an optional fiber backbone (when distances exceed normal Ethernet limitations). All station equipment shall utilize standard RJ-45 modular connections. All remote devices utilizing standard structured cabling shall be capable of PoE (Power over Ethernet) or power supplied within the CAT 5E or CAT 6 cable jacket. Wiring shall be capable of either being installed in conduit or cable trays, where shown on the plans.

B. The system shall be capable of interconnecting with the building LAN (Local Area Network). This connection shall be minimal and utilize only one Ethernet 100 Mbps (or optionally 1 Gb) connection per station to accomplish all intercom operations. Ethernet ports and associated network switches that are required to connect any intercom devices will be provided by the OWNER.

C. Provide a separate circuit for each room and administrative office so each room, speaker, amplifier, and emergency messaging display/clock can be individually addressed.

D. Overall intercom communications network shall utilize Ethernet or VoIP communications between all major components: administrative consoles, intercom stations, amplifiers and individual paging speakers, and network switches. Systems not utilizing Ethernet or VoIP communications protocol to each end-point device will not be acceptable. Systems not capable of supervising all networked devices including network amplifiers, network speakers, notification switches, and emergency messaging display/clocks will not be acceptable.

E. The network shall support a VLAN configuration to separate activity in the intercom system from other in building LAN traffic. In locations where the supervised network communications system will be considered as part of the facilities life safety systems, a dedicated and isolated network shall be required.

F. The system shall interface to the facilities iPBX via SIP trunk connectivity.

G. The Communications System shall include master clock support and synchronization of digital secondary clocks, event scheduling, and messaging software allowing the facility to configure multiple schedules per school, multi zone time tone signaling for class changes, and message notification.

H. The Communication System shall include alarm features including a comprehensive command center and alarm-focused emergency management capabilities. In the event of an alarm condition, all nonessential system operations shall be automatically suspended. Control of the system shall be transferred to a command center console operated by the incident commander. All Call-ins placed from room stations shall be re-routed automatically to the command center console.

I. The Communications System shall include Software for the management of communications during an alarm condition in the facility using a GUI located at the command center. This includes activating, clearing and providing status of all alarms in the facility, including comprehensive management of lockdown and acknowledge status of each classroom designated as a Shelter-in-Place location.

2.02 DESCRIPTION OF NETWORK INTERCOM / PA / MESSAGING FEATURES

A. The system specified is based on the Telecor eSeries Supervised Network based Communications System providing at least the features and functions outlined below. It shall be installed and programmed by a local authorized and certified Telecor dealer.

B. The system shall utilize a decentralized network structure not requiring any head-end equipment, central server, or any other control hardware to maintain system operation. Systems utilizing centralized electronics and subject to a single-point-of-failure (power supply, CPU, server, power, etc.) shall not be accepted unless the system has 100% duplication of all centralized operating equipment running concurrently and can automatically take over, including up to the minute programming configuration in the event of a failure of the main system head-end electronics or any required, centralized electronics required to make the system fully operational. Systems that are not based on decentralized structure or systems that do not provide 100% duplication of head-end or systems that operate in a “down-graded” operational mode as the result of a centralized failure are not acceptable.

C. All station devices shall receive power and data through a Power-Over-Ethernet switch. Once plugged into the LAN through a Power-over-Ethernet network switch, all networked devices shall be immediately operational and as applicable shall place or receive calls and pages from Stations as well as page all devices in the network. Consoles, intercom stations, clocks, emergency displays, or speakers connected to the network shall not require any network configuration or administration to function.

D. Each Intercom Station, Loudspeaker, clock/message display, shall be assignable to all or any combination of Unlimited Paging, Program Distribution or Time Zones in the

system.

E. Each Classroom shall be provided with a Call Station to initiate calls to a designated location.

F. Speech shall be transmitted in the frequency range from 50 Hz to 7 kHz and shall use a maximum of 128 kbps of bandwidth during a call. In order to assure maximum intelligibility, all system audio shall be HD Audio as defined in IntelTM High Definition Audio Specifications, June 17, 2010.

G. Intercom communications between consoles and system devices shall be non-blocking with no channel restrictions or limitations (other than network capacity) to the number of simultaneous conversations at any time between pairs of intercom stations, intercom station to console, console to console, console to speaker or zone of speakers, program source to a speaker or zone of speakers, or bell tones to a speaker or zone of speakers regardless of number of stations or consoles.

H. Any and all devices shall have the ability to have their programming downloaded, individually or simultaneously via the network. Programming shall be downloadable in a series of human readable, industry standard comma-separated values (CSV) files that can be saved and edited using common spreadsheet applications. Consoles, intercom stations, clocks, displays, and speakers residing on a network shall have the ability to update their programming, simultaneously from a CSV file. Furthermore, all devices shall also have the capability to be configured directly, such that device numbers, names, zones, and call-in destinations can be altered in real time without the uploading or downloading of their programming. System shall be capable of uploading firmware updates to all device classes simultaneously, via the network, without the requirement of tools, by authorized technician or qualified facility technician or representatives.

I. Audio communications between all devices shall be accomplished with latency values of a maximum of 0.1 seconds and connection times of 0.01s for 1 to 500 speakers.

J. The system shall support a minimum of 50 channels of simultaneous duplex communication paths on the intercom system LAN, plus a minimum of 10 simultaneous duplex channels for PBX integration.

K. The system shall be capable of routing calls from the Public Switched Telephone Network (PSTN) into any classroom, zone or the entire school via the District’s SIP enabled Telephone System. This shall allow for remote monitoring and two-way voice communications from outside the facility to classrooms as well as paging into areas of the school. Additional features shall include:

1. The ability to place call-ins from classroom call stations to SIP Telephones.
2. The ability to initiate calls from SIP Telephones to eSeries Classroom Speakers.
3. The ability to initiate zone and all call paging announcements from SIP Telephones to eSeries Speakers throughout the facility.
4. The ability to make outside calls from Administrative Consoles to the PSTN via the Districts Phone System.

L. The System shall allow users to configure multiple schedules per school, with an unlimited number of programmable events in each schedule. Each Event shall sound a user selectable tone, play a user provided audio file or an external audio source. In addition, a textual message shall be programmed to display on associated message displays throughout the school. All scheduling assignments shall be performed via a simple to use, Graphical User Interface (GUI) from a non-dedicated PC, residing in the School. Programming shall also be accomplished from a non-dedicated PC at the District Office. The following features and functions shall be provided. Systems that cannot provide these, shall not be acceptable.

1. The system schedules shall facilitate the requirements of combined facilities (e.g. elementary and middle schools in a common building) where multiple schedules running concurrently would be required.
2. Each event shall play any of the available tones, audio files or audio sources provided. Events shall be directed to any one or more Time Zones in the systems.
3. Events shall include textual messages to clock/message displays. These shall be formatted as fixed, flashing or scrolling displays that can include up to 200 characters in length.
4. Time Tones may be manually activated from Administrative Consoles or selected SIP phones residing on the schools IP PBX.
5. An integral Master Clock shall provide time synchronization to all secondary digital clock / Message Displays throughout the school. The communications shall be capable of obtaining it’s time synch signal from any NTP timeserver.

M. The System shall be capable of automatically distribute SMS and email notifications to relevant staff members when an emergency event is occurring the facility. Notifications shall be distributed to user alert devices such as mobile phones and smart devices. Mobile phones shall receive the notifications as SMS messages while smart devices shall receive email messages. Emergency events include:

1. The activation of emergency-themed element icons on a PC GUI (e.g., Lockdown, Evacuate, etc.)
2. Emergency Calls placed from Call Stations located room locations.

N. The system shall automatically distribute SMS and email notifications to appropriate technical support staff in the event that the system is experiencing a fault.

2.03 SUPERVISED NETWORK ADMINISTRATIVE CONTROL CONSOLE

A. The Supervised Network Administrative Control Console (subsequently referred to as Console) shall be a Telecor model e300 or approved equal. The Console shall be supervised and allow the operator to establish two-way communications with an intercom station, talkback speaker, or another Console using the handset or speakerphone. VOX functioning shall be automatically enabled when the handset is used. The Push-to-Talk button shall toggle the Console between talk and listen mode when the speakerphone is used. The Console shall provide a 2-line by 20-character LCD display. The display shall be adjusted to a range of angles for optimum viewing. When there are no active calls, the display shall show the Console name and dial number. If a time server is connected to the network, the display shall also show the time and date.

B. Incoming calls to a Console shall show the originating station dial number and name on the Console display. Calls shall be displayed in the order they are received. The operator shall scroll through the list of calls and answer them out of sequence. Emergency call-ins shall be distinctly annunciated both visually and audibly.

C. The Console shall allow call-ins to be forwarded to another Console, or for calls to be put on hold or transferred to another Console location. Additionally, call-ins or calls shall be forward/transfer-able to PBX telephone extensions via a SIP trunk interface.

D. The Console shall select remote audio sources connected at any location on the local area network, and distribute the audio broadcast from the source to all speakers in a facility or to selected areas such as a speaker zone or a selection of speakers. The Console shall be capable of audio source verification by attendant prior to page zone activation. In this manner, attendants shall listen to the audio source locally, including listening to pre-recorded announcements, prior to system broadcast.

E. The Console shall be able select a tone or a pre-recorded announcement and broadcast the tone or announcement to all facility speakers or to select areas, such as a speaker zone or a selection of speakers.

F. The Console shall be equipped with digital volume control that shall allow for the separate adjustment of the speaker listen and handset listen volumes. The levels for

intercom listen, tones, and program distributions shall be independently adjusted and stored in memory.

G. The system shall allow user programming of alphanumeric architectural room names and numbers. The Console shall be capable of using 1 to 7 digit sequences for dial out and call-in identification, and shall display station numbering, station name, and call-in priority.

H. The end-user shall be allowed to choose and determine the number and location of Consoles. The end-user shall not be limited by pre-set manufacturer limitations of the number of Consoles required by this project; allowing for unrestricted future expansion. Consoles may be added at any time. Consoles added by the end-user that exceed the engineered design for this project shall be at owner's expense. Communication between consoles or consoles and intercom stations or rooms shall not be inhibited by channel number restrictions.

I. The Console shall be capable of displaying room statuses such as Privacy and Do Not Disturb and shall have the ability to override any status limiting communication between the Console and a station with Privacy or Do Not Disturb status activated. Temporary override shall not interfere with continued activation of Privacy and Do Not Disturb after communication has been established and electively terminated.

2.04 POWER AMPLIFIERS

A. Power Amplifiers shall be used to drive groups of speakers located in corridors and outdoor locations that are assigned to speaker zones. Amplifier Zones shall be sized at 1 watt per corridor speaker, and 3.5 watts per horn. The amplifier load shall not exceed 80% capacity.

B. The amplifiers shall be capable of producing an audio output of 60, 125, or 250 watts RMS at less than 1% distortion with balanced output.

C. Power Amplifiers shall be designed to operate on a line voltage of 115 AC.

2.05 SUPERVISED NETWORK AMPLIFIERS

A. The Supervised Network Amplifier (subsequently referred to as Network Amplifier) shall provide a minimum of 25 watts for paging and public address and shall be capable of utilizing analog amplifiers to increase the amount of amplified signal from the network amplifier. The Network Amplifier shall be connected directly to the network switch by an RJ45 connector and shall receive signals directly from the network.

B. The Network Amplifier shall be supervised and in the event that network communications is lost, an audible alert shall sound on the Amplifier. The Network

Amplifier shall provide a silence feature to mute the audible alert for 24 hours.

C. The Network Amplifier shall also be capable of receiving local input from local devices such as tape decks, iPod docks, CD players, etc. The network amplifier shall be capable of transmitting signals received from the local input to other network locations or locally to directly connected 25/70 volt or 8-ohm analog speakers.

D. Each Network Amplifier shall be capable of providing two audio inputs for local devices and shall be programmable as either a microphone or line-level input.

E. The Network Amplifier shall be controlled remotely such that audio programs, input, tones, textual messages, or announcements may be initiated by other devices connected at different locations on the local area network.

F. The Network Amplifier shall have a minimum of 4 local tone/pre-recorded announcement audio message control lines which when activated will distribute tones/pre-recorded audio messages to intended network amplifiers for re-distribution, network talk-back speakers (or a zone), and/or local 25/70 volt or 8-ohm analog speakers directly connected to amplifier. Each network amplifier shall be capable of storing four (4) pre-recorded announcements in addition to a minimum of 16 tones. Tones and announcements shall be activated locally or from other network devices.

G. The Network Amplifier shall store and transmit companion textual messages for each stored audio announcements. Textual messages shall be automatically broadcasted to the same zones along with the audio messages such that any device programmed for that zone automatically receives both the audio and textual announcement/message and automatically reproduced each or both messages to the extent of the devices' capabilities.

H. The Network Amplifier shall be capable of transmitting HD level audio as defined by IntelTM High Definition Audio specifications, June 17th, 2010 at a minimum.

I. The Network Amplifier shall shut down to protect itself should an output short circuit fault or overload occur that jeopardizes the integrity of the Network Amplifier.

2.06 SUPERVISED INTERACTIVE GRAPHICAL USER INTERFACE

A. The system shall include an Interactive Graphical User Interface (subsequently referred to as IGUI). The software shall reside on the facility provided PC and should have ability to interface to District Wide Emergency Communication system located in district office.

B. The IGUI shall be supervised and shall utilize an easy-to-use Graphical User Interface for quick and easy graphically aided navigation to access functionality for all intercom stations, paging zones, and program distribution sources. Emergency

operations shall be simplified through the IGUI allowing stored audio files and alphanumeric messages for message displays to be activated from the IGUI. The IGUI shall allow common operations such as daily announcements to become simplified into single touch activated icons; removing multi-step console set ups and dial strings.

C. The voice device used to originate voice communication for the IGUI to selected locations shall be a system console, telephone handset, or microphone independent from the computer hosting the IGUI. The voice device shall remain functional and accessible regardless of the operational state of a computer supporting the IGUI.

D. The IGUI shall allow the creation of a custom operating screen(s) based on the floor plans of the facilities. Icons representing intercom stations, zones used for paging, tone distribution, textual Message distribution, and audio program distribution shall be incorporated onto the floor plans. The IGUI software shall provide:

1. The IGUI shall allow the creation of a custom operating screen(s) based on the floor plans of the facilities. Icons representing intercom stations, zones used for paging, tone distribution, textual Message distribution, and audio program distribution shall be incorporated onto the floor plans. The IGUI software shall provide: multiple routine call processing, including: hold, transfer, and forward
2. Activation of remote station auxiliary relays for applications such as door lock or release
3. Emergency functions
4. Paging
5. Audio program distribution
6. Customizable page elements
7. Customizable operating screen
8. Element library for emergency event icons
9. Initiation of emergency and non-emergency messaging, textual and audible
10. Remote station volume adjustment
11. Remote activation of do not disturb status and/or message waiting status
12. Remote station trouble indication
13. Remote station background music channel selection
14. Dynamic zone management for interactive on-the-fly console specific zones
15. Single touch emergency response (supporting both actual emergencies and drills) including but not limited to all or any combination of the following:
16. Live voice notification

17. Pre-recorded audio message
18. Digital plain text messaging with simultaneous numerically coded message capability
19. Remote system activation, i.e., access control systems, CCTV systems, door release systems, etc.

E. The IGUI must provide an efficient and reliable method of notifying the occupants within the facility of critical situations. A variety of emergency tone signals that reside within the intercom/paging system shall be activated by clicking on pre-programmed buttons on the IGUI screen, initiating the transmission of tone signals to speakers, and alphanumeric messages to message displays/digital clocks. A “lockdown” icon shall be designed as per Owner direction, with Owner selecting the appropriate tone. Whole building macros for emergency or off-normal response shall be built into the internal communication system as directed by the Owner. Each macro shall be capable of being activated by the console, the IGUI as indicated on plans or as directed by the Owner or AHJ. It shall be possible to activate a WAV file message or Owner selected tone coinciding with multi-language textual messages for distributions to zones as directed by the Owner, all from a single activation icon located on the IGUI. Other single action macros shall be activated in similar fashion via the IGUI and a custom-labeled icon. Plain language labeling of all icons on the IGUI shall be user changeable.

2.07 CONTROL INTERFACE C/W DESKTOP APPLICATION SOFTWARE

A. The Control Interface shall be a Telecor model eCI or approved equal. It shall provide a Desktop Application for PC interaction with the Intercom and Paging system, a Command Interface Protocol for external system interaction with third party systems, Group Zone functionality, and a Scripting Engine supporting multiple sequential operations.

B. The system shall incorporate a Windows based Desktop application that makes use of a Command Protocol Interface, allowing external systems to interact with the Network Intercom and Paging System. Combined with the Scripting and Group Zones features, the Desktop application shall generate a preprogrammed series of operations from a single action. These features shall be used in conjunction with a graphical user interface and the Microsoft Windows desktop.

C. Default Scripts shall be used to generate customized shortcuts according to the needs of a facility. These shortcuts shall then be placed directly on the Windows desktop and shall activate virtually any Intercom and Paging function by clicking on

the shortcut icon. These shall include activating:

1. Alerts, audio distributions, coded and plain text messages, intercom operations.
2. Pre-Recorded Evacuate, Lockdown, and All Clear audio files.
3. Companion text messages for audio alerts.
4. Coded messages on all secondary digital clocks and displays.

D. The Desktop Application shall also activate SMS text messages, computer pop-up notifications, and email distributions in conjunction with any Desktop Script. Desktop Icons such as a Panic Button shall send SMS notifications to a crisis team, advance warning to building occupants through pop-ups to heighten the level of awareness.

E. Any Desktop location running the Application shall have the ability to create and send an instant message using the Desktop's keyboard any display. The textual message can be sent independently or as a companion message to an audible alert.

F. The Desktop Application shall be capable of utilizing Soft Call and Panic buttons. Soft Call buttons shall be created to operate as a call button on the desktop with a normal or emergency call priority. They shall also be combined with other preset or on-the-fly custom text messages. Panic buttons shall allow a user to unobtrusively activate an audio path from the panic button location to another eSeries device at a security location. This shall allow security personnel to listen to an occurring situation and provide the appropriate response.

G. The System shall be capable of streaming multiple audio programs over 10 available channels, simultaneously, to speaker locations in the facility. The ability to turn the broadcast on or off to a specific location shall be controlled from the Desktop Application.

H. A user from the Desktop Application shall enable or disable Do Not Disturb (DND) mode for a group of devices such as speakers or intercom stations.

I. Volume Adjustments to individual devices, devices in a zone, or all devices in the intercom and Paging System shall be made from the Desktop Application.

J. The Desktop Application shall be used to create a call directory to provide the user with the ability to quickly and easily place calls to a large number of prospective recipients and locations. The shortcuts shall be customized with the name of the call recipient or location. The call directory shall also contain shortcuts that activate message-waiting indications in addition to the option of placing calls.

K. The system shall interface with other external systems using a Command Interface Protocol. External systems include integrated security management or building management systems via devices such as computers, programmable logic

controllers, or software based annunciator panels.

L. The Command Interface Protocol shall be used to send real time commands and receive real time status messages between the third party system and eSeries devices. The Command Interface Protocol shall be an ASCII protocol that includes both outbound messaging, and support for inbound command via a virtual COM port and a physical USB connection.

M. Scripting shall allow operations to be carried out in sequence. Scripts shall be activated in various ways including: automatically based on the day of week and time of day, using an eConsole or a phone, or by using eDesktop, or from other scripts.

N. When scripts from an eConsole or PBX phone (via eSIP), the name of the script shall be displayed on the eConsole or phone. Then the user shall be presented with options to enable or disable the script (depending on the current state of the script). eConsoles and PBX phones that dial the script number shall hear voice prompts for enabling or disabling the script.

O. Scripts shall be used for scheduling time tone programs that include tones, pre-recorded messages, and textual messages displayed on e365-TB Message Display/Clocks reoccurring at specific times and days.

P. Scripts shall perform cascading evacuation operations where evacuation audio messages are automatically first distributed to zones closest to the location of an emergency before spreading outwards to other zones according to a time schedule, thus reducing evacuation route congestion throughout the facility.

Q. Group Zones shall allow groups of page zones or devices to be defined as a group zone with a dial number. Group Zones shall be accessed from eDesktop, eConsoles or PBX phones.

R. Group zones shall be the destination for various functions including textual messages, or audio operations, such as pages or audio program distributions). Group zones shall be assigned customized names, which will appear on eConsole or phone displays when they are dialed.

S. Group Zones shall make it possible for a dial number to be forwarded to a different destination based on time and day. For example, common audio operations directed to a Group Zone dial number shall be configured to go to the usual destination during regular hours but to a different destination outside of regular hours.

T. Group Zone shall support designated priorities, such as emergency. Operations that are to a zone with a priority are automatically elevated to override any normal or lower priority operations the devices in that group zone are receiving.

2.08 ALARM MANAGER

A. The Alarm Manager shall be a Telecor Model eAM equipped with eVCAM software or approved equal. The Alarm Manager shall manage system wide communications during an alarm condition in the facility through a GUI and associated software. The Alarm Manager and associated software shall reside on the facility-provided PC.

B. During an alarm condition, all non-emergency operations shall be restricted. Operations shall be transferred to an Alarm Management Console located at the Command Center location within the facility. The command Center shall be equipped with a Console, associated GUI, PC and software to manage emergency operations during an alarm condition.

C. Included in the GUI shall be ICONS that represent the following alarm types:
   1. Lockdown
   2. Lockout
   3. Evacuation
   4. Reverse Evacuation
   5. Severe Weather
   6. Tornado
   7. Fire
   8. CO Detection
   9. General Emergency
   10. All Clear

D. Alarms shall be activated by “Clicking” on the respective ICON on the GUI. When the corresponding alarm becomes active, the ICONS shall visually change to reflect the current condition.

E. Operation of the Alarm Management Console shall be consistent with NFPA72 Emergency Communication Requirements. Operations activated by an Alarm Management Console shall have the highest priority and shall not be overridden by another operator. This shall eliminate the risk of different operators issuing conflicting instructions.

F. The Alarm Management Console shall perform live paging announcements which shall automatically suspend a pre-recorded portion of an alarm until the conclusion of the paging announcement.

G. From the Command Center, it shall be possible to change the type of alarm, silence an alarm, perform live paging in the alarmed areas, covertly listen to stations, as well as clear the alarm.

H. Call-ins placed from stations in an alarmed area shall automatically be routed to the Alarm Management Console during an alarm condition.

I. Locations designated for “Shelter in Place” such as classrooms, offices, and areas of refuge shall be equipped with Alarm Acknowledgment call stations. These stations shall be used to confirm the status of the occupants in these locations during a Lockdown Alarm Condition. Call stations shall receive pre-recorded verbal instructions to be carried out to secure the “Shelter in Place” locations. Once secure, the status shall be acknowledged by pressing a touch point on the Alarm Acknowledgement Call Station.

J. All “Shelter in Place” locations shall be monitored on the Command Center GUI in real time using the Alarm Manager software. A graphic of the school floor plan shall display the status of the room with color-coded ICONS.

1. **Orange** shall indicate that the room has received instructions to secure the room and acknowledgement is pending
2. **Green** shall indicate that the room has acknowledged that the room is secure
3. **Red** shall indicate that the room status is unknown as no acknowledgement has been received from the room.

K. If the Alarm Acknowledgement is not received from the room location after a preset period of time, the station shall automatically place a call to the Alarm Management Console. The Console Operator shall answer the incoming calls utilizing the covert listen function, which allows the operator to aurally monitor the room without the occupant’s knowledge. During a convert listen operation, the pre-announce and supervisor tones are suspended. Once the operator determines that the conditions in the room are typical of the situation, the operator shall establish a two-way intercom conversation with the classroom to determine why people in a Shelter-in-Place location did not complete the emergency response procedure.

L. The Alarm Manager shall support Medical and Security Alert Calls from Alert Call stations. Calls from these stations shall be annunciated at the Alarm Management Console, identifying the origin and type of Call. In addition, a pre-recorded announcement stating the origin and type of alarm shall be broadcast over the local speaker, and a textual message shall be scrolled on the local Message display. The audio broadcast and the textual message shall also be broadcast to one of more zones of loudspeakers.

2.09 ALARM ACKNOWLEDGE AND ALERT CALL STATIONS

A. The Alarm Acknowledge and Alert Call Stations, as indicated on the drawings, shall be Telecor model eCS-9 or eCS-10 or approved equal. The station shall have the ability to generate Emergency Priority Level call-ins, perform Alarm acknowledge operations and initiate Medical and Security Alerts. The station shall be designed to operate in conjunction with the Alarm Manager.

B. Call Stations shall be monitored for call line failure. In the event of an open circuit, short circuit or short to ground, the System shall detect the fault and notify a designated console operator automatically. The type of fault and its identity on the system shall be displayed on a designated console screen.

C. The Stations shall initiate Emergency priority level call-ins from remote locations to Consoles. Stations shall be equipped with a Call assurance LED that shall provide call confirmation whereby the LED shall flash, confirming the call-in placement. The LED shall continue to flash until the call in is answered.

D. Locations for “Shelter-in-Place” such as classrooms, offices and areas of refuge, as noted on the drawings, shall be equipped with Alarm Acknowledge or Alert Call Stations. During an Alarm Condition these stations shall notify the Alarm Management Console of the completion of alarm related emergency responses by the occupants of a “Shelter-in-Place” location.

E. The eCS-10 or approved equal stations shall have all the features the eCS-9 station, as well as additional Medical and Security Alert touchpoints. These touchpoints shall have the ability to place call-ins to Console identifying the call as a Medical or Security alert priority level.

F. Medical or Security level call-ins shall combine a call-in, audio announcement, and a scrolling textual message into a single emergency priority operation. The origin and priority of the call shall be displayed at the Console location. Additionally, an announcement shall be broadcast over a selected zone(s) of loudspeakers, broadcasting the location and type of alarm. A textual message identifying the origin of the alarm and alarm type shall also scroll across selected message display(s). The broadcast and messages shall continue to scroll until the call-in is answered.

2.10 SUPERVISED SIP TRUNK IP/PBX INTERFACE

A. The system Session Internet Protocol (SIP) Interface shall be a VoIP PBX phone interface of the same manufacturer as the supervised network intercom and paging system. Third party gateway devices shall not be accepted.

B. The SIP Interface shall be supervised and shall connected directly to the facilities network and the PBX's network and shall provide the following:
   1. Establish a barrier gateway between the intercom and paging network and the PBX and/or common computer network.
   2. Transparent audio operation between VoIP PBX phones and any device on the supervised network intercom and paging system. Paging access from any telephone on the facility system VoIP PBX to any intercom speaker, speaker zone, intercom station, console, all speakers, or paging horns and zones throughout the facility.
   3. Any call-in from the supervised network intercom and paging system shall be capable of being routed directly to a VoIP PBX phone. Call-in stations can be configured and programmed to automatically dial any number on the publicly switched telephone network, landline, or cellular number through the SIP interface and via the PBX.
   4. Ability to escalate a call-in to be redirected to a VoIP PBX connected phone via the SIP Interface. Escalation can also include the ability to dial any number on the publicly switched telephone network, landline, or cellular number through the SIP interface via the PBX.
   5. Ability to initiate alarm and crisis response protocols from any VoIP PBX connected phone.
   6. Ability to require security access code to utilize the intercom or paging system emergency communication features.
   7. Minimum of 10 simultaneous telephone channels of access to/from VoIP PBX phone system. Full caller ID support from any supervised network intercom call-in device to a VoIP PBX connected phone identifying the calling station ID/Location.
   8. Emergency level call-in to be uniquely identified as emergency on the VoIP PBX phones.
   9. Activation of all supervised networked intercom and paging system emergency tones and pre-recorded announcements from any phone connected to the building VoIP PBX phone system.
   10. The SIP Interface shall additionally allow for calls to be placed from a console to any phone number on the publicly switched telephone network (landline or cellular). Additionally, intercom calls at a console may be transferred to any number on the publicly switched telephone network to any landline or cellular

number through the SIP interface via the PBX.

C. Systems that connect to a building or district phone system and are limited to a SLT or CO connection will not be accepted as a substitute for a fully operational SIP Interface.

2.11 MASTER CLOCK /MESSAGE HOST

A. The Master Clock / Message Host shall be a Telecor model eMH or approved equal. It shall be a time master device for the eSeries network which enables configuration and activation of eSeries operations from a web-based graphical user interface (GUI). An unlimited number of operations shall be managed for activation by schedules or users. The application shall be web-based and secured via HTTPS certification. It shall be preconfigured with a variety of default operations, schedules, audio, and icons for quick customization. Users shall log into the application from any desktop computer or mobile smart device using a supported web-browser. Supported web browsers shall include Microsoft Edge, Mozilla Firefox, Google Chrome, and Apple Safari.

B. Master Clock functionality shall include central time keeping and synchronization of all other eSeries devices throughout the eSeries network.

C. The Master Clock shall manage an unlimited number of calendar-based schedules, which are collections of operations intended to be performed frequently, periodically, or on specific dates and times. For example, a schedule may be a series of bell tones that consistently indicate class changes. Users shall set schedules so that the operations they contain will activate accordingly.

D. Schedules shall be viewed, enabled or disabled in a calendar. The calendar shall display schedules on a daily, weekly, monthly or yearly basis. The eMH shall support scheduling operations up to 10 years into the future.

E. An unlimited number of holidays shall be specified and marked on the calendar. This shall indicate days where disabling all schedules may be appropriate.

F. The Master Clock shall obtain time from and synchronizes with Network Time Protocol (NTP) servers directly or via an NTP-enabled eSIP present on the eSeries network.

G. Operations shall include several components, including: pre-announce tones, pre-recorded audio, scrolling textual messages, and coded messages. If desired, specific details of the components shall be customized. Customization shall include: the number of times the pre-announce tone plays, the message scroll speed, and the delay before pre-recorded audio repeats. Depending on the operation type, user-

activated operations shall be distributed immediately or queued for later distribution.

H. The Home page shall provide a quick overview of eMH-managed operations. This shall include the next scheduled operation, the schedules that are currently active, and the next scheduled school drill. The eMH shall include user specific short tutorial videos that explain various aspects of the GUI and provides built-in on demand training.

I. The Live page shall show currently active and upcoming operations. A history of recently performed operations shall confirm operations occurred as intended. Also, users shall easily initiate on-the-fly operations on the Live page by configuring and activating them on demand.

J. Routine operations shall include an unlimited number of pre-configured common audio distributions. Examples shall include announcements for special assemblies, bus arrivals, staff meetings, and festive events.

K. Operations shall be associated with eSeries eCI scripts so that they shall be activated by users. The GUI shall indicate if the eCI script is active even if it was activated via other means such as dial access code or Visual Console for eSeries. Other emergency operations (such as Lockdown) shall also be seamlessly integrated with Visual Console for eSeries.

L. Audio files shall be used for tones or announcements while images shall be used as icons throughout the GUI to represent different operations or schedules. Audio file formats shall include (WAV and MP3) and images to support operations.

M. Access shall be user-account controlled. An unlimited number of users shall be supported with a high level of individual customization. Users shall be given access to only the pages and operations relevant to their intended roles. For each page, users shall be granted permissions to activate or configure operations and schedules from a desktop or, for certain users, from mobile devices. An administrator account shall have full access to view and make configuration changes on all pages, while an operator account shall be limited to activating routine or emergency operations and enabling or disabling schedules.

N. Users with administrative privileges shall have the ability to configure the site name, time, time zone, test zone, and import and export databases. To aid installers with initial configuration, a test mode shall be provided as well as a database import/export feature. Test mode shall redirect all activated operations to a test zone (that only the installer occupies) to prevent disrupting other people during configuration and testing. Database import/export shall allow the configuration to be exported for backup

purposes or to copy to other installations.

O. The system shall be configured for an unlimited number of dedicated emergency response operations. A corresponding drill operation shall be automatically created for each emergency situation. Users shall activate emergency response operations from facility PCs or remote mobile smart devices.

P. The Master Clock / Message Host shall support the operation of Virtual Call Stations that reside on client PC's, including management of all network connections between Virtual Call Stations and the Network Intercom and Paging System.

Q. The Master Clock / Message Host shall feature a Maintenance Portal. The portal shall provide trouble notifications for faults being experienced by any eSeries device on the eSeries Network.

1. The notification shall include a detailed fault report that provides the device name, dial number and the nature of the fault. These shall be easily copied into other documents and emails.
2. The Portal shall be configured to use an email account to automatically send trouble notification emails to a list of designated addresses. These emails shall list the details of all the current faults.
3. A link to the eMH web interface shall be provided in order for the recipient to perform troubleshooting actions such as viewing up-to-date fault information, enabling service mode status, and making configuration changes.
4. The volume of station devices shall be remotely adjustable via a web browser.

2.12 GENERAL PURPOSE I/O DEVICE

A. The General Purpose Input / Output Device shall be a Telecor model eNODE or approved equal. It shall allow third party devices and systems to interface with Network Intercom and Paging System through contact closures.

B. The I/O Device shall have a minimum of 4 inputs and 4 outputs.

C. The inputs shall connect to dry relay contacts of third-party devices and shall activate any eSeries operations. Each input shall be configurable and shall support connection to sustained or momentary contact closures. Inputs shall differentiate between single or multiple momentary contact closures.

D. Outputs shall activate third party devices and systems. Outputs shall activate in response to:

1. Paging Audio or intercom calls
2. Scripts
3. Alarms

4. Events in the Master Clock / Message Host
5. Manual Dialing of an dial number
6. Analog Clock Correction
7. Trouble Status Indication
8. Service Mode

E. The I/O Device shall support tracking features where the output will automatically activate if the I/O Device detects the activation of paging audio, call-ins, Scripts and Alarms.

F. The I/O Device Output shall be capable of being manually dialed and activated from a console, or a phone on the facility's PBX. Once dialed, the caller shall be prompted by voice commands.

G. The I/O Device shall be integrated with the Master Clock/Message Host, allowing outputs to be activated according to scheduled events. The outputs can also be programmed to provide correction to synchronous movement analog clocks.

H. All I/O Device Inputs and Outputs shall be monitored and shall detect opens, shorts and ground faults on the connection between the third-party device and the I/O device. If any of these conditions are detected, a fault condition shall be raised on the system.

2.13 MOBILE QUICK ACCESS

A. The system shall include a Mobile Quick Access feature that shall allow staff members to quickly activate Emergency Notifications. (e.g. Lockdown) using mobile smart devices.

B. Notifications shall include the broadcast of pre-recorded audio announcements over the facility's public address speakers and textual messages to eSeries displays with a single activation.

C. The feature shall include emails and SMS messages that shall be delivered to custom lists of recipients.

D. Button options shall be customizable, allowing staff a choice of notifications from their mobile devices depending on the staff's authority.

2.14 SUPERVISED CALL STATIONS

A. The Supervised Call Stations, as indicated on the drawings, shall be Telecor model eCS-1 eCS-2, eCS-3, eCS-6 or approved equal. The station shall be used to initiated calls from remote locations to eSeries Consoles.

B. Call Stations shall be monitored for call line failure. In the event of an open circuit, short circuit or short to ground, the System shall detect the fault and notify a

designated console operator automatically. The type of fault and its identity on the system shall be displayed on a designated console screen.

C. Call Stations shall provide “message waiting” indications to staff members. If no one is present in a room to respond to a call, or the room is in Privacy or Do Not Disturb mode, the console operator shall have the option to leave a Message Waiting (MW) indication at the Station. If the MW option is chosen, the LED indicator on the room call switches shall begin to pulse. When a call-in is initiated from the room, the MW indication shall be automatically deactivated, and the call-in shall be automatically routed to the console that left the MW indication.

D. Call Stations shall utilize a momentary contact touchpoint to initiate a “Normal” priority level call. Stations equipped with an “Emergency” touchpoints shall initiate “Emergency” priority level calls. All stations shall have a Call Assurance LED. The LED shall flash when a call in initiated, confirming call placement to the user. The LED shall continue to flash until the call is answered by the console operator.

E. Calls Stations that are equipped with “Privacy” touchpoints shall place the room into a “Privacy” state, preventing the monitoring of audio activity in that room. When in the state privacy, the touchpoint shall illuminate indicating privacy status. When a call is initiated from the Call Station, the privacy state shall automatically be suspended for the duration of the call and automatically re-enabled when the call is complete. If a Console places a call to a location that has a Call Station that is in “Privacy”, the caller shall be given verbal instructions, automatically generated by the console, that the room has been placed in privacy and the caller’s options are to cancel the call, leave a message waiting indication or connect regardless. If they choose to connect, the audio shall be allowed to be transmitted from the console to the room, but the calling party shall not listen to the room audio unless the party in the room turns off the privacy feature.

F. Call stations that are equipped with “DO NOT DISTURB” (DND) touchpoints shall place the room into DND mode when pressed. When DND mode is enabled, the back lit LED on the station shall illuminate, indicating that the station is in a DND state. Schedule scheduled events, zone pages and normal priority audio programs shall be blocked from being broadcast into a room that is set into the DND state. However, Emergency pages, manual tones and high priority audio programs shall continue to be broadcast into the room. If a call-in is initiated from a room is set to DND, the DND status shall be automatically suspended for the duration of the call, and automatically re-enabled when the call is completed. If a call is placed from a Console to a location

that has a Call Station set to DND, the caller shall be given verbal instructions, automatically generated by the console, that the room has been placed in DND and the callers options are to cancel the call, leave a message waiting indication or connect regardless. If they choose to connect, the intercom call shall proceed normally allowing the caller to speak to the party in the room

G. Call Stations denoted with a V suffix (eCS-1V, eCS-2V eCS-6V) shall have the ability to control the volume of the local eSeries room speaker. Call Stations with Volume Controls shall include volume up and volume down momentary contact touchpoints to adjust volume of audio being broadcast over the speaker. Separate user-set volume levels shall be maintained for intercom calls, normal and emergency priority paging announcements. Volume controls shall be disabled when there is no audio being broadcast to the speaker.

2.15 VIRTUAL CALL STATIONS

A. The system shall include Virtual Call Stations that shall reside on classroom PC’s as well as portable PC’s that are used in classroom locations that are equipped with network speakers. Virtual Call Stations shall mimic the look and behavior of physical Call Stations. These shall feature interactive and animated buttons which react to user inputs such as mouse clicks or finger presses on touch screen devices.

B. Virtual Call Stations shall include Call Assurance indication via a virtual LED representation. When a call is placed the virtual LED shall blink to indicate that the call has been placed.

C. Virtual Call Stations shall be customizable to have any or all of the following configurations:

1. Push to Call
2. Emergency
3. Privacy
4. Do Not Disturb
5. Channel Select
6. Volume
7. Alarm Acknowledgment
8. Medical Alert
9. Security Alert

D. Virtual Call Stations shall be configured with Volume buttons that shall adjust the volume in a room. Volume adjustments shall only affect the current active audio broadcast into the room, for example lowering the volume of paging announcements

and not affecting the volume of intercom or emergency announcements.

E. When used with the Call Manager feature, Virtual Call Stations shall support Alarm Acknowledgement as well as Medical and Security Alert functionality. Alarm Acknowledgement functionality shall be used in conjunction with Alarm Manager operations to signal completion of emergency response instructions. Medical and Security Alert touchpoints shall activate a combined emergency response that shall initiate a priority call-in, as well as an audio broadcast and a scrolling text message on Message Displays.

F. When used with portable PC's that are moved between locations, users shall be prompted to enter the room number of their current location.

G. The implementation of the Virtual Call Station shall be a client-server model. The server software shall reside in the Master Clock and Message host hardware. The client portion shall be installed on computers throughout the facility and connected to the facility network.

2.16 SUPERVISED MESSAGE DISPLAY/CALENDAR CLOCK/SPEAKER/STROBE

A. The Supervised Message Display/Calendar Clock/Speaker/Strobe Assembly (subsequently referred to as MDCSS Assembly), as indicated on the drawings, hall be a Telecor model e2444-LD or approved equal

B. The MDCSS Assembly shall receive power and data over a RJ45 connect CAT5E/6 cable via a Power-Over-Ethernet switch port. Once plugged into the LAN through a Power over Ethernet network switch, the MDCSS shall be immediately functional and shall not require any network configuration or administration to function

C. The MDCSS Assembly shall be supervised and monitored for connectivity to the network. Additionally, any Call Stations connected to the MDCSS shall be monitored for call line failure. In the event of an open circuit, short circuit or short to ground, the System shall detect the fault and notify a designated console operator automatically

D. The MDCSS Assembly's Speaker shall have a power rating of 10 watts of audio signal and provide a minimum of 92db @ 1 meter SPL for maximum intelligibility.

E. The MDCSS Speaker shall provide transmission of HD audio as generated from intercom console and/or associated push-to-talk, intelligent microphone, supervised network amplifier, or program sources connected to the network.

F. The MDCSS Speakers shall support talkback; to optimize intelligibility talkback capabilities shall be supported.

G. The MDCSS Assembly shall support the direct connection with RJ45 connectors of two supervised room Call Stations. The stations shall provide the means for: normal

calls, emergency calls, privacy mode, and do not disturb mode, as well as for the adjustment of Audio Volume. Call Stations shall include a call placed assurance status LED to indicate a call has been placed. Call Stations shall be supervised and immediately indicate disconnection or a wiring fault.

H. Emergency Call Stations shall be separate and clearly labeled with a red button so as to impart obvious operation in the event of an emergency. Systems that only provide a single call station with dual emergency and normal operation based on a sequence of button presses shall not be acceptable.

I. The volume of the MDCSS Speaker shall be adjusted individually, by zone, or across the entire network. Volume controls incorporated into certain Call Station models shall allow a user to adjust the volume of a local MDCSS speaker. Volume levels can be set for specific functions: intercom, paging, emergency paging, and Public Channel operations.

J. Volume controls shall be capable of establishing and maintaining levels for intercom, paging, program distribution, and tones, independently for each of the above functions. Emergency announcements shall not be affected by the adjustment of other speaker volume/levels such as paging, intercom, or other lower priority audio broadcasts. Systems that utilize a manually operated transformer or resistive volume control design shall not be acceptable.

K. The MDCSS Speaker shall have the capability to be configured as a member of one or more paging zones.

L. The MDCSS Assembly shall include an integral LED Strobe that shall illuminate for the duration of an announcement being broadcast over the MDCSS speaker to alert room occupants of the announcement in progress.

M. The LED Strobe shall be configured to illuminate in up to 4 colors (white, red, green or blue) with various flash patterns. Patterns can be set to activate based on the priority of announcements. For example, using a distinct color and flash pattern for an Emergency Announcement while a routine announcement or intercom call can be assigned another pattern and color.

N. The MDCSS Assembly shall include a Message Display/Clock that shall simultaneously display plain text emergency or routine messages and independent numerically-coded messages. When not displaying a message, it shall display the current time and date. Hours and minutes shall be displayed with large 2.25” digits. Seconds shall be slightly smaller for easy distinction. The date shall be displayed in plain text by a 10-character, dot matrix display showing the day of the week, followed

by the month and date. The date shall be displayed in the English, Spanish or French language.

O. The Message Display/Clock shall automatically broadcast the audio announcement and a corresponding text message that is initiated on the over the communications system. These shall be enhanced by strobe illumination.

P. The Message Display/Clock shall also display text-only messages independent of any audio messages.

Q. In addition to plain text messages, the Message Display/Clock shall also simultaneously display numerically-coded messages which can be activated independently to provide trained staff with additional context to the plain text messages.

R. The Message Display/Clock shall include elapsed timer and count-down functions. Used in conjunction with a Timer Button Panel, users shall set the Clock to count upwards from zero to 24 hours or count down from a specified value to zero. Additionally, the unit shall have a local input that will accept a relay closure to activate the elapsed or countdown timer operation. Timers embedded into pre-set plain text messages shall display messages for a pre-set period of time.

S. All Message Display/Clocks shall be continuously synchronized to a Time Master connected anywhere on the same network Time corrections shall be performed instantaneously so that all Clocks display the correct time. If communication is lost with the Time Master, Clocks shall maintain the time independently and stay synchronized with each other. Once communication with the Time Master is re-established, the displays shall automatically resynchronize with the Time Master.

T. The MDCSS Assembly shall integrate with the Classroom Sound Field System and automatically mute the System during an intercom call, paging announcement or class change tone signal. Integration shall include the ability for an Emergency level call to be initiated from the Sound Field pendant microphone to the Administrative Console.

U. The MCDSS Assembly shall be equipped with 3 control relays to support integration with ancillary classroom devices. The relays shall be automatically activated during an emergency call-in or when receiving a broadcast or textual emergency message.

V. The LED strobe shall require Class 4, PoE+ power from the Network Switch.

W. The MCDSS Assembly shall be flush mounted using an e2444-BBF, or approved equal enclosure. In applications where surface mounting is required, an e2444-BBS or approved equal enclosure shall be provided.

2.17 SUPERVISED MESSAGE DISPLAY/CALENDAR CLOCK/SPEAKER

A. The Supervised Message Display/Calendar Clock/Speaker Assembly as indicated on the drawings, shall be a Telecor model e2444 or approved equal.

B. The Assembly shall be identical to the Supervised Message Display/Calendar Clock/Speaker/Strobe Assembly as described in section 2.16 of the specifications, however it will not be equipped with the LED Strobe.

2.18 SUPERVISED NETWORK INTERCOM TALK-BACK SPEAKER

A. The Supervised Network Intercom Talk-Back Speaker (subsequently referred to as Network Speaker) shall be a Telecor model eS8-TB. The Network Speaker shall be supervised and capable of up to 10 watts of audio signal and provide a minimum of 92db @ 1 meter SPL for maximum intelligibility. Speaker spacing shall be as defined by manufacturer to provide maximum intelligibility.

B. The Network Speaker shall provide transmission of HD audio as generated from intercom console and/or associated push-to-talk, intelligent microphone, supervised network amplifier, or program sources connected to the network.

C. The Network Speaker shall provide a dry contact output that can be activated remotely from a station or from a console, such as may be required in a door release application.

D. The Network Speaker shall receive power and data over a RJ45 connect CAT5E/6 cable via a Power-Over-Ethernet switch port. Once plugged into the LAN through a Power over Ethernet network switch, the Network Speaker shall be immediately functional and receive calls and pages from consoles on the network. The Network Speaker shall not require any network configuration or administration to function.

E. The Network Speakers shall support talkback; to optimize intelligibility talkback capabilities shall be supported via a microphone conditioned for low noise, HD audio, and with compression and noise gate capability. Stations that use the speaker instead of a separate microphone for talkback capability shall not be accepted.

F. The Network Speaker shall have a call-in roll-over feature where if it places a call-in to a primary call destination which is not answered after a preset amount of time, the call-in shall be automatically escalated to a secondary call-in destination. If both the primary and secondary call-in destinations are unavailable, the call-in shall be redirected to a back-up Station, Console, or telephone device.

G. The Network Speaker shall have the capability to be configured as a member of one or more paging zones.

H. The Network Speaker shall support the direct connection with RJ45 connectors of two, supervised room notification stations. The stations shall provide the means for: normal calls, emergency calls, privacy mode, and do not disturb mode. Notification stations shall include a call placed assurance status LED to indicate a call has been placed. Notification stations shall be supervised and immediately indicate disconnection or a wiring fault.

I. In addition to the visual call-in assurance status indicators on the notification stations, call-in assurance status indication must also be provided on the associated speaker. Also, in addition to visual call-in assurance, audible call-in assurance shall also be provided in support of persons with visual disabilities.

J. Under blackout conditions, the notification station shall be illuminated such that it can be located in the dark.

K. Normal call stations must support the ability to activate emergency call-in signals via multiple button presses and press and hold operations. Emergency call stations shall be separate and clearly labeled with a red button so as to impart obvious operation in the event of an emergency. Systems that only provide a single call station with dual emergency and normal operation shall not be acceptable.

L. The Network Speaker shall provide local, visual indication of operation or failed-communication and shall immediately annunciate a loss of communication at the main console location.

M. Network Speaker volume must be capable of individual level settings through the network. Settings must not be adjustable without authorization. Volume controls located in rooms must be centrally lockable via the network. Systems that allow a volume adjustment without authorization shall not be acceptable. Systems that utilize a manually operated transformer or resistive volume control design shall not be acceptable. Volume controls shall be capable of establishing and maintaining levels for intercom, paging, program distribution, and tones, independently for each of the above functions. Emergency announcements shall be sent at a volume/level as required by the AHJ and shall not be affected by the adjustment of other speaker volume/levels for the purposes of paging, intercom, or other lower priority audio events.

2.19 SUPERVISED NETWORK MASTER/SATELLITE TALKBACK SPEAKER

A. The Supervised Network Master/Satellite Talkback Speaker (subsequently referred to as the Master Talkback Speaker) shall be a Telecor model eS8-TB4 or approved equal. The Master Talkback Speaker shall support all functionality of the Telecor

model eS8-TB (specified above).

B. The Master Talkback Speaker shall be supervised and shall support the connection of Satellite Speakers, and support up to four watts of additional 25V Satellite Speaker load. Satellite Speakers shall be Telecor model S8T2570 or approved equal.

C. The Satellite speakers shall not support talkback; to optimize intelligibility talkback capabilities shall be supported from a single point via a microphone conditioned for low noise, HD audio, and with compression and noise gate capability. Stations that use the speaker instead of a separate microphone for talkback capability shall not be accepted.

D. The Satellite Speaker shall receive power over a RJ45 connect CAT5E/6 cable via the Supervised Network Master/Satellite Talkback Speaker. Both the Supervised Network Master/Satellite Talkback Speaker and the Satellite Speaker shall receive all power through a single Power-Over-Ethernet switch port. Systems that require auxiliary power or additional external or supplementary audio power amplification are not acceptable.

E. SUPERVISED SPEAKER BREAKOUT MODULE

F. The Speaker Breakout Module shall be a Telecor model eSBM-TB or approved equal. It shall provide the means of integrating traditional analog speakers and call initiating devices to the eSeries System. The Module shall also be a Single Zone Paging Adapter that can drive an amplifier to provide paging coverage in a facility. The Module shall have three relay outputs that can activate automatically during a call processing operation.

G. The Module shall receive power and data through a Power-Over-Ethernet switch. Once plugged into the LAN through a Power over Ethernet network switch, the Module shall place or receive calls and pages from the eSeries network. The Module shall not require any network configuration or administration to function.

H. Speech shall be transmitted through the Module in crystal-clear HD Audio. Audio shall be transmitted in the frequency range from 50 Hz to 7 kHz and shall use a maximum of 128 kbps of bandwidth during a call. Audio between the Module and eConsoles shall be non-blocking.

I. The Module shall support eSTB-12 2x2 Ceiling Inlay Speakers, which shall connect to the eSBM-TB via a standard CAT5 cable or conventional 8Ω/25V/70V speakers to provide paging and talkback operation from eSeries e300 eConsoles or phones via an eSIP and an IP-PBX.

J. The volume of the speakers shall be adjustable individually, by zone, or across the entire eSeries network via the ePort Management Interface or eCI Control Interface. Volume controls incorporated into certain eCS station models shall also allow a user to adjust the speaker volume locally. Volume levels shall be set by specific functions: intercom, paging, emergency paging, and Public Channel operations.

K. Call-in capabilities shall be provided with addition of any of Telecor's eSeries Call Stations. The eCS-6 and eCS-3 shall be used to initiate Normal and Emergency calls respectively. Advanced stations that provide additional features shall also be available: the eCS-1 (Privacy and Normal Call), eCS-2 (Do Not Disturb and Normal Call) , and eCS-4 (Volume Control, Public Channel Select and Normal Call). All eCS Call Stations shall also provide "message waiting" indication.

L. The eSBM-TB shall also support placing normal and emergency priority call-ins from simple pushbutton call switches. Pressing the normal call switch shall initiate a normal call-in, and either pressing it three times quickly or pressing and holding it for three seconds to shall place an emergency call-in. Pressing the emergency switch once shall place an emergency call-in.

M. The Module shall have the ability to direct normal and emergency call-ins to different devices. If the device that is configured to receive the call-in loses network connectivity, the Module shall automatically search for an alternate destination. If no other suitable call-in destinations exist, the Module shall audibly and visually indicate a fault.

N. The Module shall have a call-in roll-over feature where if a call-in to the primary call destination is not answered after a pre-set amount of time, the call shall be automatically copied to a secondary call destination. If both the primary and secondary call destinations are unavailable, the call shall be redirected to a back-up eConsole.

O. The Module shall have the capability to be configured as a member of one or more paging zones.

P. The Module shall have a built-in 4-watt audio amplifier that shall drive up to 4 watts of audio to a small zone of 25/70 volt loudspeakers. The module shall provide a line level audio output that can connect to an external power amplifier for applications where the speaker zone load exceeds 4 watts.

Q. The Module shall be monitored for network connectivity. If the Module's network connection is lost, targeted e300 eConsoles shall report that station as absent and display its dial number. When the Module is used with eCS Call Stations, the Module

shall also provide full supervision and monitoring for Call Station and call-in destination connectivity. If a wiring fault is detected between an eCS Call Station and the Module, the Module shall audibly and visually indicate the error utilizing the status LEDs on the Module. The eCS Call Stations shall pulse to indicate a trouble condition. In case of a fault, the ePort or eLog shall log the location, time, date and type of fault. If so configured, the ePort, eLog, eCI and eAmplifiers shall also generate an alarm tone.

R. The Module's status LED that shall flash in different patterns to indicate normal operation, call-in assurance, message waiting, a call or paging audio in progress, or to indicate an error.

S. The Module shall be equipped with three relays that can be used to operate auxiliary devices such as strobe lights, tone initiating devices and door locks.

T. The eSBM-TB shall be wall-mounted using the attached mounting brackets.

2.20 LOUDSPEAKERS

A. The Speakers, as indicated on the drawings, shall be Telecor models STB-12, STB-5, and STB-10 or approved equals. These Speakers shall be used in conjunction with the eSBM-TB (or approved equal, as described in section 2.20 to provide endpoint connectivity to Analog Loudspeakers when Talk-Back capabilities are required.

B. The 24” x 24” lay-in tile speaker assembly shall a Telecor model STB-12 or approved equal. It shall incorporate an 8" cone loudspeaker, equipped with a dual 25/70 volt line-matching transformer, pre-assembled into a 24" x 24" square perforated steel baffle and combination backbox, designed to be installed flush in a suspended ceiling.

C. The loudspeaker shall have a wide frequency response for general-purpose voice and music reproduction. The line-matching transformer shall have primary taps at 5, 2.5,1.25, 0.63, and 0.32 watts. The baffle is finished in a mar-resistant, white epoxy coating. The baffle is finished in a mar-resistant, white epoxy coating.

D. The speaker assembly shall be designed to be installed in a suspended ceiling. Installation is quick and simple as the 24" x 24" is designed to fit into a common 2-foot square ceiling grid. Tie off tabs allow the assembly to be secured to the building structure or ceiling grid to address any safety concerns.

E. The 12” x 24” lay-in tile speaker assembly shall a Telecor model STB-5 or approved equal. It shall incorporate an 8" cone loudspeaker, equipped with a dual 25/70 volt line-matching transformer, pre-assembled into a 12" x 24" square perforated steel baffle and combination backbox, designed to be installed flush in a suspended

ceiling.

F. The loudspeaker shall have a wide frequency response for general-purpose voice and music reproduction. The line-matching transformer shall have primary taps at 5, 2.5, 1.25, 0.63, and 0.32 watts. The baffle is finished in a mar-resistant, white epoxy coating. The baffle is finished in a mar-resistant, white epoxy coating.

G. The speaker assembly shall be designed to be installed in a suspended ceiling. Installation is quick and simple as the 12" x 24" is designed to fit into a common 2-foot square ceiling grid. Tie off tabs allow the assembly to be secured to the building structure or ceiling grid to address any safety concerns.

H. The pre-assembled 8” packaged ceiling loudspeaker shall be a Telecor STB-10 assembly or approved equal. It shall include the loudspeaker/transformer/baffle assembly.

I. The loudspeaker size shall be 8 inches in diameter and have a power handling capacity of 15 watts. The voice coil shall be of high-temperature bonded construction, be one inch in diameter and have an impedance of 8 ohms. The speaker shall have a frequency range of at least 65 Hz to 17,000 Hz and an axial sensitivity of 92dB at 1 m, with a 1 watt input signal @ 1000 Hz. The loudspeaker shall be equipped with a factory wired 25/70 volt line-matching transformer. The transformer shall have the primary taps at 5/16, 5/8, 1-1/4, 2-1/2, and 5 watts. The insertion loss shall be no greater than 1.0 dB. The transformer shall be mounted to the speaker with the secondary leads soldered to the speaker terminals.

J. The assembly shall include a baffle constructed of 22 gauge, cold-rolled steel finished with a mar-resistant white, semi-gloss, epoxy coating. The baffle shall have a diameter of 13".

K. The STB-10 shall mount to a T7 support bridge, used to attach the assembly to suspended ceilings. The support bridge shall accept an enclosure, model H7, for applications where a protective enclosure is required. The H7 enclosure shall attach to the support bridge with appropriate mounting screws. The enclosure shall be a Telecor H7 or approved equal. A circular molded polystyrene damping pad shall be fitted to the inside top of the enclosure to prevent acoustical and mechanical resonances. The pad’s surface shall be molded with a triangular pattern for enhancing low frequencies and shall optimize the audio response of the enclosure.

2.21 RE-ENTRANT HORN/LOUDSPEAKER

A. The Re-Entrant Horn/loudspeakers, as indicated on the drawings, shall be a Telecor model A-15T or approved equal.

B. It shall be a double re-entrant type, with a flared bell and an integral compression driver rated for 15 watts of continues audio power. The frequency response shall be 375 -14,000Hz. Nominal sensitivity shall be such that a sound pressure level of 110 dB at 1000 Hz. (on axis) at distance of one meter is produced with an input of one watt. Sound dispersion shall be no less than 100 degrees, regardless of the mounting position. The horn shall contain a weatherproof, built-in, 25/70 volt line-matching transformer. Power taps shall be at 0.48, 0.94, 1.8, 7.5 or 15 watts for a 25V line and 1, 2, 3.8, 7.5 or 15 watts for a 70 V line. The power taps shall be screwdriver adjustable. Impedance selection shall be 5,000, 2500, 1300, 666, 333, 87, or 45 ohms.

C. The unit shall include a die-cast universal mounting bracket, allowing the horn to be positioned both in the vertical and horizontal planes with a single adjustment. The wiring terminals and the screwdriver power tap shall be enclosed by a clear plastic cover for security and weather protection. The horn shall be finished in a grey epoxy. Dimensions shall be 9 1/4" deep with a diameter of 8".

2.22 SECURITY INTERCOM STATIONS

A. The Security Intercom Stations as indicated on the drawings, shall be a Telecor model eSTN-1 or approved equal. The Station shall provide for two-way communications as well as call-in capabilities.

B. The Station shall receive power and data through a Power-Over-Ethernet switch. Once plugged into the LAN through a Power over Ethernet network switch, the Station shall receive calls and pages from the eSeries network. The Station shall not require any network configuration or administration to function.

C. The Station shall have a call-in roll-over feature whereby if a call-in to the primary call destination is not answered after a preset amount of time, the call shall be automatically copied to a secondary call destination. If both the primary and secondary call destinations are unavailable, the call shall be redirected to a back-up Station or Console.

D. The Station shall have the capability to be configured as a member of one or more paging zones

E. The Station shall be tamper-proof in design and construction and shall provide for two-way communications as well as call-in capabilities. The faceplate shall be fabricated from 11-gauge stainless steel with a brushed, mar-resistant finish. The speaker shall be protected against tampering by three barriers located between the faceplate and the speaker cone. A Mylar speaker cone shall be used in order to

prevent damage to the speaker from liquids.

F. The Security Intercom Stations shall mount onto standard, three-gang electrical boxes, of a depth of no less than 2.875". Mounting hardware shall be tamper-proof. The switch actuator shall be fabricated from solid metal, and connected to the faceplate by a pair of welded studs. It shall be no less than 1/2" in diameter and shall be situated flush to the front of the faceplate. The actuator shall activate a momentary contact switch whose movement shall be limited by a mechanical stop to prevent damage caused by heavy impact.

2.23 LED STROBES

A. The LED Strobes, as indicated on the drawings, shall be a Telecor model eLD1 or approved equal. The LED strobes shall illuminate for the duration of an announcement being broadcast over local speaker or horn to alert room occupants of the announcement in progress

B. The LED Strobe shall receive power and data through a Power-Over-Ethernet switch. Once plugged into the LAN through a Power over Ethernet network switch. When the LED strobe is installed in locations with an associated Talkback Speaker, Breakout Module or Message Display Calendar Clock, the Strobe and the associated device shall only require a single Ethernet drop.

C. The LED Strobe shall be configured to illuminate in up to 4 colors (white, red, green or blue) with various flash patterns. Patterns can be set to activate based on the priority of announcements. For example, using a distinct color and flash pattern for an Emergency Announcement while a routine announcement or intercom call can be assigned another pattern and color.

D. The LED Strobe shall be assigned to an associated speaker, an individual speaker zone, multiple zones or all zones. The Strobe shall be activated by placing an intercom call to the room speaker associated with the Strobe, broadcasting an announcement to that speaker, or by an activation of an alarm event such as a Lockdown. The Strobe shall illuminate for the duration of the announcement or event

E. The LED strobe shall require Class 4, PoE+ power provided from the Network Switch

F. The LED Strobe shall be flush mounted using a standard 4, 11/16” square x 2” deep backbox.

2.24 VANDAL RESISITANT HORN/LOUDSPEAKER

A. The Vandal Resistant Loudspeakers, as indicated on the drawings, hall be a Telecor STB-16 or approved equal. It shall be a vandal-resistant loudspeaker assembly that utilizes a double re-entrant horn compression type loudspeaker. It shall be used in

locations as indicated on the drawings.

B. These are weatherproof units that are designed for outdoor installation. They are capable of delivering 16 watts of continuous power and include an integral 25/70 volt line-matching transformer. The transformer features color-coded primary taps at 16, 8, 4, 2, and 1 watts. The nominal frequency range is 350 Hz to 10 kHz, with a sensitivity of 96 dB SPL (1 watt/1 meter).

C. The loudspeaker shall be assembled onto a 16-gauge steel baffle that incorporates a unique interwoven steel security screen for maximum speaker protection while remaining acoustically transparent. This shall prevent any object from penetrating the loudspeaker. The baffle shall be finished in a powder epoxy coating that provides a resilient surface suitable for harsh environments.

D. The STB-16 shall be secured to the backbox with “pin-in-torx” tamper-proof screws, which are included with the unit. The STB-16 shall be suitable for flush mounting using the H16 Recessed Back Box. Alternatively, surface installations shall be accommodated using the SH-16 Surface Enclosure.

E. DIGITAL CALENDAR CLOCK/MESSAGE DISPLAY

1. The Digital Calendar Clock /Message Displays, as indicated on the drawings, shall be a Telecor model e365-TB or approved equal. The unit shall simultaneously display the current time and date. The time is displayed in hours, minutes, and seconds. Hours and minutes are displayed with large 2.25” digits. Seconds are slightly smaller for easy distinction. The date is displayed in plain text by a 10-character, dot matrix display showing the day of the week, followed by the month and date. The date shall be displayed in the English, Spanish or French language.
2. The Digital Calendar Clock/Message Display shall receive power and data over a RJ45 connect CAT5E/6 cable via a Power-Over-Ethernet switch port. Once plugged into the LAN through a Power over Ethernet network switch, the Display shall be immediately functional and shall not require any network configuration or administration to function.
3. The Digital Calendar Clock/Message Display shall be supervised and monitored for connectivity to the network. Additionally, any Call Stations connected to the Display shall be monitored for call line failure. In the event of an open circuit, short circuit or short to ground, the System shall detect the fault and notify a designated console operator automatically

4. These Displays shall be designed for use in conjunction with the Master Clock/Message Host. All secondary clocks shall be synchronized with the Master Clock. Corrections shall be done instantaneously and all clocks shall display the identical time and date. In the event of a power failure, the System shall maintain accurate timekeeping during the outage. Once power is restored, all clocks shall be immediately updated with the correct time and date.
5. In addition to displaying the time, the Unit shall display textual messages in the dot matrix section of the display to the audio announcement that is being broadcast over the communication system speakers. These messages shall be used to alert personnel of an emergency or a situation of concern.
6. The Unit shall also display text-only messages independent of any audio messages.
7. In addition to plain text messages, the Digital Calendar Clock/Message Display shall also simultaneously display numerically-coded messages which can be activated independently to provide trained staff with additional context to the plain text messages.
8. The Digital Calendar Clock/Message Display shall include elapsed timer and count-down functions. Used in conjunction with a Timer Button Panel, users shall set the Clock to count upwards from zero to 24 hours or count down from a specified value to zero. Additionally, the unit shall have a local input that shall accept a relay closure to activate the elapsed or countdown timer operation. Timers embedded into pre-set plain text messages shall display messages for a pre-set period of time.
9. Messages shall be programmed using the Editor software or from a web based Graphical User Interface (GUI). Messages can be activated by the Master Clock/Message Host, allowing text to be displayed at specific times and days of the week. Messages shall be displayed using a variety of visual effects including scrolling or flashing single lines of text, as well as alternating between different lines of text. The dot matrix display shall default back to the date when not displaying messages.
10. The Digital Calendar Clock/Message Display shall be suitable for surface or recessed installations using the appropriate enclosure. For surface installations, the 2431-BBS enclosure is required. For recessed installations, the 2431-BBF enclosure is used. Two surface-mount enclosures shall be mounted back-to-back with a 2423 Dual Mounting Kit, creating a double-faced version.

2.25 DIGITAL CLOCKS

A. The Digital Clocks shall be Telecor model eCLK-2.5 / eCLK-4 or approved equal.

B. The eCLK-2.5 shall incorporate a 2.5" display and located as indicated on the drawings. It shall be suitable for surface or recessed installations using the appropriate enclosure. For surface installations, the 2421-BBS or approved equal Enclosure shall be used. For recessed installations, the 2421-BBF or approved equal Enclosure shall be used.

C. The eCLK-4 shall incorporate a 4" display and located as indicated on the drawings. It shall be suitable for surface or recessed installations using the appropriate enclosure. For surface installations, the 2431-BBS or approved equal Enclosure shall be used. For recessed installations, the 2431-BBF or approved equal Enclosure shall be used

D. The Digital Clocks shall utilize seven-segment, AlGaAs “Supper Bright” LED displays which provide exceptional visibility. The Clocks shall incorporate a single piece front cover that is free of grooves and gaps. This shall keep infectious contaminants out of the eClock. The cover's non-porous surface shall allow for easy, comprehensive, hygienic cleaning with anti-bacterial agents.

E. The Digital Clocks shall receive power and data through a Power-Over-Ethernet switch. The Digital Clocks shall not require any network configuration or administration to function. Once plugged into the LAN through a Power over Ethernet network switch, the Digital Clocks shall be functional.

F. These Displays shall be designed for use in conjunction with the Master Clock/Message Host. All secondary clocks shall be synchronized with the Master Clock. Corrections shall be done instantaneously and all clocks shall display the identical time and date. In the event of a power failure, the System shall maintain accurate timekeeping during the outage. Once power is restored, all clocks shall be immediately updated with the correct time and date.

G. Two surface-mount enclosures shall be mounted back-to-back with a 2423 Dual Mounting Kit, creating a double-faced version.

2.26 ANALOG SECONDARY CLOCKS

A. The Analog Secondary Clocks shall be Telecor eACLK eSeries Analog Clocks or approved equal. Analog Clocks shall reside on a facility’s data network and shall use Power-over-Ethernet technology to receive power and data for operation and synchronization.

B. All Analog Clocks on the LAN shall be continuously synchronized to a Time Service connected anywhere on the same network. Time corrections shall be performed

instantaneously so that all Analog Clocks display the correct time. If communication is lost with the Time Service, the Analog Clock shall maintain the time independently. Once communication with the Time Service is re-established, the Clock shall automatically resynchronize with the Time Service.

C. The Analog Clock shall connect to a PoE drop at a network switch. Up to two single-face clocks or one dual-face clock shall be supported from a single network port. Dual face models shall also be available for wall or ceiling mounting.

D. The Analog Clock shall incorporate a network port and provide PoE Power and Data for a Network Speaker and associated call stations in classroom locations. Clocks that cannot support a Network Speaker and call stations from a single network drop, requiring 1 Network drop for the analog clock and a 2nd Network drop for the classroom speaker will not be accepted. The speaker shall be installed using CAT-5/6 cable, and shall support network speakers at distances of up to 328 feet (100 m) away from Analog Clock.

E. The speaker stations that shall be used with the Clock include: a paging-only eS8-MA speaker, an eS8-TB-MA Talkback Speaker, an eS8-TB4-MA Talkback Master Speaker with additional satellite speakers, or a conventional 8-ohm speaker connected to an eSBM-TB Speaker Breakout Module. In addition, the eSeries speaker shall support normal and emergency Call Stations and auxiliary devices such as strobe lights, tone initiating devices and door locks.

F. The clock assembly shall incorporate a durable steel case in either 12” or 16“ face size as indicated on the drawings.

2.27 EMERGENCY NOTIFICATION

A. The system shall be capable of providing emergency notifications by email and SMS to mobile devices and designated PC’s. during an emergency utilizing DWConnect LT This feature will notify all relevant staff members so that they are made aware of the emergency event and can respond appropriately. Up to 100 users can be supported directly. When integrated with the facilities email server to effectively distribute notifications to an unlimited number of alert devices.

B. Alert devices may be mobile phones and smart devices. Mobile phones shall receive the notifications as SMS messages while smart devices shall receive email messages.

C. When deployed, the Emergency Notification Feature shall support the Fault Monitoring capabilities of the Master Clock/Message Host. Trouble/Fault notifications from eSeries devices shall be annunciated on the visual console with a flashing Icon.

Activation of this icon shall distribute notifications of a fault to appropriate technical support staff.

2.28 VUALERT EMERGENCY ALERT

A. The Emergency Alert Components shall be VuAlert or equal. The VuAlert platform shall consist of Dynamic Displays, Dynamic View Adapters and Integrators as located on the drawings and specifications.

B. The platform shall allow visual displays to be integrated into Telecor's eSeries. These displays shall show the time, weather, information, alarms, messages, and emergency alarms. Multiple visual layouts and color schemes shall be available for use. The time shall be displayed as either an analog or digital clock. Messages and emergency alarms shall include plain text and audio. Messages shall have the ability to be scheduled to appear at certain times and days of the week. Live local weather at the facility shall also be shown on each screen.

C. Messages shall be configurable to appear on specific displays and zones (which shall group together multiple displays).

D. Severe weather notifications issued by the National Oceanic and Atmospheric Administration (NOAA) shall activate weather alerts automatically.

E. Emergency alarm screens shall be activated from the eSeries Visual Console GUI. This shall allow complete integration with an operational control from the facility's Telecor communications system. VuAlert emergency alarms shall activate in conjunction with the delivery of SMS text messages and email notifications.

F. The VuAlert platform shall support an unlimited number of displays. All displays shall have adjustable brightness levels. A scheduled sleep mode feature shall be available for further energy conservation. Should a VuAlert display lose power, it shall automatically resume regular operation upon power and network restoration.

G. Displays shall connect via wired Ethernet or wireless Wi-Fi to the facility LAN which shall have access to the VuAlert cloud-based web portal. This portal shall be used to manage and configure the VuAlert platform and its features. The cloud-based nature of the VuAlert platform shall provide the ability to manage different sites, each with their own sets of displays, through the web portal.

H. The Dynamic Display shall be a Telecor model VA-DD or approved equal as indicated on drawings. It shall consist of a 22" HD screen. The Dynamic Display shall be equipped with both wired and wireless network adapters for connection to the facility LAN.

I. The Dynamic Display shall be wall mounted with the VA-B surface mount bracket in either a landscape or portrait orientation.

J. The Dynamic View Adapter shall be a Telecor model VA-DVA or approved equal as indicated on drawings. It shall allow any third-party display capable of receiving HDMI input to serve as a VuAlert display. This shall include large-format HD resolution displays. The Dynamic View Adapter shall include wired and wireless network adapters to allow the display to connect to the facility LAN.

K. The Integrator shall be a Telecor model VA-I or approved equal as indicated on drawings. It shall provide integration between Telecor's eSeries System and the VuAlert platform.

L. VuAlert messages and emergency alarms shall have the ability to be configured so that they can be activated from Visual Console.

EXECUTION

3.01 GENERAL

A. Install the system in accordance with the manufactures printed instructions and recommended cable types.

B. Provide point-to-point wiring diagrams showing location of all wire pulls. Mark all cables corresponding to point-to-point wiring diagrams.

3.02 TESTING AND ACCEPTANCE

A. System Acceptance Test

1. Have the company field adviser adjust the completed system to desired volume levels of customer.
2. The system shall operate for at least two weeks with no failures or changes required.
3. Test every circuit in the system to ensure proper operation.
4. Test each daily function school will be using making sure staff is knowledgeable in the operation of the system.

3.03 CLOSEOUT

A. The Contractor shall provide a one-year warranty of the installed system against defects in material and workmanship. All labor and materials shall be provided at no expense to the Owner during normal hours. The warranty period shall begin on the date of acceptance by the Owner.

B. The Contractor shall, at the Owner's request, make available a service contract offering continuing factory authorized service of this system after the initial warranty period.

C. The system manufacturer shall maintain engineering and service departments capable of rendering advice regarding installation and final adjustment of the system.

END OF SECTION 275116

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SECTION 275319

DISTRIBUTED ANTENNA SYSTEM (DAS)

PART 1 - GENERAL

1.01 SUMMARY

A. The contractor will design, furnish, install, and provide a five (5)-year warranty for a Fiber Distributed Antenna System (DAS) In-Building First Responder Network. See other sections in this specification for additional warranties relating to other system components. The installed system will include fiber optic cabling in conduits, roof mounted antenna, indoor antenna, antenna system integrity alarm, 70% of battery capacity remaining alarm, alarms remoted to fire control room using an independent fire control panel, alarm interface compatibility to standard fire alarm panels, all hardware, bi-directional amplifiers, band-pass filters, surge suppressors, lightning protection, transmission lines, power cabling, coaxial cabling in conduits, UPS, repeaters, design/installation labor, etc.

B. The contractor must provide the turnkey installation of a complete, working, in-building fiber based DAS-based signal booster system including design, installation with UPS to hold DAS operational for a minimum of 24 hours setup and optimization.

C. The purpose of this system is to provide communication coverage for public safety personnel when performing their duties in the building. The intent of this system is to provide the coverage, so that these personnel will be able to communicate anywhere within the building, to exterior commanders, personnel, and dispatchers under the worst of conditions.

D. Active Distribution. Active components shall be interconnected only with single-mode fiber optic cable.

E. Remote Management. The DAS shall provide for remote configuration, control, and monitoring of active components.

F. An automatic monitoring system with a dedicated panel in the emergency command center of the building is required.

G. Network Management System (NMS): The DAS shall have a NMS capable of alarm, monitor, configuration and control of all Active Components.

H. Simple Network Management Protocol (SNMP) Alarm Reporting and SNMP Integration: The DAS NMS shall be capable of integration with third party SNMP based NMS products for alarm purposes and provide alarming information.

I. Public Safety Network (PSN) Approval. The Contractor shall design and implement a DAS capable of receiving the approval or certification from the local operator(s) of a

respective band.

1.02 DEFINITIONS

A. ATTENUATION: The reduction in signal power, expressed in decibels, as a result of coupling, heat loss, or transmission distance in a cable or in air.

B. BDA: Bi-directional amplifier in-building radio communication system that brings wireless signals into a structure from outside, amplifies those signals with a signal booster, and then evenly distributes the amplified signals throughout a structure via a Distributed Antenna System (DAS). The system also amplifies signals originating inside the building and transmits them outside.

C. CABLE ASSEMBLY (JUMPER): Short length of flexible coaxial cable used to attach antennas or other components to the main coaxial cable distribution system.

D. DAS: (Distributed Antenna System): A network of service antennas connected at intervals along shielded coaxial transmission lines and all connected to head-end electronics amplifying the signals to be distributed. Often refers to a system that includes both the passive distribution system and the active amplifying electronics.

E. DIRECTIONAL COUPLER: A component which directs a small portion of downstream RF energy to a port which can be connected to an antenna or another branch of distribution cabling, and also serves as a combiner of upstream energy between the tap port and the through connection.

F. DONOR ANTENNA: The antenna, usually mounted on the outside of a structure where a DAS is installed, which picks up signals over-the-air from a donor source.

G. DONOR SOURCE: The repeater, transceiver, cell site or other radio site that produces signals which a DAS will relay and distribute.

H. REFLECTED POWER: Power which is reflected back along a transmission line as a result of discontinuities in line impedance caused at connectors or close proximity of metallic objects.

I. RF (RADIO FREQUENCY): Energy from electromagnetic waves, or alternating currents that produce electromagnetic waves, in the spectrum of radio frequencies (30 kHz to 300GHz).

J. SPLITTER: A passive component that has a single input port and two or more output ports, effectively splitting the signal equally amongst the output ports. It also serves to combine upstream signals from the "output" ports into composite signals at the "input" port.

K. TERMINATION: A device that is installed on the end of a transmission line to provide a pure resistive 50-ohm load.

1.03 REFERENCES

A. Codes and orders: The design of all equipment and materials shall conform to the following codes and orders:
   1. NFPA-72 2016.
   2. IFC 2018, 510.4 and 510.5
   3. NFPA 1221 216.

B. Rules, Regulations and Plans:
   1. FCC Rules and Regulations 47 CFR

C. Standards: The following standards shall apply to the design work, and are hereby made a part of these Specifications to the extent referenced:
   1. Telecommunications Industry Association (TIA) Technical Systems Bulletin TSB 88-A.

1.04 CONTRACTOR QUALIFICATIONS AND WORKMANSHIP

A. The Contractor shall provide documentation demonstrating five (5) years of experience designing, installing, and commissioning DAS solutions of a similar scope and complexity.

B. The Contractor shall provide documentation demonstrating certification from the manufacturer of the active components of the DAS.

C. The Contractor shall comply with the latest editions of the National Electrical Code, National Electrical Safety Code, National Contractor's Association Standard of Installation, relevant local regulations, and manufacturer's instructions during the design, installation, and commissioning of the DAS.

D. The Contractor shall provide documentation demonstrating NICET IB-PSC Level II certification.

1.05 DAS PERFORMANCE SPECIFICATIONS

A. The primary requirement is to provide in-building signal booster systems that must receive and re-transmit to support Sherriff and Fire Radio Systems used in Williamsburg, VA. This system must be state-of-the-art, operating bi-directionally and in full-duplex.

B. Public Safety Network Approval. The contractor shall design and implement a DAS capable of receiving the approval or certification from the local operator(s) of a respective band.

C. Active Distribution. Active components shall be interconnected only with single-mode fiber optic cable.

D. Remote Management. The DAS shall provide for remote configuration, control, and monitoring of active components.

E. PERFORMANCE

1. The DAS shall meet or exceed the Minimum Downlink Receive Signal Level (RSL) as required by the local juridiction.

F. Completed installations (including cabling) must comply with all applicable codes and standards, including County Building and Electrical Codes, NFPA, ANSI, NEC, OSHA, EIA, IEEE, R-56 etc., as well as, the FCC Rules and Regulations, as applicable. The system shall use fiber optic cable to minimize any cable losses. Equipment provided must be UL listed and the FCC type accepted for this specific application. Compliance to codes and standards must extend to include proper grounding, bonding and surge protection. A coverage Acceptance Test shall be executed prior to final acceptance of an installed system. Coverage acceptance testing shall be based on audio quality performance in evenly spaced test grids in the defined service areas. A minimum of 20 (twenty) tests will be taken per floor/level.

1. Refer to the IFC Section 510 EMERGENCY RESPONDER RADIO COVERAGE. All new buildings shall have approved radio coverage for emergency responders within the building based upon the existing coverage levels of the public safety communication systems of the jurisdiction at the exterior of the building.

G. The proposed system will provide digital signal strength coverage over 99% area on each floor/level of the equipped building, or in specific areas defined by the District of Columbia in a Scope of Work document for a particular building or site. Systems must provide a minimum digital and analog coverage of Circuit Merit (CM) 3, with a reliability factor of 100%. A Coverage Acceptance Test must be executed prior to final acceptance of an installed system. Coverage acceptance testing must be based on audio quality performance in evenly spaced test grids in the defined service areas. A minimum of twenty tests will be taken per floor/level. Total number of test grids will be determined by the City of Williamsburg, based on the size of the space per floor/level.

H. The DAS system shall be powered by the building’s electrical distribution system. A transient voltage surge suppressor shall be provided as part of the bidirectional amplifier design, and protect the incoming power line from transients.

I. Provide uninterruptable power source(s) (UPS) capable of maintaining the system operational for a period of at least 24 hours per IFC Section 510 (appendix J)

J103.1.3 secondary power.

J. The DAS unit shall be furnished in a wall mounted NEMA 4 cabinet. The cabinet shall have a front door that is provide with a locking handle. Provide twelve (12) sets of keys. Adequate space inside the cabinet shall be provided for servicing the unit. The unit shall be labeled with an exterior nameplate stating “Radio Amplifier”. Internal components shall be identified with labels. The cabinet shall be large enough to dissipate internal heat without venting the inside of the cabinet to the outside atmosphere. External or exposed filters or openings are unacceptable.

K. In-building antenna system: The in-building antenna system shall consist of a sufficient number of antennas and/or radiating cable distribute with the building to meet the -90 dBm, or 10 dB above noise floor, design criteria throughout the building. Coaxial power dividers shall distribute and balance the radio signals into appropriate branch circuits connecting back to the DAS.

1. Each splitter shall be mounted in a separate junction box located so as to be easily accessible for maintenance while maintaining security from tampering. Each junction box shall be labeled externally. Also, provide label below grid indicating junction box location above.
2. Antenna Isolation: Provide an antenna isolation requirement of 15 dB higher than the gain of the amplifier per NFPA requirements.

L. Degraded performance in emergencies:

1. The signal booster shall be designed to allow degraded performance in adverse conditions, such as high temperatures in the event heat from a nearby fire, voltage fluctuations or other abnormal conditions that may occur during an emergency. Circuits that intentionally disable the signal booster in such situations (i.e. under/over voltage, over/under current, over/under temperature, high VSWR, etc.) are not acceptable. It is the purpose of this specification to assure the maximum possible level of communications to public safety personnel depending upon the signal booster even to the extent of damaging the signal booster as long as some communications benefit can be provided during the emergency.

M. During initial installation, each system must be optimized to perform in accordance with the specifications set forth in the system design, manufacturer’s specifications and FCC regulations. The contractor must ensure that uplink and downlink levels are properly set and consistent with design expectations. The contractor must further ensure that noise and spurious products are held within limits set forth in the system

design, manufacturer's specifications and FCC regulations. Prior to system acceptance, for each active DAS, booster amplifier, etc., the contractor must submit a Proof of Performance certification, that lists the design expectations, actual measurements, and, if applicable, FCC specifications for the following parameters:

1. Worst case DAS uplink input level, in dBm.
2. Worst case DAS uplink output level, in dBm.
3. DAS downlink input level, in dBm.
4. DAS downlink output level, in dBm.
5. Noise and spurious products, DAS uplink output, in dBc.
6. Noise and spurious products, DAS downlink output, in dBc.

N. The original Proof of Performance report must be submitted to Owner, and a copy of the Proof of Performance report must be affixed to its associated equipment.

O. The system is designated for in-building use and must be designed and quoted as follows:

1. Design and appearance will be of " finished" construction, etc. must be concealed and/or unobtrusive in the all finished areas. Flush-mount ceiling antennae may be acceptable on a case-by-case basis. Proposed wiring methods in areas of open ceiling shall be submitted and approved by A/E prior to installation.

1.06 SUBMITTALS

A. Comply with Division 01 requirements.

B. Provide Product data. Include dimensions and manufacturers' technical data on features, performance, accessories, and finishes.

1. Component data sheets
    a. Donor and in-building antennae
    b. Coaxial cable, connectors, splitters, combiners, and couplers
    c. Fiber optic cable and connectors
    d. Bi-directional amplifier(s) (BDA)
    e. Fiber optic master unit(s)
    f. Fiber optic remote unit(s)
    g. Network Management unit(s)
    h. Antenna mast
2. Design documents
    a. RF link budget
    b. Overlay of system components on floor plans

c. Donor antenna and grounding drawings
d. Bill of Materials (BOM)
e. Maintenance Service Contract
f. Statement of Work (SOW): The contractor shall submit a SOW that has been accepted by the customer or customer's designated representative.
g. Acceptance Test Plan (ATP): The contractor shall submit an ATP that has been accepted by the customer or customer's designated representative.

C. Shop Drawings: For DAS head-end and distribution system.
1. Include dimensioned plans, elevations including panel, rack, and cabinet layouts, sections, details, and attachments to other work, including required clearances and service space around equipment.
2. Provide a riser diagram.
3. Provide floor plan with interior antenna locations.
4. Provide signal strength propagation modeling in 3D.
5. Show fabrication and installation details of antenna mast and base. Designate components and accessories, including clamps, brackets, fittings, etc.
6. Detail fabrication, including anchorages and attachments to structure and to tower.
7. Dimensional Plan and Elevations of Head-end Equipment: Show access and workspace requirements.
8. Wiring Diagrams: For power, signal, and control wiring and transmission cable, include cross connects, taps, equipment interconnection diagrams, and other connections, cords.
9. Show locations of bonding connections.
10. Signal to Noise Interference Ration (SNIR) map.

D. Design Calculations: Calculate signal attenuation budget and show calculated line and equipment losses for the system based on the functional block diagram, to show that proposed system layout can be expected to perform up to the specification. Calculate signal strength from sources to endpoints. Allowable losses between components and user interface shall be used to determine size and type of cable.

E. Equipment List: Include each piece of equipment and include model number, manufacturer, serial number, location, and date of original installation. Insert testing record of each piece of adjustable equipment, listing name of person testing, date of test, and description of as-left set points.

F. Field quality-control test reports. Submit written test reports to include the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

G. Submittal Requirements at Close Out
   1. Drawings: Submit as-built drawings indicating:
      a. Donor antenna, grounding and lighting protection details
      b. Cable routing, splitters, couplers and coverage antenna locations
      c. Active component locations, layout and configuration
   2. Test Reports
      a. Submit Accepted ATP reports confirming the requirements been met.
   3. Field Reports: Submit sweep-testing results for all cable runs.
   4. Field Reports: Submit OTDR test results for all fiber runs.
   5. Operation and Maintenance Data: Submit hardware and software manuals for all Active Components.
   6. Warranty Documents:
      a. Submit for all manufactured components specified in this Section.
      b. Submit Contractor’s System Warranty.
      c. Submit Manufacturer' s Extended Warranty.

H. Operation and Maintenance Data: For head-end and distribution system to include in emergency, operation, and maintenance manuals:
   1. Refer to Division 01 Section “Operation and Maintenance Data”.
   2. Instructions for periodic testing and inspection.
   3. Tests shall be to determine if impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not. Include recommended testing intervals.
   4. Service Manuals:
      a. Service manuals shall be supplied for each signal booster. The minimum contents of each manual shall include:
         1) Operating and installation detail.
         2) Block (sub assembly) overall circuit diagram with assembly number detail.
         3) Mechanical assembly drawing with part number detail.
         4) Detailed schematic circuit diagrams listing all components and locations.

5) Detailed parts list.

b. Equipment provided without detailed schematics and parts lists are unacceptable.

I. Qualification Data:

1. Certification of in-building system training issued by a nationally recognized organization or school.
2. For factory trained technician/installer.

J. Copy of valid FCC issued General Radio Operators License for:

1. System designer
2. Tester
3. Lead installation personnel

K. Provide training/education certificate issued by equipment manufacturer of equipment being installed.

L. Field quality-control reports.

M. Provide documentation demonstrating certification from the manufacturer of the active components of the DAS.

N. Warranty Documents:

1. Contractor' s system warranty.
2. Manufacturer' s extended warranty.

1.07 COORDINATION

A. Coordinate layout and installation of ceiling-mounted antenna system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.08 QUALITY ASSURANCE

A. The minimum qualifications of the system designer, tester, and lead installation personnel shall include:

1. A valid FCC issued General Radio Operators License.
2. Certification of in-building system training issued by a nationally recognized organization or school.
3. Provide training/education certificate issued by equipment manufacturer of equipment being installed.

B. Installer Qualifications: Factory trained technician who is trained and approved for installation of units required for this Project.

C. Testing Agency Qualifications: Qualified agency, with the experience and capability to conduct testing indicated.

D. Source Quality Control: Materials and equipment shall be new, unused and UL listed (UL Standard 1459).

E. The system and components shall be supplied by one manufacturer of established reputation and experience who shall have produced similar apparatus for a period of at least ten (10) years and who shall be able to refer to similar installations rendering satisfactory service.

1.09 WARRANTY

A. Refer to Division 01 Section “Warranties”.

B. The DAS System and Alert Radio System Trades shall warrant this system for a minimum of five (5) year against defective parts and/or workmanship and shall provide parts and labor to fulfill this warranty at no cost to Owner.

1. Five (5) year limited warranty from the date of system acceptance on splitters, couplers, and in-building antennae
2. Twenty year limited warranty from date of system acceptance on coaxial cable, fiber optic cable and connectors

C. Under warranty coverage, the successful contractor must provide same business day response time for system malfunctions.

D. The contractor must perform optimization of each system during the initial warranty period, sixty (60) to ninety (90) days prior to warranty expiration. This optimization task is separate from the initial optimization performed during system installation. The contractor must include pricing for annual system optimization to be included as part of post-warranty maintenance.

E. Actual scope of work for annual optimization and maintenance will vary on a case by case basis, but will typically consist of the following:

1. Optimize the system to perform in accordance with the specifications set forth in the system design, manufacturer’s specifications and FCC regulations.
2. Ensure that uplink and downlink levels are properly set and are consistent with design specifications.
3. Ensure that noise and spurious products are held within limits set forth in the system design, manufacturer’s specifications and FCC regulations.
4. Update the Proof of Performance records for the system, listing the design expectations, actual measurements, and, if applicable, FCC specifications for the following parameters:
    a. Worst case DAS uplink input level, in dBm.
    b. Worst case DAS uplink output level, in dBm.

c. DAS downlink input level, in dBm.
d. DAS downlink output level, in dBm.
e. Noise and spurious products, DAS uplink output, in dBc.
f. Noise and spurious products, DAS downlink output, in dBc.

5. The updated Proof of Performance report must be submitted to the Owner, and a copy of the updated Proof of Performance report must be affixed to its associated equipment.
6. Visually inspect outside antenna installation. Correct any issues found with the antenna mounting hardware, grounding system, or outside cabling.
7. Visually inspect inside DAS or booster amplifier equipment installation. Correct any issues found with RF cabling, electrical connection, or equipment mounting.
8. Clean equipment fans, filters and other ventilation system components.
9. Inspect and replace any defective indicator lights.
10. Test UPS system performance for proper fallback to battery power and the duration of battery operation.
11. Test fault reporting system for proper operation and reporting of system faults.

F. Submit a written Preventive Maintenance Report to Owner, listing the results of the optimization and preventive maintenance effort. The report must include the Proof of Performance report for active RF components, and details of any other discrepancies found and corrective actions taken.

1.10 MAINTENANCE

A. The Contractor shall provide an optional maintenance service contract, covering for a period of one-year: preventative maintenance, system monitoring, spares, fault mitigation, equipment repair, and response time.

PART 2 - PRODUCTS

2.01 GENERAL

A. The contractor shall design, furnish, install, and warranty a complete signal booster system for the DAS. The installed system shall include all hardware, bi-directional amplifiers, band-pass filters, surge suppressors, lightning protection, UPS, transmission lines, power cabling, antennas, and other components necessary for a complete operational system as specified and as acceptable to the local authorities having jurisdiction.

2.02 ROOF ANTENNA

A. A lightning surge suppressor shall be connected to the feed line in-between the antenna and the DAS. A cooper grounding plate shall be provide with the surge

suppressor, and bonded to the grounding system. The DAS is to be installed the building, the surge suppressor will be installed the building at the cable penetration point. Building penetration for the feed line cabling shall be protected with a waterproof/UV stabilized cable boot suitable for the installation, or with an electrical service weather head with a cable drip loop.

B. The antenna system, antenna mast, cable, and surge suppressor shall be grounded by attachment to the building's grounding system. Grounding cable shall be sized according to manufacturer's recommendations.

2.03 IN-BUILDING OMNI-ANTENNA

A. 360° omnidirectional in-building antenna, 680-960 MHz and 1710-2700 MHz; impedance 50 ohm; maximum input power 50W. Color - white, ceiling mount. Provide thru-hole ceiling mount, pigtail cable KSR195, plenum rated, RF Connector: N Female.

1. Provide wire guards where required.

2.04 RADIO FREQUENCY (RF) DAS-BASED SIGNAL BOOSTER SYSTEMS

A. In-building signal booster systems shall receive and re-transmit the entire uplink/downlink frequency band utilized by the regional emergency service provider(s). The contractor shall confirm with the regional emergency service provider(s) as to the specific frequencies used by the various agencies. This system shall be state-of-the-art, operating bi-directionally and in full duplex. The system shall be fully compatible with and function on Willliamsburg VA's Public Safety Radio System.

2.05 CABLES AND CONNECTORS

A. All cables are to be plenum rated. Cabling installed on exterior of building or under slab to be rated for installation type.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The DAS and backup power housing shall be mounted side by side. An electric circuit breaker with one (1) 20 amp 120 VAC emergency dedicated receptacle shall be provided for the Distributed Antenna System (DAS) head-end. Provide one (1) 20 amp branch circuit for each future micro cell or similar equipment. Each remote unit requires one (1) 20 amp 120 VAC receptacle branch power circuit. Locate remote unit receptacle within 4-feet of the remote unit. Each back up power supply shall have one (1) 20 amp dedicated receptacle branch circuit. The number of remote units and location shall be determined via calculations and modeling of propagation results

during design of the system and shall be shown on the shop drawings and shall be verified in the field at the time of installation. Remote units are wall mounted and require a wall space of 30-inches wide x 36-inches high. Once design of system has been completed, Contractor shall determine circuit(s) to be utilized at the direction of the Engineer.

B. All exterior cable shall be installed in a 2-inch conduit.

C. NEMA 4 Enclosures. All equipment such as radios and power systems supporting this network shall be housed in NEMA 4 compliant enclosures.

D. Pathways: Pathway survivability shall either:
   1. Provide for metal raceways for interconnecting conductors, cables or other physical pathways.
   2. Provide pathways that are routed through 2-hour rated fire enclosures or protected areas.

3.02 TESTING

A. Upon completion of installation, the radio system tested to ensure that two-way coverage on each floor of the building reveals a minimum signal strength of -95 dBm in 99 percent of the building’s area. In addition, the quality of radio signal shall be no less than Delivered Audio Quality (DAQ) 3.4 as defined by the Telecommunications Industry Association (TIA). The test procedure shall be conducted as follows:
   1. Each floor of the building shall be divided into a grid of 20 approximately equal areas.
   2. The test shall be conducted using a calibrated portable radio of the latest brand and model used by the Williamsburg Public Safety Radio System talking through the agency's radio communications system.
   3. A maximum of two nonadjacent areas shall be allowed to fail the test. This cannot be determined until the grids and test results are in.
   4. In the event that three of the non-adjacent areas fail the test, in order to be more statistically accurate, the floor may be divided into 40 equal areas. A maximum of four nonadjacent areas shall be allowed to fail the test. If the system fails the 40-area test, the system shall be altered to meet the 99% coverage requirement.
   5. A test location approximately in the center of each grid area shall be selected for the test, then the radio shall be enabled to verify two-way communications to and from the outside of the building through the public agency's radio communications system. Once the test location has been selected, that location

shall represent the entire area. If the test fails in the selected test location, that grid area shall fail, and prospecting for a better spot within the grid area shall not be allowed.

6. The gain values of all amplifiers shall be measured and the test measurement results shall be kept on file with the building owner so that the measurements can be verified during annual tests. In the event that the measurement results become lost, the building owner shall be required to rerun the acceptance test to reestablish the gain values.
7. As part of the installation a spectrum analyzer or other suitable test equipment shall be utilized to insure spurious oscillations are not being generated by the subject signal booster. This test shall be conducted at time of installation and subsequent annual inspections.

B. The minimum qualifications of the system designer, tester and lead installation personnel shall include:
   1. A valid FCC-issued General Radio Operators License; and
   2. Certification of in-building system training issued by a nationally recognized organization or school or a certificate issued by the manufacturer of the equipment being installed.
   3. Personnel may be exempt from these requirements upon successful demonstration of adequate skills and experience satisfactory to the City of Williamsburg Emergency Manager or designee.

C. Final tests and inspection shall be held in the presence of Architect/Engineer's representatives, and to their satisfaction. The Contractor shall supply personnel and any required auxiliary equipment for this test without additional cost.

3.03 TECHNICAL ASSITANCE AND TRAINING

A. A factory trained technician for the DAS System Trade shall instruct the proper designated authority on the programming and correct operation of the system after the installation is completed. This instruction shall be scheduled at the convenience of the staff. Provide eight (8) hours of training.

END OF SECTION 27 53 19 275319

SECTION 283111

BUILDING INTRUSION DETECTION

PART 1 - GENERAL

1.1 REFERENCE TO OWNER'S GENERAL CONDITIONS

A. The Owner's / Project General Conditions shall be considered part of this Specification. Unless this Section contains statements, which are more definitive or more restrictive than those contained in the Owner's General Conditions, this Specification shall not be interpreted as waiving or overruling any requirements expressed in the General Conditions documentation.

1.2 SUMMARY

A. Statement of Work: The work of this section includes, but is not limited to the following:

1. Provide and install complete and operational Building Intrusion Detection System as described in this Specification Section and related drawings and documentation requirements as set forth within this documentation.
2. Systems and Components Specified in this Section shall be provided by Owner's Assigned Subcontractor, Hudson and Payne, as indicated in the Bidding Document.
3. Conduits, sleeves, electrical boxes and power for all Building Intrusion Detection System components specified in this Section shall be provided under the General Contractors scope as indicated on Drawings and in Division 28 Specification Sections.
4. The General Contractor shall coordinate the work efforts of the Owner's Assigned Subcontractor with all other trades.

B. All facilities, materials, equipment, transportation, and necessary labor for a complete and operational Building Intrusion Detection System integrated with Access Control Components provided by separate Owner's Contractor, as described herein.

C. Additional Contractor requirements:

1. Required licenses and permits including any required bonding or insurance requirements that comply with general conditions of specifications and contract documentation.
2. Verification of dimensions and conditions at the job site.
3. Installation in accordance with the contract documentation, applicable installation procedures or codes as set forth by the state or county of the project or manufacturer's recommendations.
4. Submittal information and provisions.
5. Documented System testing procedures.
6. Instruction of operating personnel.
7. Manuals and provisions thereof.
8. Maintenance and warranties.

1.3 RELATED DOCUMENTS

A. General: Comply with all Contract Documents.

1.4 RELATED WORK

A. The Contractor shall coordinate with Electrical Contractor on raceway / junction box locations/power needs for equipment and routing of cables / raceway from equipment, terminal and pull boxes to system equipment racks and or wall fields.

B. Related Work: Equipment and materials provided and installed by others, unless otherwise shown in this Section or the Drawings, shall include but are limited to:

1. Section 07 84 00 – FIRESTOPPING
2. Section 08 11 13 – HOLLOW METAL DOORS AND FRAMES
3. Section 08 33 23 – OVERHEAD COILING DOORS
4. Section 08 71 00 – DOOR HARDWARE
5. Section 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
6. Section 26 05 29 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
7. Section 26 05 33 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS
8. Section 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

1.5 DEFINITIONS

A. Regardless of their usage in codes or other industry standards, certain words or phrases as used in the Drawings or Specifications for the Work, shall be understood to have the specific meanings as ascribed to them in the following list:

1. The term “Contractor” – Integrator who has been awarded or assigned the contract to perform the work under this section.
2. The terms “shall” is mandatory, “will” is informative, and “should” is advisory.
3. “Provide” – To supply, install, connect, and configure, for safe intended normal operation.
4. The terms “Indicated”, “shown”, or “noted” – As indicated on drawings or specifications.
5. The terms “Equivalent”, “similar”, or “equal” – equal in materials, size, color, design, and efficiency of specified product, conforming to base bid manufacturer selections.
6. The terms “Reviewed”, “satisfactory”, “accepted”, “approved”, “directed” – As reviewed, satisfactory, accepted, approved, or directed by the Owner or Owner’s Representative.
7. The term “Professional grade” – Equipment that is intended for commercial use and is rated for continuous 24-7 use.
8. The term “User-friendly controls” – Touch screen graphical user interface (GUI) or other graphical controls that are intuitively configured for ease of use in a logical, easily recognizable, configuration that utilizes industry standard symbols wherever applicable.
9. The term “Labels” – refers to labels on audio-visual equipment as outlined in Section 3.4.
10. The abbreviation "OFE" refers to items that are Owner Furnished Equipment
11. The abbreviation "OFCI" refers to items that are Owner Furnished Contractor Installed Equipment
12. The abbreviation “VSS” refers to video surveillance system.
13. The abbreviation “CCTV” refers to closed circuit television camera systems and components.
14. The abbreviation “ALM” refers to an integrated alarm system and components.
15. The abbreviation “ACS” refers to an integrated access control system and components.

1.6 REFERENCE STANDARDS, REFERENCE MATERIALS AND/OR CODES

1. Applicable Codes and Standards: Systems shall be installed in accordance with the latest applicable revisions pertaining to all applicable national, state, and local codes and standards including, but not limited to the following:

    a. Federal, State and Municipal Building Codes and all other Authorities having jurisdiction.
    b. International Building Code / BOCA National Building Code
    c. National Electrical Code (NEC)
    d. American Standards Association (ASA)
    e. Electronics Industries Association (EIA)
    f. Institute of Electrical and Electronic Engineers (IEEE)
    g. National Electrical Manufacturers Association (NEMA)
    h. Occupational Safety and Health Administration (OSHA)

2. National Fire Protection Agency NFPA

    a. NFPA-70 National Electric Code in particular the following sections:

        1) Sect 300: Wiring in ducts plenums, and other air handling spaces.
        2) Sect 318: Cable trays
        3) Sect 645: Electronic Computer / data processing equipment.
        4) Sect 760: Fire protection signaling system.
        5) Sect 770: Optical fiber cables
        6) Sect 780: Closed-Loop and programmed power distribution.

    b. NFPA-71 Installation, Maintenance and use of Signaling Systems for Central Station Service.
    c. NFPA-72 National Fire Alarm and Signaling Code
    d. NFPA 72-D - Installations, Maintenance and Use of Proprietary Protective Signaling Systems
    e. NFPA 75 Protection of Electronic Computer Data Processing Equipment
    f. NFPA 262: Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces

3. IEEE

    a. IEEE 802.3: STANDARD FOR LOCAL AREA NETWORKS

4. Underwriters Laboratories (UL)

    a. UL Listed- Underwriter's Laboratories Listed
    b. UL 83: Thermoplastic-Insulated Wires and Cables
    c. UL 294: Access Control System Units / ULC Standard for Access Control Systems
    d. UL 611: Central Station Burglar Alarm Units and Systems
    e. UL 634: Standard for Connectors and Switches
    f. UL 639: Standard for Intrusion Detection Units
    g. UL 1076: Proprietary Burglar-Alarm Units and Systems
    h. UL 1581: Reference Standard for Electrical Wires, Cables, and Flexible Cords
    i. UL 1635: Standard for Digital Alarm Communications System Units.
    j. UL 1655: Standard for Community-Antenna Television Cables
    k. UL 1666: Standard for Test for Flame Propagation Height of Electrical and Optical-Fiber Cables Installed Vertically in Shafts

5. UL 1950 Information Technology Equipment, including Electrical Business Equipment ANSI / TIA / EIA:

a. ANSI C2: NATIONAL ELECTRIC SAFETY CODE
b. ANSI X3T9.5 STANDARD FOR FIBER DISTRIBUTED DATA INTERFACE (FDDI)
c. TSB-67: TRANSMISSION PERFORMANCE FOR FIELD TESTING OF UTP CABLING SYSTEM
d. TIA-222 STRUCTURAL STANDARD FOR ANTENNA SUPPORTING STRUCTURES AND ANTENNAS
e. EIA 232-D Interface between Data Terminal Equipment and Data Circuit-Termination Equipment Serial Binary Data
f. EIA RS-310-C Racks, Panel, and Associated Equipment
g. TIA-455-78 Revision B, FOTP-78 IEC 60793-1-40 Optical Fibers - Part 1-40: Measurement Methods and Test Procedures – Attenuation
h. TIA 568-B.1-2000 Telecommunications Standard
i. TIA-568-C.2 BALANCED TWISTED-PAIR TELECOMMUNICATIONS CABLING AND COMPONENTS STANDARDS
j. TIA/EIA-569-A-1995 (Commercial Building Standard for Telecommunications Pathways and Spaces)
k. TIA / EIA: 606a Telecommunications Infrastructure Standard
l. TIA / EIA: 607 Grounding and Bonding Requirements
m. EIA/CEA: 861 A DTV Profile for Uncompressed High Speed Digital Interfaces.
n. TIA-862 Revision B, February 29, 2016, Structured Cabling Infrastructure Standard for Intelligent Building Systems Document History

6. Video Coding Experts Group VCEG

a. H.262[1] or MPEG-2 Part 2
b. H.263
c. H.264/MPEG-4 AVC
d. H.264 or MPEG-4 Part 10
e. H.265 or High Efficiency Video Coding (HEVC),

7. References to codes and standards called for in the Specifications refer to the latest edition, amendments, and revisions to the codes and standards in effect on the date of these Specifications.

1.7 SCOPE OF WORK REQUIREMENTS

A. The Contractor shall provide a Building Intrusion Detection System compatible with the Owner’s existing Division-Standard system and operations.

B. The Contractor shall provide equipment that, where required, shall conform to the applicable requirements of the Underwriters Laboratories, Inc., local codes, the National Electrical Code, and any other governing codes. Such items shall bear a label or mark indicating their conformance to the above requirements.

C. The Contractor shall provide a complete and operational system configured and installed for user-friendly operation and low maintenance.

1. Provide one adjustment and calibration of the System, as directed by the Owner’s Representative, before Final Acceptance.
2. Provide one adjustment and calibration of the System, as directed by the Owner’s Representative, after Final Acceptance.

D. On-site factory technical support shall be provided, if necessary, to assure optimized configuration and performance of installed equipment and systems.

E. Installation work shall be in compliance with all Contract Documents, all applicable standards, governing codes, regulations, and authorities having jurisdiction.

F. The Contractor shall validate exact location and installation of the equipment, power, conduit, and raceway systems and coordinate exact location and installation of the equipment, power, conduit, and raceway systems with the Electrical Contractor.

G. All finalized software affiliated with the equipment, including but not limited to, the DSP, Control System, etc. is the property of the Owner and will be provided on labeled CDs or electronic media for archival purposes at project acceptance.

H. The Contractor shall supply all control software, programming service codes, programming notes, files interactive source codes, all media and associated software, touch panel design, all passwords, licenses, dangles and “keys” or other associated control or programming items at no additional cost to the Owner at commissioning.

1.8 SYSTEM DESCRIPTION AND REQUIREMENTS

A. The following is for a basic system description and is not intended to be exhaustive in nature and is not complete for proper installation or operation of system. The specification and the Contract Documents are complementary and together illustrate the full design intent.

B. The Intrusion Detection System shall be a state-of-the-art system designed to comply with the requirements for an integrated access control and proprietary alarm monitoring system.

C. Materials:

1. Furnish and install, at locations indicated on Drawings, the specified equipment to provide a completely operational Integrated Security Management System without additional cost to the Owner to complete installation or operation.
2. The following list of main items of the installation shall not be considered to be all-inclusive:

    a. Devices:
        1) Intrusion Detection Fire/Burglar Panel Honeywell Vista 250BPT or approved substitute
        2) Motion Detectors Honeywell Dual Tec, Infrared Passive or approved substitute.
        3) IP/Cellular Communicator
        4) Keypads
        5) Door Contacts
    b. Wiring for security/intrusion system.

D. Provide and install all equipment, components, wire, cable, antennae, and associated mounting hardware as required to meet manufacture’s specifications and documented installation procedures.

E. All material and equipment shall be standard, regularly manufactured equipment. All systems and components shall be thoroughly tested and proven in actual field use. Where possible, all

system components shall be from one manufacturer. Whenever components are included from sources other than the manufacture of the system, the Contractor shall demonstrate and verify that the components are compatible, prior to the system acceptance, and shall provide to the Owner that use of such components will not void or impair the system warranty.

F. The System will provide continuous year-round, 24 hours-per-day, 7 days-per-week operation. The major function of the System will be to provide controlled access, intrusion detection, surveillance and assessment and communications as required.

G. The System will incorporate the necessary components to collect, transmit and process alarms, tamper and trouble conditions, advisories, and access requests in accordance with security procedures. The Intrusion Detection System will support the normal flow of authorized personnel and vehicles through controlled-access points to maintain facility operating efficiency.

H. The Contractor shall comply with all codes, licenses, and regulations for state, county, and/or local governing body. This includes but not limited to: fail safe operating, power failure, and interfacing with fire control system.

I. The system shall provide both supervised and non-supervised alarm point monitoring. Upon recognition of an alarm. The system shall be capable of alarming or disarming alarm points both manually and automatically, by the time of day, and by the day of the week.

J. Alarm events with defined priorities shall be able to pop-up automatically in an Alarm event window for operator attention. The pop-up shall display the name of the event (reader, alarm point, card holder, or the system alarm), time, date, if a card event, the card number, type of event and cardholder's name. An event counter shall also display the number of times the event was reported to the Alarm event monitor prior to Acknowledgment or Clearing the event. Event instructions shall be made available by double clicking on the event.

K. The alarm event window shall allow the operator to initiate a physical response to the event as well as a written response. Responses shall include but not limited to: acknowledge, clear, open a preprogrammed floor plan, energize, de-energize, pulse, time pulse, add comment, shunt, or un-shunt.

L. The system programming shall be user friendly, and capable of being accomplished by personnel with no prior computer experience.

M. After installation, the Owner shall be able to perform hardware configuration changes. These hardware configuration changes shall include, but not limited to, door open time, door contact shunt time, point and reader names, when and where a cardholder is valid, and the ability to add or modify card databases as desired without the services of the Contractor or Manufacturer.

N. System Monitoring and Control

1. The MDF will be the focal point for monitoring and controlling System equipment, it will be able to operate unattended. To preclude unauthorized use, the operator workstations will be protected by a multi-level password scheme. All operator log-on and log-off transactions will be automatically stored in a historical file for future recall.

O. Data Processing and Storage

P. The processing and storage of system status and database information will be performed by the Access Control System (ACS) server to support the real-time operation of the Intrusion Detection System and for the initiation of system data and control signals in response to operator requests and software application programs. The ACS server will be rack-mounted in the MDF Room. The ACS server will communicate with the operator workstations over the facility Local Area Network (LAN) or (VLAN) via CAT6A cable.

1. To assure adequate expansion capability, ACS server working memory and archival storage will be provided with a spare capacity of at least 50 percent of initial requirements with provisions for a minimum growth capability of 100 percent of initial capacity.
2. To prevent unauthorized access and manipulation, the ACS server programs and databases will be protected by a multi-level password scheme.

Q. Signal Transmission

1. The Intrusion Detection System will support a distributed data collection and processing scheme.
2. This ACP will be connected via CAT6A cable from the Network Interface Card to the Network switch.
3. Video signals from interior CCTV cameras and exterior CCTV cameras mounted on the side of the building will be transmitted to the nearest dedicated Surveillance and Assessment System (SAS) network switch via CAT6A cable.
4. The design of the Intrusion Detection System will incorporate line supervision features to detect any attempt to compromise the signal lines between system components. The level of line security provided will meet or exceed the requirements for Grade AA service as defined in UL 1076.
5. IP master and remote intercoms within 290 feet of a LAN drop will communicate over the facility LAN via CAT6A cable. Exterior remote intercoms more than 290 feet from a LAN drop will communicate via fiber optic cable.

R. Controlled Access

1. Card readers will utilize proximity technology. Each card reader will be provided with separate visual indications that access has been granted or denied. Access will be controlled by assigning any combination of controlled-access points to each individual for authorized access. Access may be further controlled by assigning a time zone for access at each controlled-access point. All access transactions will be archived.
2. Normally, access authorization decisions will be made locally at the associated IFP. Sufficient local memory will be provided to store all access authorization data for up to 500 individuals. Access authorization data will be automatically downloaded from the ACS server, as appropriate. If authorization data for an individual requesting access is not found at the ACS server will be queried for a decision.
3. Exterior doors and indicated windows shall be monitored for open-closed position. Door sensors shall be concealed in the frame and door. Upon detecting an open door or window, an alarm shall be reported to a monitoring laptop computer in the Reception Office. The report shall indicate the location of the door or window. After a programable time delay, an audible alarm shall sound at the computer. The audible alarm shall originate from the computer and can be silenced. Subsequent alarms shall repeat the process. An alarm shall not sound at the sensor location. Sensors shall be programmable to be armed or disarmed for each sensor at protected opening locations to accommodate schedule variability. After the door or window has been closed, the system may be returned to standby mode. There shall be the ability to program selected doors and windows to disable the detection of open doors and windows.
4. In the event the door/gate is not closed within a predetermined time period (programmable) a held open advisory will be annunciated at an operator workstation(s). Each controlled-access door/gate will be equipped with a request-to-exit sensor or exit pushbutton to shut the door/gate position switch for unalarmed exit.

S. Intrusion Detection

1. System shall be Honeywell Vista 250, with battery back-up, to be compatible with existing

District -wide monitoring system.

2. System shall be monitored by remote central station via fiber optic network. System will monitor status of the Fire Alarm Panel and report status to remote central station.
3. Provide wireless push-button in the administrative area to activate an emergency alarm and report the alarm to the remote central stations. Push-button shall be Honeywell 5802WXT.
4. Provide wiring, controls, peripheral devices, equipment, and appurtenances required and necessary to provide a complete, fully operational system.
5. Wiring shall be concealed above drop ceilings, in cable trays or in conduits. Exposed wiring in Mechanical Rooms shall be in conduits. Exposed wiring and conduits shall not be installed on walls or ceilings in finished spaces. In spaces with ceilings open to the structure, wiring shall be in conduits. Conduits shall be grouped as much as possible and shall be parallel or perpendicular to building structure and features to provide a neat appearance.
6. Controlled-access doors, and monitored doors will be equipped with door position switches to detect authorized and unauthorized opening.
7. Tamper switches will be provided within all accessible Intrusion Detection System enclosures, cabinets, and door junction boxes (except boxes associated with the SAS) to detect unauthorized opening or tampering.
8. System Programming Database: The Contractor shall assist the Owner in setting up the system database requirements and formats. Forms to be utilized in collecting and entering all data shall be provided to the Owner by the Contractor. Written instructions on the use of all forms shall be included. Examples of the sequence of completion for all related forms shall be provided. The Owner shall be responsible for the actual data collection and entry to ensure a complete understanding of the system and its contents.
9. Programming: The Contractor shall initially configure the system in accordance with the design shown in the drawings. All alarm point definitions, camera/monitor, alarm point call up and in/out relationships, individual component descriptions, and any other programmable parameters required shall be as shown in the appropriate drawings and schedules. The Owner shall perform any additional programming with the assistance of the Contractor. All programming must be approved by Owner for approval before installation is started.

1.9 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall carefully control handling and installation of all items which are not immediately replaceable, so that completion of the work will not be delayed by hardware or equipment losses before, during, and after installation. The Contractor is responsible for all items until Final Acceptance.

B. The Contractor shall, prior to installation, protect exposed surfaces with material which is easily removed without marring finishes.

C. The Contractor shall, without cost to the Owner, replace any products damaged during storage or handling.

1.10 SCHEDULING

A. The Contractor shall submit a schedule to the Owner for approval. The schedule shall show sequence of work, etc. from time of Notice to Proceed to final sign off of project. This schedule shall be submitted on Microsoft Project, both paper and electronic format, with submittals.

B. It shall be the responsibility of the Contractor to coordinate the installation of the system to be

compatible with the work of the other trades. The Contractor shall attend weekly progress meetings and provide continuous on-site project management.

C. It shall be the responsibility of the Contractor to arrange with the Owner a mutually acceptable time for Acceptance Testing, based upon the dates provided in the Solicitation.

1.11 PROJECT SCHEDULE

A. A (mandatory) pre-bid site visit can be utilized to allow the Contractor to review the current jobsite conditions and define special requirements.

B. All Requests for Information (RFI) shall be directed to the Consultant and should be received by Close of Business (COB) on the date published.

1.12 BID/TECHNICAL PROPOSALS

A. The ALM and or ACS System Installer shall be experienced in the provision of systems similar in complexity to those required for this [project and shall at least meet the following criteria:

1. The primary business of the Contractor/Installer shall be the installation of ALM and or ACS systems.
2. At least five (5) years' experience with the specified equipment and systems.
3. Experience with at least one project of similar size and complexity as outlined in these specifications.
4. Be an authorized dealer and service facility for the products specified and furnished.
5. The Contractor shall provide personnel with extensive training for each system type and configuration.
6. The Contractor shall maintain a fully staffed installation crew and service crew for maintenance and installation of the specified systems.
7. Lead Installer shall have factory training in support of installed systems and equipment.
8. The contractor shall demonstrate that the installation staff consists of certified security professionals.
9. Final ALM and or ACS System configurations shall be approved by the Owner's Representative, Architect and Consultant.
10. At the request of the Owner, Contractor shall demonstrate that he has:

    a. Sufficient facilities and equipment for this work.
    b. Sufficient staff with the appropriate technical expertise and experience for this project.

1.13 PRE-BUILD AND FINAL SUBMITTALS

A. Provide the following for approval sixty days after Notice to Proceed and prior to commencement of work:

1. A complete list of all products to be incorporated within the work with all quantities listed. Each product shall be listed with specification section references in Excel format.
2. Complete functional diagrams of each system required for a complete and operational system with descriptive narratives of any deviations from the specified system design.
3. Provide shop drawings as defined in the section below.

B. Shop Drawings:

1. Shall not be smaller than 24"x36" and shall be sized as appropriate for thorough understanding of systems.

2. All drawings shall be scaled appropriately but not less than 1/8" =1'.
3. Schematic detailed wiring diagrams showing interconnection of Contractor provided components and fabricated products, wiring, and cabling diagrams depicting cable types, and device designators. Each component shall have a unique designator and use same designator throughout the project.
4. Show location of all equipment in racks, consoles, or on tables, with complete dimensions, wire routing, and cabling within housing.
5. Show all A.C. power outlet locations and terminal strip locations within each equipment rack.
6. Plans and sections of the building and adjacent grounds showing the location of all installed equipment such as loudspeakers, racks, consoles, plates/panels, antennas, (etc.).
7. Patch panel layouts and labeling strips, including color schemes as necessary.
8. Full fabrication detail of custom enclosures and millwork indicating dimensions, material, finish, and openings for equipment.
9. Provide complete drawings for all fabricated plates and panels. Drawings shall include dimensional locations of components, component type, engraving information, plate color information, and a complete bill of materials for each plate.
10. Complete labeling schemes for all cabling and equipment components for the project. Include font size and styles along with a sample cable label and equipment label. All labeling shall be consistent within the project scope.
11. A complete wire schedule showing source and destination and indicating conduit location and sizing. Provide conduit sizing and layout with at least a 20% oversize for project utilization for future system growth.
12. Provide a complete conduit riser and associated conduit plans for a complete conduit system. Include a Junction Box schedule showing type, size, mounting style, and location of each box.

C. Submittal Format: (PDF version)

1. Arrange product data in alphanumeric order by system type and room indicate on cut sheet the options provided.
2. Separate major groupings Use multiple volumes / lists of content
3. Index product data sheets by manufacturer and model or part number.
4. Each submittal shall include a unique numbering scheme and be numbered in consecutive order.
5. Reference addendum or change order numbers as applicable.
6. Reference specification section, part, article, paragraph, and/or drawing reference as applicable.
7. Provide via pdf, posted to FTP, thumb drive and or CD / DVD ROM.
8. Each submittal shall include a complete table of contents with the following information:

    a. Project title and number.
    b. Submittal number.
    c. Date of submission.

D. Submittal Format: (Printed Option if specifically Required)

1. Each submittal shall be in three-ring binders no larger than 3" spines and sized for 150% of material enclosed. Use multiple volumes if necessary.
2. Arrange product data in alphanumeric order by system type and room.
3. Separate major groupings with labeled binder tabs.
4. Index product data sheets by manufacturer and model or part number.
5. Each submittal shall include a unique numbering scheme and be numbered in consecutive order.
6. Reference addendum or change order numbers as applicable.

7. Reference specification section, part, article, paragraph, and/or drawing reference as applicable.
8. Each submittal shall include a complete table of contents with the following information:

    a. Project title and number.
    b. Submittal number.
    c. Date of submission.

1.14 PROJECT CONDITIONS

A. Verify conditions on the jobsite applicable to this work. Notify Owner's Representative in writing of discrepancies, conflicts, or omissions promptly upon discovery.

B. If conditions exist on the jobsite which make it impossible to install work as shown on the drawings or detailed in the specifications, recommend solutions, and submit drawings showing how the work may be installed as well as an adjusted new schedule to the Consultant and Owner for approval.

1.15 QUALITY ASSURANCE

A. Provide and maintain an effective Quality Control program and perform sufficient inspections, surveys, and tests of all items of work, including those of other trades, to ensure compliance with the contract documents. Furnish appropriate facilities, accurately calibrated instruments and testing devices required to perform the quality control operations and with sufficient work forces to cover the installation operations within the actual installation sequences. Coordinate this work with the quality control requirements of other technical Sections of the Specifications and with requirements of the Contractor and governing authorities having jurisdiction.

B. Manufacturer Qualifications: All system components shall be furnished by the manufactures of established reputation and experience who shall have produced currently operating Integrated Security Management Systems which include access control and alarm monitoring. Manufacture shall be able to similar installations rendering satisfactory service.

C. Bidder Qualifications: The bidder shall furnish in writing to the Owner proof of compliance with the manufacturer's system installation certification program.

1. Hold all legally required state contractor's licenses necessary to accomplish the installation and activation of the described system at the facilities indicated. Contractor shall submit copies of licenses to the Owner prior to the start of work.
2. Have a local office staffed with factory-trained technicians, fully capable of engineering, supervision installation, and system start-up. Providing the Owner training, and servicing hardware and software for systems of similar complexity and function as the system described in this specification.
3. Indicate complete and total compliance with the provisions of this specification by letter, signed by an officer of the corporation, or a principal if other ownership currently exists. This letter shall also clearly identify any exceptions to specification requirements.

1.16 PRE-INSTALLATION MEETING/SCHEDULE

A. Prior to the start of the work, and at the Owner/Consultant's direction, meet at the project site to review methods and sequence of installation, special details and conditions, standard of workmanship, testing and quality control requirements, job organization and other pertinent topics related to the work. The meeting shall include the Contractor, Contractor's Project Manager, the Owner/Consultant, and the General Contractor. Inspection and testing services (if any) and any other sub-Contractors whose work requires coordination with this work shall be coordinated.

B. A Conduit/Wiring Analysis shall be conducted at the Pre-Installation Meeting. The Electrical Contractor shall submit "as-built" drawings locating all existing conduit runs, junction boxes, and electrical outlets. Show location and type of all special receptacle boxes and plates to be supplied and/or modified by the Electrical Contractor. Verify and inspect all necessary conduits and outlets. Provide with the submittals, a list of all conduits, boxes, and power changes necessary for installation of systems in each location.

1.17 FINAL INSPECTION AND TESTING / COMMISSIONING

A. Upon completion of installation and Contractor testing and commissioning (as outlined in sections 3.6), the Consultant shall perform system(s) inspection and testing (as outlined in section 3.7).

B. To assist the Consultant by providing a minimum of one person for inspection and two persons for testing who are familiar with all aspects of the system(s).

C. The process of testing the system(s) may necessitate moving and adjusting certain components such as PIR sensor and or glass break location adjustments.

D. Testing will include operation of each camera and sub system and any components deemed necessary. Provide required test equipment, tools, and materials required to perform necessary repairs and/or adjustments.

E. In the event that further adjustments or work is required during testing, the Contractor shall continue his work until the system(s) is acceptable at no addition to the contract price. If approval is delayed due the defective equipment, and/or failure of equipment or installation to meet the requirements of this specification, the Contractor shall pay for additional time and expenses of the Owner at the rate specified by the Owner.

1.18 WARRANTY

A. All equipment provided by the Contractor shall be installed per manufacturer's specifications and warranted by the Contractor for a period of one (1) year from the date of written acceptance to meet all performance requirements outlined herein. Warranties shall not be pro-rated. For all Owner-provided equipment, include pricing for an initial one-year service contract.

B. During the warranty period, no charges shall be made for any labor, equipment, or transportation to maintain performance and functions.

C. The Contractor shall respond with remedy to a trouble call within twenty-four (24) hours after receipt of such a call and shall provide a 24-hour service phone number. Uptime for system(s) shall be no longer than 24-hour period. All replacement parts/components shall be of an equal or higher level for service.

D. Equivalent replacement equipment shall be temporarily provided when immediate on-site repairs cannot be made.

E. At least two routine inspection and adjustment visits will be scheduled for the first year. Submit reports to Owner.

F. Provide a separate price for an optional yearly service contract for five (5) years, to begin at the end of the initial warranty and service contract. Provide details on coverage and options.

1.19 INSTRUCTION OF OWNER PERSONNEL

A. After final inspection and completion, provide instruction to Owner designated personnel on the operation and maintenance of the system(s).

B. Develop an instructional course based on the use of the system(s) and manufacturer's recommendations. Provide a minimum of five (5) hours of instruction. Arrange courses so that operational and maintenance classes are separate.

C. The training plan or class shall include detailed sections, outlines and related reference materials. The Owner personnel shall be able to utilize these materials in the subsequent training of their co-workers.

D. Submit an outline of the course with sample instructional aids for approval thirty (30) days prior to scheduled instruction sessions.

E. The training time shall not be less than a total of 12 hours, and shall consist of:

1. Three periods: four (4) hours during normal day shift for system operators. Specific schedules shall be established at the convenience of the Owner. The twelve hours shall be broken down into several sections.
2. Four (4) hours of system training shall be provided to Owner supervisory personnel so that they are familiar system operation.

3. Four (4) hours of system maintenance familiarization training shall be provided to the Owner's telecommunications personnel as needed.

F. The specified training schedule shall be coordinated with the Owner and will follow the training outline submitted by the Contractor as part of the submittal process.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Electronic component models shall be commercially available for a least one (1) year prior to bid, or be approved by the Consultant and or Owner's Representative.

B. All equipment and material shall be new.

C. All equipment must be UL listed or built to UL standards, where required.

2.2 GENERAL

A. All equipment shall be professional grade and rated for continuous duty. Basic guidelines have been prepared with manufacturer names, makes, and model numbers included as minimum performance requirements. These must be satisfied unless a variance (separate document) is submitted and approved by the Owner's representative and or Consultant.

B. The system shall be installed and configured for simplicity of operation, with user-friendly controls.

C. Provide product quantity as required for a complete and operable system. If any quantities are given, the Contractor shall provide at least the given amount. Some of the products listed under this section may not be required to fulfill the work as outlined.

D. Regardless of the length or completeness of the descriptive paragraphs listed herein, each device shall meet published manufacturer's specifications.

E. Remove all manufacturer's nameplates or logos from product, as required, within the public site lines or spaces.

F. Paint all wall and ceiling mounted devices as directed by the Consultant/Architect.

G. The Contractor is responsible for providing a fully operational, turnkey ALM and ACS systems.

2.3 PRODUCTS

A. The quantities of components shall be determined and installed by the Contractor based on the requirement to provide a fully operational Integrated Security Management System, as per the intent of the specification, and as shown on the drawings and recommended by the Manufacturer.

2.4 FRONT END SYSTEM

A. For performance PC system configurations that require high availability, the manufacturer shall be consulted for appropriate custom PC system configuration.

1. Computer Specifications:

a. Acceptable product:

1) DELL CPU and components
2) Or approved equal.

2.5 FRONT END SOFTWARE REQUIREMENTS

A. Specifications for software:

1. The System shall interface with control access software.
2. Acceptable product:

a. CCURE 9000
b. No Exceptions.

2.6 COMPONENTS

A. Access Control Panel, provided by Owner's separate Contractor:

1. Provide with Power Supply
2. Provide with Power Distribution
3. Provide with Enclosure
4. Provide with Backplates
5. Acceptable Products:

a. Software House with CCURE 9000 software
1) Life Safety Power Enclosures
2) Power Supplies

B. Intrusion Detection Panel

1. 250 inputs
2. 8 On-Board Zones
3. Key pads shown on electrical drawings.
4. 2 zones,
5. 250 user codes with 99 profile
6. Acceptable Product:

a. Honeywell Vista 250
b. No Exceptions.

C. Master Intercom Station, provided by Owner's separate Contractor:

1. PoE SIP compatible

2. 7” LCD Touchscreen
3. 7 capacitive buttons with RGB LED backlighting
4. Acceptable Product:

    a. AiPhone IX-MV7-HB

D. Door Station Intercom, provided by Owner’s separate Contractor:

1. Audio streaming Two-way, Full duplex
2. Echo cancellation
3. Noise reduction
4. Image sensor 1/3″ Progressive scan RGB CMOS
5. Horizontal field of view: 180° Vertical field of view: 120° Fixed iris,
6. 6 Megapixel resolution
7. RFID Capability for Card Read Functionality
8. PoE
9. SIP compatible
10. Provide with appropriate intercom mount
11. Acceptable product:

    a. AiPhone IX-EA Weather resistant door station
    b. No exceptions.

E. Card Reader, provided by Owner’s separate Contractor:

1. Reader Type: Multi-Technology mullion
2. Frequency: 13.56 MHz
3. Requires RS-485 Interface
4. PIV Output: 75 bit PIV
5. Voltage Range: 5-16 VDC
6. Read Range: 2.5”
7. Current Requirement: Avg: 100mA Peak: 170mA
8. Provide with Credentials
9. Acceptable products:

HID Signo Readers 40NKS-00-000000 for Single Gang 20NKS-01-000000 for Mullion

F. Graphic Keypad for Intrusion detection System

1. Normal/Standby Current: 130 mA + 1.6 mA per active zone
2. Alarm Current: 165 mA + 2 mA per active zone
3. Multi Zone
4. Acceptable Product:

    a. Honeywell V128BPTWF-KT Vista

2.7 PLATES AND PANELS

A. Provide plates and panels as described in the drawings and as required for a fully operable system.

B. Custom plated shall be 1/8” thick aluminum, standard EIA sizes, brushed black anodized finished unless otherwise noted.

C. Plastic plates are not allowed.

D. Lettering shall be in all caps and numbers engraved with a color contrasting to the base material with a minimum size of 0.25”.

1. Font Size shall be 1/8”

a. Font Style shall be Helvetica

E. Acceptable manufacturers of custom plates and panels:

1. RCI Custom
2. Panel Authority
3. Whirlwind

2.8 PROPOSED SUBSTITUTIONS

A. Where specific equipment is described, it is not the intention to discriminate against the products of other manufacturers, but rather to establish a standard of quality. All proposed substitutions should be submitted as alternates with exemption documentation for consultant approval and complete product data sheets.

B. The Owner’s Representative and or Consultant requires manufacturer’s original specification tests. The Owner’s Representative and or Consultant will evaluate and approve/disapprove all substitutions.

C. Items designated “no substitutions” shall be that specified item only. Submission of items other than specified shall not be considered and may disqualify RFP submission.

2.9 CABLES AND WIRING

A. Security wiring needs to be non-shielded.

B. Plenum Ratings: Cable routed in conduits and or equipment racks cannot have non-plenum rated (PVC) jacket. All other cables shall have a plenum or riser rated jacket compliant to the cable run and purpose. Cable runs shall be continuous without splices.

C. Cable Selection: Based on signal type as indicated on single line diagram, noted at equipment input, or output connection type. Wire manufacturer and part numbers are provided as a basis of cable quality and signal characteristics. Alternate cable manufacturers to be requested for approval during pre-build submittal.

D. Provide cabling complaint with Section 28 05 13 - CONDUTORS AND CABLES FOR ELECTRONIC SAFETY.

E. Provide the following cabling types as required for a fully operable system:

1. Communication outlet cables: 18 AWG 2 conductor shielded – West Penn
2. Control cables:
   - 22 AWG 6 Conductor shielded – West Penn

- 18 AWG 4 conductor shielded – West Penn

3. Precision video cable: Belden 8281 as required.
4. 9-conductor 22AWG. communications cable: Belden 9945.
5. 9-conductor 18AWG. communications cable: Belden 83659.
6. Unshielded Twisted pair Category 5e Cabling West Penn Wire 254245
7. F/UTP Category 6A Cabling West Penn Wire 254346BL
8. Shielded Twisted pair HDBaseT Cabling Extron XTP DTP 24

PART 3 - EXECUTION

3.1 INSTALLATION

A. All equipment shall be mounted with sufficient clearance to meet all applicable codes and facilitate observation and testing.

B. All equipment shall be securely fastened with appropriate fittings to ensure positive grounding and be free of ground loops throughout the entire system.

C. Units shall be installed parallel and square to building lines. All wires shall be gathered and fastened to create an orderly installation.

D. Electronic equipment shall be permanently mounted in equipment racks or as applicable to the equipment and application.

E. The contractor shall mount all equipment, mounting brackets, plates, and panels, plumb and level.

F. Contractor shall follow all applicable standards including ASIS Commission on Standards and Guidelines documentation as a basis of design, fabrication, construction, and Performance Verification.

G. Contractors shall provide shaft locks or security covers on non-user operated equipment having front panel access.

H. The contractor shall permanently install all equipment to be firmly mounted and held in place. Provide necessary equipment supports to hold and support loads with at least a 5:1 safety factor.

I. Contractor shall validate bracing or blocking for proper mounting and safety.

J. Contractors shall provide seismic bracing for appropriate equipment where the project is in a seismic zone or it is required by local codes and or installation practices.

3.2 EQUIPMENT HOUSING

A. Equipment Enclosures / Racks:

1. Install all applicable equipment in racks and or wall mounts according to manufacturer’s recommendations and product application.
2. Provide adequate ventilation, thermal management, and temperature-controlled fans to maintain a rack temperature of less than 85 degrees Fahrenheit.

3. Provide rear support and rear rack rails for housing mounted equipment greater than 15” deep.
4. Allow a minimum of 20% open rack space to support future expansion.
5. Fill all empty spaces with blank panels, sizing as required; painted and or anodized to match housing.
6. Locate operator useable equipment and patch panels at an appropriate operating height.
7. Key all door locks for each housing type (front, rear) alike.
8. Looking at the equipment racks from the rear of the racks, install all AC power and ground cabling on the left and audio and video cabling on the right.
9. Provide LED lights mounted in the top of every two racks to illuminate the interior for service or maintenance. LED lights shall be individually switch-able and placed so as to provide maximum illumination throughout the rack.
10. Dress all loose cabling for a clean and orderly rack. The use of electrical tape for any cable management is prohibited.
11. The use of tie wraps for network and optical fiber cabling is prohibited
12. Provide nylon braded sleeving for wiring harnesses for a clean installation of cabling that is visible to user areas. Sleeving color shall be coordinated with location and device color.

3.3 PATCH PANELS

A. Video Patch Panel Configuration:

1. Patch panels shall be located in designated racks as shown on drawings.
2. All patch panels shall be in consecutive rack spaces located approximately 46” above the floor.
3. Locate inputs from microphone input plates and floor plates on the top row of each patch bay.
4. Locate sends and tielines on the bottom row of each patch bay.
5. Coordinate final patch bay normaling as directed by the Owner’s Representative and or Consultant.
6. Provide 24”x32” reference diagram of the patch bay system. The layout shall be easily understood. Mount diagram behind Plexiglas and mount in the rack or control room close to the patch bay rack.
7. Diagram shall show all input and output locations, patch normals, and any console connections and interconnection of rooms and equipment.

B. Unshielded Twisted Pair UTP / STP RJ-45 Patch Panel Configuration:

1. Patch panel shall be located in designated racks as shown on drawings.
2. All patch panels shall be in consecutive rack spaces located approximately 46” above the floor.
3. Configure and terminate patch bay per TIA / EIA standards.

3.4 LABELING

A. Device Labeling:

1. Provide, for each piece of rack-mounted equipment, a printed label (black background and white lettering) and attach to the front of the equipment. Install in a plumb, level, and permanent manner. Provide rear mounted labeling for all rack-mounted equipment.
2. Provide engraved label on each user-operated control that describes the function or purpose of the control as appropriate. Adjust size of label to appropriate size for location.

B. Rack Labeling:

1. Provide custom project plates at the top of each equipment rack designating Consultant and installation Contractor (see rack elevations for details).
2. All rack panel labeling shall be engraved and filled.

C. Wire and terminal strip labeling:

1. Provide each terminal strip with a unique descriptor and numerical designator for each strip. Show strip information on the drawings.
2. Provide logical and legible cable and wiring labels permanently attached for easy identification to each cable on both ends.
3. Label on cables shall be adhesive style striping covered with clear, heat shrink tubing, sized appropriately for the cable.
4. The wiring designator shall be alphanumeric code, unique for each cable.
5. Each cable type shall be labeled starting with different destinations (i.e. mic series “Mxxx”, speaker series “Sxxx”, etc.).
6. On projects that have multi room connectivity the source and destination room numbers should be the prefix for the cable number indicating a cable that traverses between two rooms.
7. Locate the cable designator at the origination and the destination of each circuit. Locate cable designator within 2” of connection point.

3.5 PERFORMANCE STANDARDS

A. All provided devices / equipment shall meet and or exceed published manufacturer’s specifications and be compliant with the outlined salient capabilities as described in section 2, and be compatible with all applicable standards and configurations.

3.6 CONTRACTOR TESTING AND OR COMISSIONING

A. Prior to energizing or testing the system, ensure the following:

1. Execution: Activate all alarm or other output devices that are in the system for proper operation, including supervisory and trouble circuit tests.
2. Report: A checkout report for each piece of equipment shall be prepared by the Contractor and submitted to the Owner, one copy of which shall be registered with the equipment manufacturers. This report shall include a complete listing of every device, the date it was tested and by whom, and the results and date tested (if failure occurred during any previous tests). The final test reports shall indicate that every device tested successfully. Submit two typed copies of the test reports on 8 ½” x 11” papers, in a neatly bound folder to the Owner for approval. Failure to comply with this will result in a delay of final testing and acceptance.
3. All products are installed in a proper and safe manner per the manufacturer’s instructions.
4. Insulation and shrink tubing are present where required.
5. Dust, debris, solder, splatter, etc. is removed.
6. Cable is dressed, routed, and labels and all connections are consistent with regard to polarity.
7. All labeling has been provided and installed.
8. All products are neat, clean, unmarred, and securely fastened.
9. All debris has been cleaned and removed from the site.
10. All electronic devices are properly grounded.

B. Perform the following test. Record all results in the final project manual.

1. Test each AC power outlet for proper connections for hot, neutral, and ground.
2. Measure and record the DC resistance for the technical ground in the equipment racks and console. Resistance should be 0.15 ohms or less.
3. After the testing report and as-built drawings have been approved by the Owner's representative, the completed system shall be tested in the presence of the Owner's representative.
4. Acceptance of the system shall require a demonstration of the stability of the system. This shall be adequately demonstrated if the system operates for a ninety (90) day period with a 99% system on-line reliability. Should major equipment failure occur, the Contractor shall replace component(s) and begin another ninety (90) day test period. This test shall not start until the Owner has obtained beneficial use of the system. If the requirements provided in the paragraph above are not completed within six (6) months after beginning the tests described therein, the Contractor shall replace the System with another one from approved Manufacturer, and the process shall be repeated until final acceptance of the System and its equipment by the Owner.
5. Once the final test is complete, each purchased spare component must be inserted into the System and the System tested in potentially affected areas again to insure complete functionality. The original removed parts will become the System spares.

C. Input Verification Test: (IP Cameras)

1. Verify video stream presence on network and verify resolution and color depth settings.
2. Configure IP address for each stream to multi-image processor and to recorder as specified.
3. Perform complete system operation to verify proper system operation.
4. In a similar manner, check any other cameras or streaming devices as appropriate.

D. Notification:

1. Once all of the above is complete, the system is ready for inspection. Formally notify the Owner's representative and or consultant at least seven (7) days prior to desired inspection date.
2. Final adjustments and configurations will be conducted at the time of inspection.

3.7 CONSULTANT ACCEPTANCE TESTS

A. Consultant acceptance tests will not be performed until after the contractor's system checkout as outlined within section 3.6 has been completed and the test results have been received and reviewed by the consultant and or owner's representative.

B. Consultant acceptance testing will be conducted based on applicable sections of the ANSI/INFOCOM 10:2013 Audiovisual Systems Performance Verification Standard.

C. Checklist items within this list will be verified by visual and or audible methods as part of normal use case operational scenarios, with the assumption that the contractor has fulfilled their obligation to test and ensure that the systems are tested, complete and free of operational defects per section 3.6 above.

D. The system acceptance tests will be supervised by the consultant and will consist of the verification checklist as well as any additional tests as required:

1. A physical inventory will be taken of all equipment on site and will be compared to equipment lists in the contract documents.
2. The operation of all system equipment shall be demonstrated by the contractor.
3. Contractor shall provide a laptop to support testing activities that is configured and connected to any and all control processors for any evaluation and adjustments (tuning) activities by the consultant.
4. Both subjective and objective operational tests will be required by the Consultant to determine compliance with the specifications and industry standards. The Contractor shall be responsible for providing all required test equipment based on system complexity and equipment selection / configuration.
5. Operational use case test scenarios may be conducted based on programmed room uses and functionality.
6. All final, “as-built” drawings, run sheets, manuals, and other required documents, as detailed in Part I, shall be on hand. Two complete sets of these documents shall be delivered to the Owner at this time. (One complete set shall have been delivered to the Consultant prior to the scheduling of Acceptance Tests).
7. In the event further adjustment is required, or defective equipment must be repaired or re-placed, tests may be suspended or continued at the option of the consultant.

E. Any charge for additional time incurred by the consultant required for overseeing the system tests, due to improper system installation or previous failed systems, shall be the responsibility of, and charged directly to the contractor and or subcontractor as appropriate.

END OF SECTION

SECTION 284600
FIRE DETECTION AND ALARM SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:

1. This specification describes an addressable Fire Detection and alarm signaling system. The control panel shall be intelligent device addressable, analog detecting, low voltage and modular, with digital communication techniques, in full compliance with all applicable codes and standards. The features and capacities described in this specification are required as a minimum for this project and shall be furnished by the successful contractor.
2. The system shall be in full compliance with National and Local Codes.
3. The system shall include all required hardware, raceways, interconnecting wiring and software to accomplish the requirements of this specification and the contract drawings, whether or not specifically itemized herein.
4. All equipment furnished shall be new and the latest state of the art products of a single manufacturer, engaged in the manufacturing and sale of analog fire detection devices for over ten years.
5. The system as specified shall be supplied, installed, tested and approved by the local Authority Having Jurisdiction, and turned over to the owner in an operational condition.
6. In the interest of job coordination and responsibilities the installing contractor shall contract with a single supplier for fire alarm equipment, engineering, programming, inspection and tests, and shall be capable of providing a “UL Listing Certificate” for the complete system.
7. The system specified shall be that of Cerberus™ PRO which meets the project requirements. Other systems shall be submitted 10 days prior to bid date for approval by the Engineer. All system approved shall meet all the requirements spelled out in this specification. System approval shall be in writing by the Engineer and a copy shall be submitted with the system submittals.

1.03 DEFINITIONS

A. ASME: American Society of Mechanical Engineers
B. FACP: Fire alarm control panel.
C. FM: FM Global (Factory Mutual)
D. Furnish: To supply the stated equipment or materials.
E. Install: To set in position and connect or adjust for use.
F. LED: Light-emitting diode.
G. NCC: Network Command Center
H. NFPA: National Fire Protection Association. Definitions in NFPA 72 apply to fire alarm terms used in this Section.
I. NICET: National Institute for Certification in Engineering Technologies.
J. Provide: To furnish and install the stated equipment or materials.
K. UL: Underwriters Laboratories

1.04 SYSTEM DESCRIPTION

A. The system shall be a complete, electrically supervised fire detection and notification system, with a microprocessor based operating system having the following capabilities, features, and capacities:
    1. Support of [TechAdvance+] mobile test system capable of providing point test reports in NFPA standard format without manual report entries.
    2. System shall provide an output port for monitoring purposes by external systems. Communications to an external system shall be RS-232 or RS-485 communications.
    3. The local system shall provide status indicators and control switches for all of the following functions:
        a. Audible and visual notification alarm circuit zone control.
        b. Status indicators for sprinkler system water-flow and valve supervisory devices.
        c. Any additional status or control functions as indicated on the drawings, including but not limited to; emergency generator functions, fire pump functions, door unlocking and security with bypass capabilities.

1.05 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with NFPA 72 and all contract documents and specification requirements.
B. All interconnections between this system and the monitoring system shall be arranged so that the entire system can be UL-Certificated.

C. System shall be a complete, supervised, non-coded, addressable multiplex fire alarm system conforming to NFPA 72.

D. The system shall have Style 4 circuits for each floor. The system shall operate in the alarm mode upon actuation of any alarm initiating device. The system shall remain in the alarm mode until all initiating device(s) are reset and the fire alarm control panel is manually reset and restored to normal.

E. The system shall be capable of the following configurations. Both configurations are permitted on the same network.
   1. The system shall support up to 252 addressable devices, which may be divided in any ratio on one, two, three, or four separate, isolated Class B circuits.
   2. The system shall support two loops of 252 addressable devices, each of which may be divided in any ratio on one, two, three, or four separate, isolated Class B circuits.

F. The system shall support H-series devices and Cerberus PRO series devices.

G. The system shall have a built-in digital alarm communication transmitter.

H. The system shall provide an off-normal warning prior to reset for all active devices.

I. The system shall be capable of remote monitoring via Cerberus™ PROView, a proprietary software system that provides a graphical representation of the fire alarm control panel at a remote PC when connected via Ethernet to the system. The display will show the exact state of the panel, including blinking LEDs, and with menu buttons for control.

J. The system shall be capable of being configured either at the control panel or via a PC Tool.

K. The system shall provide the following functions and operating features:
   1. The FACP and auxiliary power panels shall provide power, annunciation, supervision and control for the system.
   2. Provide Class B initiating device circuits.
   3. Provide two Class B notification appliance circuits. Arrange circuits to allow individual, selective, and visual notification by zone. Notification appliance circuits shall be zoned to correspond with the building fire barriers and other building features.
   4. Strobes shall be synchronized throughout the entire building.
   5. Provide electrical supervision of the primary power (AC) supply, presence of the battery, battery voltage, and placement of system modules within the control panel.

L. The system shall provide a field test function where one person can test the complete system or a specific area while maintaining full operational function of other areas not being tested. Alarms, supervisory signals, trouble signals shall be logged on the system printer and in system history during the walk-test.

M. Alarm functions shall override trouble or supervisory functions. Supervisory functions shall override trouble functions.

N. Fire alarm signal initiation shall be by one or more of the following devices:
   1. Manual pull station
   2. Heat detector
   3. Addressable area smoke detectors
   4. Specialized Duct Smoke detector
   5. Automatic sprinkler system water flow switch.
   6. Clean agent control panel release.

O. Activation of any system fire, security, supervisory, trouble, or status initiating device shall cause the following actions and indications at all network Person Machine Interfaces using basic graphics and multiple detail screens.
   1. Fire Alarm Condition:
      a. Sound an audible alarm and display a custom screen/message defining the building in alarm and the specific alarm point initiating the alarm in a graphic display.
      b. Log into the system history archives all activity pertaining to the alarm condition.
      c. Print alarm condition on system printer.
      d. Sound the ANSI 117-1 signal with synchronized audible notification appliances and synchronized strobes throughout the facility.
      e. Audible signals shall be silenced from the fire alarm control panel by an alarm silence switch. Visual signals shall be programmable to flash until system reset or alarm silencing, as required.
      f. A signal dedicated to sprinkler system water flow alarm shall not be silenced while the sprinkler system is flowing at a rate of flow equal to a single head.
      g. Activation of any smoke detector in a single elevator lobby or an elevator equipment room shall, in addition to the actions described, cause the recall of that bank of elevators to the 1st floor and the lockout of controls. In the event of recall initiation by a detector in the first floor lobby, the

recall shall be to the alternate floor as determined by the AHJ.

h. Where indicated on drawings heat detectors in elevator shaft and machine rooms shall activate an elevator power shunt trip breaker. The heat detectors shall be rated at a temperature below the ratings of the sprinkler heads in respective locations to insure that the power shall be shut off before activation of sprinkler system.

i. System operated duct detectors as per local requirements shall accomplish HVAC shut down.

j. Door closure devices shall operate by floor or by local requirements.

2. Supervisory Condition:

a. Display the origin of the supervisory condition report at the local fire alarm control panel graphic LCD display.

b. Activate supervisory audible and dedicated visual signal.

c. Audible signals shall be silenced from the control panel by the supervisory acknowledge switch.

d. Record within system history the initiating device and time of occurrence of the event.

e. Print supervisory condition to system printer.

3. Trouble Condition

a. Display at the local fire alarm control panel graphic LCD display, the origin of the trouble condition report.

b. Activate trouble audible and visual signals at the control panel and as indicated on the drawings.

c. Audible signals shall be silenced from the fire alarm control panel by a trouble acknowledge switch.

d. Trouble conditions that have been restored to normal shall be automatically removed from the trouble display queue and not require operator intervention. This feature shall be software selectable and shall not preclude the logging of trouble events to the historical file.

e. Trouble reports for primary system power failure to the master control shall be automatically delayed for a period of time equal to 25% of the system standby battery capacity to eliminate spurious reports as a result of power fluctuations.

f. Record within system history, the occurrence of the event, the time of occurrence and the device initiating the event.

g. Print trouble condition to system printer.

P. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1.06 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories. Complete manufacturer's catalog data including supervisory power usage, alarm power usage, physical dimensions, and finish and mounting requirements.

B. Power calculations. Battery capacity calculations. Battery size shall be a minimum of 125% of the calculated requirement. Provide the following supporting information:

1. Supervisory power requirements for all equipment.
2. Alarm power requirements for all equipment.
3. Power supply rating justification showing power requirements for each of the system power supplies. Power supplies shall be sized to furnish the total connected load in a worst-case condition plus 25% spare capacity.
4. Voltage drop calculations for wiring runs demonstrating worst-case condition.
5. NAC circuit design shall incorporate a 15% spare capacity for future expansion.

C. Submit manufacturer's requirements for testing Signaling Line Circuits and device addresses prior to connecting to control panel. At a minimum the following tests shall be required; device address, the usage (Alarm, Supervisory etc), environmental compensation, temperature ratings for thermal detectors and smoke detector sensitivities. This requirement shall need approval before any wiring is connected to the control panel.

D. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.
3. Complete drawings covering the following shall be submitted by the contractor for the proposed system:

a. Floor plans in a CAD compatible format at a scale of 1/8"=1'-0" showing all equipment and raceways, marked for size, conductor count with type

and size, showing the percentage of allowable National Electric Code fill used.

b. Provide a fire alarm system function matrix as referenced by NFPA 72, Figure A-7-5.2.2 (9). Matrix shall illustrate alarm input/out events in association with initiation devices. Matrix summary shall include system supervisory and trouble output functions. Include any and all departures, exceptions, variances or substitutions from these specifications and/or drawings at time of bid.

4. Installation drawings shop drawings, and as-built drawings shall be prepared by an individual experienced with the work specified herein.
5. Incomplete submittals shall be returned without review, unless with prior approval of the Engineer.

E. Qualification Data: For qualified Installer, Applicator, manufacturer, fabricator, professional engineer, testing agency, and factory-authorized service representative.

F. Source quality-control reports.

G. Field quality-control reports.

H. Operation and Maintenance Data: For all fire alarm equipment, to include in operation and maintenance manuals.

I. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

J. Warranty: Sample of special warranty.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: The publications listed below form a part of this publication to the extent referenced. The publications are referenced in the text by the basic designation only. The latest version of each listed publication shall be used as a guide unless the authority having jurisdiction has adopted an earlier version.

1. FM Global (Factory Mutual (FM)):FM Approval Guide
2. National Fire Protection Association (NFPA)
   a. NFPA 70 National Electrical Code
   b. NFPA 72 National Fire Alarm Code

c. NFPA 90A Standard For The Installation of Air Conditioning and Ventilating Systems
d. NFPA 101 Life Safety Code

3. Underwriters' Laboratories, Inc. (UL) equipment standards, Latest Edition
   a. UL Fire Protection Equipment Directory
   b. UL Electrical Construction Materials Directory
   c. UL 38 – Manually Actuated Signaling Boxes for Use With Fire Protection Signaling Systems
   d. UL 228 – Door Holding Devices
   e. UL 268 - Smoke Detectors for Fire Protective Signaling Systems
   f. UL 268A - Smoke Detectors for Duct Application
   g. UL 464 - Audible Signal Appliances
   h. UL 497A – Secondary Protectors for Communications Circuits
   i. UL 521 - Heat Detectors for Fire Protective Signaling Systems
   j. UL 864 - Control Units for Fire Protective Signaling Systems
   k. UL 1283 – Electromagnetic Interference Filters
   l. UL 1449 - Transient Voltage Surge Suppressors
   m. UL 1971 - Signaling Devices for the Hearing Impaired
4. International Code Council
   a. International Building Code
   b. International Fire Code.
5. State and Local Building Codes as adopted and/or amended by The Authority Having Jurisdiction, ADA, and/or State and local equivalency standards as adopted by The Authority Having Jurisdiction.
6. ISO 9002

B. Supplier Qualifications
1. The manufacturer of the supplied products must utilize multi-channel product distribution on a national basis to be considered for this bid. The manufacturer must have factory branches as well as independent distributors to allow the end user with the ability to utilize factory trained and authorized competitive service providers after system installation and commissioning.
2. Provide the services of a factory trained and certified representative or technician, experienced in the installation and operation of the type of system provided. The representative shall be licensed in the State if required by law.

3. The technician shall supervise installation, software documentation, adjustment, preliminary testing, final testing and certification of the system. The technician shall provide the required instruction to the owner's personnel in the system operation and maintenance.
4. The suppliers shall furnish evidence they have an experienced service organization, which carries a stock of spare and repair parts for the system being furnished.
5. The equipment supplier shall be authorized and trained by the manufacturer to calculate, design, install, test, and maintain the air sampling system and shall be able to produce a certificate stating such upon request.

C. Installer Qualifications:
1. Before commencing work, submit data showing that the manufacturer has successfully installed fire alarm systems of the same scope, type and design as specified.
2. The contractor shall submit copies of all required Licenses and Bonds as required in the State having jurisdiction.
3. The contractor shall employ on staff a minimum of one NICET level II technician or a professional engineer, registered in the State of the installation.
4. The contractor shall be qualified by UL for certifying fire alarm systems.
5. Contractors unable to comply with the provisions of Qualification of Installers shall present proof of engaging the services of a subcontractor qualified to furnish the required services.

D. Testing Agency Qualifications: Qualified for testing indicated.

E. Source Limitations for fire alarm equipment: Obtain fire alarm equipment from single source.

F. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.
3. Combustion Characteristics: ASTM E 136.

G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

H. Pre-installation Conference: Conduct conference at Project site.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project site in original, unopened packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, and shelf life if applicable.

B. Store materials inside, under cover, above ground, and kept dry and protected from physical damage until ready for use. Remove from site and discard wet or damaged materials.

1.09 PROJECT CONDITIONS

A. Installed products or materials shall be free from any damage including, but not limited to, physical insult, dirt and debris, moisture, and mold damage.

B. Environmental Limitations: Do not deliver or install products or materials until spaces are enclosed and weather-tight, wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire alarm equipment that fail(s) in materials or workmanship within specified warranty period.

1. Warranty Period: 1 year from date of Substantial Completion.

1.11 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements all equipment shall be Cerberus™ PRO.

2.02 CONTROL PANEL

A. The fire alarm control panel shall be microprocessor based using multiple microprocessors throughout the system providing rapid processing of smoke detector and other initiation device information to control system output functions.

B. There shall be a watchdog circuit, which shall verify the system processors and the software program. Problems with either the processors or the system program the panel shall activate a trouble signal, and reset the panel.

C. The system modules shall communicate with an RS 485 network communications protocol. All module wiring shall be to terminal blocks, which will plug into the system card cage

D. The system shall be capable of the following configurations. Both configurations are permitted on the same network.

1. The system shall support up to 252 addressable devices, which may be divided in any ratio on one, two, three, or four separate, isolated Class B circuits.
2. The system shall support two loops of 252 addressable devices, each of which may be divided in any ratio on one, two, three, or four separate, isolated Class B circuits.

E. The system shall be capable of supporting unshielded wiring applications.

F. System Components:

1. The System Periphery board shall be capable of 252 intelligent devices distributed between one, two, three, or four Class B SLC circuits. Any trouble on one circuit shall not affect the other circuit. This module controls the signaling from the initiation devices reporting alarms and troubles to the control panel. This module shall also provide the signaling to the field devices for the controlling the output of specific initiation devices. The on board microprocessor provides the periphery board with the ability to function even if the main microprocessor fails. LED’s on the board shall provide annunciation for the following; Power, Gnd. Fault, Alarm, Trouble. This board is integral to the system. The board shall be model number FCI2016-U1.
2. The system periphery board shall be capable of supporting two system drivers of 252 intelligent devices distributed between one, two, three, or four Class B SLC circuits, for a total panel capacity of 504 addressable devices. Any trouble on one circuit shall not affect the other circuit. This module controls the signaling from the initiation devices reporting alarms and troubles to the control panel. This module shall also provide the signaling to the field devices for the controlling the output of specific initiation devices. The on board microprocessor provides the periphery board with the ability to function even if the main microprocessor fails. LED’s on the board shall provide annunciation for the following: Power, Gnd. Fault, Alarm, Trouble. This board is intergral to the system. The board shall be model number FCI2017-U1.
3. The Signal Line Circuits (SLC) shall be tested for opens, shorts and communications with all addressable devices installed before connection to the

control panel. Systems without this capability shall have a test panel installed for initial testing to eliminate any possible damage short term or long term to the control panel. After initial testing replace the test panel and proceed with complete testing.

4. The standard Operator Interface shall have the ability to view events, acknowledge, silence, and reset the system and any networked Cerberus™ PRO control panels, when configured as a global PMI.
5. The LED Operator Interface shall have the ability to view events, acknowledge, silence, and reset the system and any networked Cerberus™ PRO control panels, when configured as a global PMI. Additionally, the operator interface provides twelve multicolored configurable LEDs for annunciating system status
6. The System Periphery Board shall contain 2 Class B NAC circuits rated at 3 amps each with power-limited outputs. The zones shall be isolated and independently supervised. There shall be at least 6 unique codes/signals for each circuit based on system logic. These signals shall be Temporal Code 3 (Evacuation), Steady (Such as “Recall”), Temporal Code 3 (for CO alarms), March Time 120ppm, March Time 60ppm, and March Time 30ppm. The card shall have the following LED’s to provide trouble shooting and annunciation; Power, Gnd. Fault, Zone Activation or Trouble. This functionality shall be integral to the system. The card shall be model number FCI2016-U1/FCI2017-U1.
7. The control panel shall be equipped with four Form C relays for alarm, trouble, supervisory, and programmable output. The system shall provide the mounting of all system cards, field wiring, and panel’s inter-card wiring. All power limited field wiring shall be separated from all non-power limited internal wiring. The card shall be model number FCI2016-U1/FCI2017-U1.

G. System response time from alarm to output shall be an average of three (3) seconds.
H. All system cards and modules shall have Flash memory for downloading the latest module firmware.
I. Passwords:
   1. Technician Level Password - There shall be a 5 character password that a user must enter into the control panel in order to perform such maintenance- and control-related functions at the panel as:
      a. Arming and disarming devices.

b. Activating, deactivating or modifying detector ASD and sensitivity settings.
c. Activating and deactivating the History Log function, and deleting obsolete entries.
d. Changing the system time and date.

2. Maintenance Level Password - There shall be a 5 character password that a user must enter into the control panel in order to access the panel's reporting functions and walktest functions.
3. Acknowledge Silenceable Reset Access - There shall be a key required to open a locked cabinte that a system user must use in order to acknowledge events, turn silenceable audibles and visuals on and off, and perform panel resets.

J. Degrade Mode Alarm Activation:
1. Each Cerberus™ PRO panel shall operate as a stand-alone fire alarm control panel with complete functionality in the event of loss of communications with other Cerberus™ PRO panels on a network.

K. Software Modifications: The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made. Systems that require the use of external programmers or change of EPROMs are not acceptable.

L. Logic: The fire alarm system shall support generic functions that deal with binary states (True/False, high/low), and produce desired outputs from one or more binary inputs (for example, alarm outputs from detector or manual station inputs). AND, OR, NOT, Any N, Latches, Start Timer, Delay Timer, Restart Timer are generic functions. Generic functions can be used as inputs to other function. The system shall support 500 logic functions.

M. History: The system shall store 20000 events in history. Trouble warnings will occur when the History buffer is full.

N. Reports:
1. The system shall have the ability to provide configuration, status, queue and history reports.
2. Configuration reports shall provide the following information:
a. Custom Messages
b. Database Information
c. Entity Type

d. Device Usage
e. Zone usage
f. Device Category
g. Firmware revision

3. Status reports shall provide the following information:
   a. Disarmed cards and devices
   b. ASD settings
   c. Sensitivity in %/foot
   d. Alarm threshold in %/foot
   e. Temperature in degrees C
   f. Walktest
4. Queue reports shall provide the following information:
   a. Alarm events with custom message and event time
   b. Supervisory events with custom message and event time
   c. Trouble events with custom message and event time
   d. Status events with custom message and event time
   e. Information events
5. History reports shall provide Address, History Type, Description, Time & Date and Custom Message. The following event types shall be reported:
   a. Alarm events
   b. Supervisory events
   c. Status changes
   d. Alarm verification
   e. Output activation from logic
   f. System Reset
   g. Event Acknowledgements
   h. Block Acknowledgements
   i. Audible Silence System Flag Changes
   j. Sensitivity Changes
   k. Arm / Disarm Commands
   l. Arm / Disarm By Logic
   m. Manual Output Overrides
   n. Output Overrides By Logic
   o. Time Changes
   p. Menu Logins

q. ASD Changes
r. Walktest
s. Device Input to Logic Activations/Deactivations

2.03 POWER SUPPLY

A. The system Power Supply FP2011-U1 shall be a 170 Watt, 6-amp that provides 24VDC power for system operation. The power supply shall be filtered and regulated. The power supply provides power for all system operation, including signaling line circuits, notification appliance circuits, auxiliary power, battery charger, and all optional modules The power supply shall be rated for 120/240 VAC 50/60 Hz. The module shall be model number FP2011-U1

B. The system Power Supply/FP2012-U1 shall be a 300 Watt, 10amp supply that provides 24VDC power for system operation. The power supply shall be filtered and regulated. The power supply provides power for all system operation, including signaling line circuits, notification appliance circuits, auxiliary power, battery charger, and all optional modules The power supply shall be rated for 120/240 VAC 50/60 Hz. The module shall be model number FP2012-U1.

C. The battery charger shall be able to charge the system batteries up to 100 AH batteries. Battery charging shall be microprocessor controlled and programmed with a special software package to select charging rates and battery sizes. An optional Thermistor for monitoring battery temperature to control charging rate shall be available.

D. Transfer from AC to battery power shall be instantaneous when AC voltage drops to a point where it is not sufficient for normal operation.

2.04 SYSTEM ENCLOSURE

A. Provide the enclosure needed to hold all the cards and modules as specified with at least spare capacity for two cards. Provide the color as to the local AHJ requirements. The outer doors shall be capable of being a left hand open. The inner door shall have a left hand opening.

B. Provide Black cabinet enclosure.

2.05 INTELLIGENT INITIATING DEVICES

A. General

1. All initiation devices shall be insensitive to initiating loop polarity. Specifically, the devices shall be insensitive to plus/minus voltage connections.

B. Smoke Detectors – Standard Addressable H-Series

1. The detector shall be guaranteed in writing not to false alarm when configured by the factory trained certified technician. The detector must provide up to 11 different environmental algorithms that allow the detector to provide superior false alarm immunity without the need for additional alarm verification delays.
2. The detector shall have a multicolor LED to streamline system maintenance/inspection by plainly indicating detector status as follows: green for normal operation, amber for maintenance required, red for alarm.
3. The multi-criteria smoke detector shall be an intelligent digital photoelectric detector with a programmable heat detector. Detectors shall be listed for use as open area protective coverage, in duct installation and sampling assembly installation and shall be insensitive to air velocity changes. The detector communications shall allow the detector to provide alarm input to the system and alarm output from the system within four (4) seconds. So as to minimize the effort required by the installing and maintenance technician to appropriately configure the detector to ensure optimal system design, the detectors shall be programmable as application specific. Application settings shall be selected in software for a minimum of eleven environmental fire profiles unique to the devices installed location.
4. The detector shall be designed to eliminate the possibility of false indications caused by dust, moisture, RFI/EMI, chemical fumes and air movement while factoring in conditions of ambient temperature rise, obscuration rate changes and hot/cold smoke phenomenon into the alarm decision to give the earliest possible real alarm condition report.
5. The intelligent smoke detector shall be capable of providing three distinct outputs from the control panel. The outputs shall be from an input of smoke obscuration, a thermal condition or a combination of obscuration and thermal conditions. The detector shall be designed to eliminate calibration errors associated with field cleaning of the chamber.
6. The detector shall support the use of a relay, or LED remote indicator without requiring an additional software address. Low profile, white case shall not exceed 2.5 inches of extension below the finish ceiling.
7. For the detector where required, there shall be available a locking kit and detector guard to prevent unauthorized detector removal.
8. The smoke detector shall be model number HFP-11.

9. Where required, there shall be available a programmable remote lamp configurable to remotely duplicate the on-board LED status of another system device with the same software address. It shall be model ILED-H.

C. Heat Detectors – Addressable

1. Thermal Detectors shall be rated at 135 degrees fixed temperature and 15 degrees per minute rate of rise. Detectors shall be constructed to compensate for the thermal lag inherent in conventional type detectors due to the thermal mass, and alarm at the set point of 135 degrees Fahrenheit. The choice of alarm reporting as a fixed temperature detector or a combination of fixed and rate of rise shall be made in system software and be changeable at any time without the necessity of hardware replacement.
2. The detectors furnished shall have a listed spacing for coverage up to 2,500 square feet and shall be installed according to the requirements of NFPA 72 for open area coverage. The thermal detector shall be model number HFPT-11.
3. Model HI921 heat detector shall have the following temperature settings:
   a. Fixed temperature at 135F, 145F, 155F, 165F, 174F
   b. Rate of Rise at 15F/ min (8.3C) at 135F (57C)
   c. Rate of Rise at 15F/ min (8.3C) at 174F (79C)
   d. Low temperature warning at 40F (4.4C)

D. Detector Bases – Addressable

1. Detector bases shall be low profile twist lock type with screw clamp terminals and self-wiping contacts. Bases shall be installed on an industry standard, 4" square or octagonal electrical outlet box.
2. Detectors shall be listed per UL 268A as “direct in duct” without need for a duct housing.
3. The model number for the standard base shall be DB-11 - 6” Version.
4. The model number for the standard base shall be BB-11E - 4” Version.
5. Duct detector shall have remote indictor station.

E. Manual Pull Stations – Addressable

1. Provide addressable manual stations where shown on the drawings, to be flush or surface mounted as required. Manual stations shall contain the intelligence for reporting address, identity, alarm and trouble to the fire alarm control panel. The manual station communications shall allow the station to provide alarm input to the system and alarm output from the system within less than four (4) seconds.

2. The manual station shall be equipped with terminal strip and pressure style screw terminals for the connection of field wiring. Surface mounted stations where indicated on the drawings shall be mounted using a manufacturer's prescribed matching red enamel outlet box.
3. Pull stations shall be double-action.
4. Where required, there shall also be available pull stations with break glass, capable of explosion proof installation, capable of weatherproof installation, reset key operation, and metal housings.

F. Addressable Interface Devices

1. Addressable Interface Devices shall be provided to monitor contacts for such items as water-flow, tamper, and PIV switches connected to the fire alarm system. These interface devices shall be able to monitor a single or dual contacts. An address will be provided for each contact. Where remote supervised relay is required the interface shall be equipped with a SPDT relay rated for 4 amps resistive and 3.5 amps inductive. The addressable interface modules shall be model number HTRI Series.
2. Where needed a Conventional Zone Module shall connect to the Signal Line Circuit, which will allow the use of conventional initiation devices. This module shall have the ability to support up to 15 convention smoke detectors and an unlimited number of contact devices. This module shall also be capable of monitoring Linear Beam detectors and conventional Flame detectors. Where required, there shall be an intrinsically safe detection solution for NEMA defined intrinsically safe installations (model DI-3IS with ISI-1) compatible with the conventional zone module. The module shall be model HZM.
3. Single Device Damper Monitoring and Control: A single HTRI switch input shall be able to monitor all 3 states of a damper – open, closed, and in transit. A single HTRI-R shall be able to fully control a damper (through the relay connected to the motor control) while also using its switch input for monitoring all 3 states of the damper.
4. Model FCIO422 addressable input/output module shall be insensitive to polarity and shall have capability for up to 4 separate inputs (Class B) or 2 separate Class A inputs and 4 separate outputs (Class B).

2.06 NOTIFICATION APPLIANCES

A. Series MH115 AC Horn

1. AC horns shall be Cerberus™ PRO Series MH115, or approved equal

2. Models shall be UL 464 Listed for Fire Protective Service, and shall include a die-cast metal housing to protect the horn mechanism
3. Sound output shall be 95 dBA minimum at 10 feet
4. Mounting options shall include surface mounting for indoor or outdoor applications and semi-flush for indoor applications
5. All models shall have screw terminal inputs for in / out field wiring
6. The finish shall be textured enamel
7. All notification appliances shall be listed for “Special Applications”

B. Series ZH & ZR – Strobes, Horns, Horn/Strobes

1. Audible/Visual notification appliances shall be listed for indoor use, and shall meet the requirements of FCC Part 15 - Class B
2. Appliances shall be listed under UL Standard 1971 (Standard for Safety Signaling Devices for Hearing Impaired) and UL Standard 464 (Fire Protective Signaling)
3. Appliances shall use a universal back plate, which shall allow mounting to a single-gang, double-gang, 4-inch-square, 4”-octal, or a 3-1/2”-octal backbox
4. Two-wire appliance wiring shall be capable of directly connecting to the mounting back plate
5. Continuity check shall occur for entire NAC circuit prior to attaching any audible / visual-notification appliances
6. Dust cover shall fit and protect the mounting plate
7. Dust cover shall be easily removed when the appliance is installed over the back plate
8. Removal of an appliance shall result in a trouble condition by the Fire Alarm Control Panel (FACP)
9. Strobe appliances shall produce a minimum flash rate of 60 flashes per minute (1 flash per second) over the Regulated Input Voltage Range, and shall incorporate a Xenon flashtube enclosed in a rugged Lexan® lens
10. Strobes shall be available with two or four field-selectable settings in one unit, and shall be rated – per UL 1971 – for up to:
    a. 185cd for wall mounting
    b. 177cd for ceiling mounting
11. Strobes shall operate over an extended temperature range of 32°F to 120°F (0°C to 49°C), and be listed for maximum humidity of 95% RH

12. Strobe inputs shall be polarized for compatibility with standard reverse-polarity supervision of circuit wiring by a Fire Alarm Control Panel (FACP)
13. Audibles and Audible/Strobe Combinations
    a. Horns and horn / strobes shall be listed for Indoor use under UL Standard 464
    b. Horns shall be able to produce continuous synchronized output or a temporal code-3 synchronized output
    c. Horns shall have at least 2 sound-level settings of 90 and 95 dBA
    d. Synchronization Modules
    e. The strobe portion, when synchronization is required, shall be compatible with DSC sync modules, FS-250 panel, FireFinder XLS panel, or PAD-3 power supply with built-in sync protocol
14. The strobes shall not drift out of synchronization at any time during operation
15. Audibles and strobes shall be able to synchronize on a 2-wire circuit with the capability to silence the audible, if required
16. Strobes shall revert to a non-synchronized flash-rate, if the sync module or Power Supply should fail to operate (i.e. – contacts remain closed)
17. All notification appliances shall be listed for Special Applications: Strobes are designed to flash at 1-flash-per-second minimum over their “Regulated Input Voltage Range”

2.07 REMOTE TEXT ANNUNCIATOR

A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
    1. Mounting: Flush mounted cabinet.

B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.08 DIGITAL COMMUNICATOR

A. The Multi-Point Digital Alarm Communicator FCA2015-U1 shall be UL864 listed to provide point identification of alarm, supervisory, security and trouble events to a Central or Remove Receiving Station. The DACT shall support the following:
    1. Ademco Contact ID or SIA protocol

2. Ademco Contact ID selection shall provide the ability to transmit events for up to 999 individual zones
3. SIA selection shall provide the ability to transmit events for up to 10000 individual points
4. Programming of accounts and phone numbers
5. Dual phone line interface
6. Line fault monitoring.
7. Automatic 24-hour test
8. The DACT supports configurable alarm, alarm restoral, trouble, trouble restoral, supervisory, supervisory restoral, and reset events.
9. The DACT supports Ademco Contact ID alarm event codes for general alarm, smoke detector alarm, waterflow alarm, duct alarm, and manual alarm events.
10. Optionally, the DACT can be programmed to report events by event queue only.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the work.

3.02 INSTALLATION

A. Perform work in accordance with the requirements of NFPA 70, NFPA 72 and NECA 1, Standard of Good Workmanship in Electrical Contracting.
B. Fasten equipment to structural members of building or metal supports attached to structure, or to concrete surfaces.
C. In the event that limited energy cable installation is allowed, all cable runs shall be run at right angles to building walls, supported from structure at intervals not exceeding 3 feet and where installed in environmental air plenums, be rated for such use and tied/supported by components listed for environmental air plenums installation.
D. Wiring Method:
    1. All wiring for new fire alarm/detection systems shall be installed in conduit.
    2. Junction box covers shall be painted red with letters “F/A” using a permanent marker on the cover.
    3. Fire alarm signaling line and notification appliance circuits shall not be electrically loaded beyond eighty percent (80%) of full capacity to allow for future expansion of the system.

E. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

F. Provide primary power for each panel from normal/ emergency panels as indicated on the Electrical Power Plans. Power shall be 120 VAC service, transformed through a two-winding, isolation type transformer and rectified to low voltage DC for operation of all circuits and devices.

3.03 BOXES, ENCLOSURES AND WIRING DEVICES

A. Boxes shall be installed plumb and firmly in position.

B. Extension rings with blank covers shall be installed on junction boxes where required.

C. Junction boxes served by concealed conduit shall be flush mounted.

D. Upon initial installation, all wiring outlets, junction, pull and outlet boxes shall have dust covers installed. Dust covers shall not be removed until wiring installation when permanent dust covers or devices are installed.

E. "Fire alarm system" decal or silk-screened label shall be applied to all junction box covers.

3.04 CONDUCTORS

A. Each conductor shall be identified as shown on the drawings at each with wire markers at terminal points. Attach permanent wire markers within 2 inches of the wire termination. Marker legends shall be visible.

B. All wiring shall be supplied and installed in compliance with the requirements of the National Electric Code, NFPA 70, Article 760, and that of the manufacturer.

C. Wiring for strobe and audible circuits shall be a minimum 14 AWG, signal line circuits minimum 18 AWG twisted.

D. All splices shall be made using solderless connectors. All connectors shall be installed in conformance with the manufacturer recommendations.

E. Crimp-on type spade lugs shall be used for terminations of stranded conductors to binder screw or stud type terminals. Spade lugs shall have upset legs and insulation sleeves sized for the conductors.

F. The installation contractor shall submit for approval prior to installation of wire, a proposed color code for system conductors to allow rapid identification of circuit types.

G. Wiring within sub panels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance.

3.05 DEVICES

A. Relays and other devices to be mounted in auxiliary panels are to be securely fastened to avoid false indications and failures due to shock or vibration.

B. Wiring within panels shall be arranged and routed to allow accessibility to equipment for adjustment and maintenance.

C. All devices and appliances shall be mounted to or in an approved electrical box.

3.06 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

B. Permanently label or mark each conductor at both ends with permanent alphanumeric wire markers.

C. A consistent color code for fire alarm system conductors throughout the installation.

3.07 ACCEPTANCE TESTING

A. A written acceptance test procedure (ATP) for testing the fire alarm system components and installation will be prepared by the engineer in accordance with NFPA 72 and this specification. The contractor shall be responsible for the performance of the ATP, demonstrating the function of the system and verifying the correct operation of all system components, circuits, and programming.

B. A program matrix shall be prepared by the installing contractor referencing each alarm input to every output function affected as a result of an alarm condition on that input.

C. The installing contractor prior to the ATP shall prepare a complete listing of all device labels for alphanumeric annunciator displays.

D. Loop Resistance Tests: Measure and record the resistance of each circuit with each pair of conductors in the circuit short-circuited at the farthest point from the circuit origin. The tests shall be witnessed by the owner and test results recorded for use at the final acceptance test.

E. Preliminary Testing: Conduct preliminary tests to ensure that all devices and circuits are functioning properly. After preliminary testing is complete, provide a letter certifying that the installation is complete and fully operable. The letter shall state that each initiating and indicating device was tested in place and functioned properly. The letter shall also state that all panel functions were tested and operated properly. The Contractor and an authorized representative from each supplier of equipment shall be in attendance at the preliminary testing to make necessary adjustments.

F. Final Acceptance Test: Notify the owner in writing when the system is ready for final acceptance testing. Submit request for test at least 14 calendar days prior to the test date. A final acceptance test will not be scheduled until meggar test results, the loop resistance test results, and the submittals required in Part 1 are provided to the owner. Test the system in accordance with the procedures outlined in NFPA 72.
   1. Verify that the control unit is in the normal condition as detailed in the manufacturer's operating and maintenance manual.
   2. Test each initiating and indicating device and circuit for proper operation and response. Disconnect the confirmation feature for smoke detectors during tests to minimize the amount of smoke or test gas needed to activate the detector.
   3. Test the system for all specified functions in accordance with the contract drawings and specifications and the manufacturer's operating and maintenance manual.
   4. Visually inspect all wiring.
   5. Verify that all software control and data files have been entered or programmed into the FACP.
   6. Verify that Shop Drawings reflecting as-built conditions are accurate.
   7. Measure the current in circuits to assure that there is the calculated spare capacity for the circuits.
   8. Measure voltage readings for circuits to assure that voltage drop is not excessive.
   9. Measure the voltage drop at the most remote appliance on each notification appliance circuit.

G. The acceptance inspector shall use the system record drawings in combination with the documents specified in this specification during the testing procedure to verify operation as programmed. In conducting the ATP, the acceptance inspector shall request demonstration of any or all input and output functions. The items tested shall include but not be limited to the following:
   1. System wiring shall be tested to demonstrate correct system response and correct subsequent system operation in the event of:
      a. Open, shorted and grounded signal line circuits.
      b. Open, shorted and grounded notification, releasing circuits.
      c. Primary power or battery disconnected.
   2. System notification appliances shall be demonstrated as follows:
      a. All alarm notification appliances actuate as programmed

b. Audibility and visibility at required levels.

3. System indications shall be demonstrated as follows:
   a. Correct message display for each alarm input at the control display.
   b. Correct annunciator light for each alarm input at each annunciator and graphic display as shown on the drawings.
   c. Correct history logging for all system activity.
4. System off-site reporting functions shall be demonstrated as follows:
   a. Correct zone transmitted for each alarm input
   b. Trouble signals received for disconnect
5. Secondary power capabilities shall be demonstrated as follows:
   a. System primary power shall be disconnected for a period of time as specified herein. At the end of that period, an alarm condition shall be created and the system shall perform as specified for a period as specified.
   b. System primary power shall be restored for forty-eight hours and system-charging current shall be normal trickle charge for a fully charged battery bank.
   c. System battery voltages and charging currents shall be checked at the fire alarm control panel.

3.08 DOCUMENTATION

A. System documentation shall be furnished to the owner and shall include but not be limited to the following:
   1. System record drawings and wiring details including one set of reproducible drawings, and a CD ROM with copies of the record drawings in DXF format for use in a CAD drafting program.
   2. System operation, installation and maintenance manuals.
   3. System matrix showing interaction of all input signals with output commands.
   4. Documentation of system voltage, current and resistance readings taken during the installation, testing and ATP phases of the system installation.
   5. System program showing system functions, controls and labeling of equipment and devices.

END OF SECTION 284600

SECTION 311000

SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Protection of existing trees.
2. Clearing and grubbing.
3. Removal of trees and other vegetation.
4. Topsoil stripping.

1.3 DEFINITIONS

A. Remove: Remove and legally dispose of items indicated. Removal includes digging out and off-site disposing of stumps and roots or burning if allowed by local ordinance

B. Tree Protection Zone: The area surrounding individual trees or groups of trees to be protected during construction and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

C. Topsoil: Friable, clay loam surface soil, found in varying depths.

1.4 MATERIALS OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of trees, plantings and other improvements adjoining the construction that might be misconstrued as damage caused by the Work.

1.6 PROJECT CONDITIONS

A. Traffic: Conduct site clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets,

walks or other occupied or used facilities without permission from authorities having jurisdiction.

B. Protection of Existing Improvements: Provide protections necessary to prevent damage to existing improvements indicated to remain in place.

1. Protect existing improvements on adjoining properties and on Owner's property.
2. Restore existing improvements damaged by clearing operations to their original condition.

C. The conditions existing at the time of inspection for bidding purposes will be maintained by the Owner to the extent practical. However, minor variations may occur due to natural occurrences prior to the start of clearing work.

D. Do not commence site-clearing operations until erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS

2.1 TREE PROTECTION FENCING

A. Tree protection fencing shall conform to standard and specification 3.38-2 (plastic fence) of the Virginia Erosion and Sediment Control Handbook.

PART 3 – EXECUTION

3.1 PROTECTION OF EXISTING TREES AND VEGETATION

A. Install tree protection fencing as indicated. Erect and maintain a temporary fence around the drip line of individual trees or around the perimeter drip line of groups of trees to remain.

1. Do not store construction materials, debris, topsoil or other excavated material within the tree protection zone.
2. Do not permit vehicles or other equipment within the tree protection zone.
3. Maintain tree protection zones free of weeds and trash.

B. Protect existing trees and other vegetation indicated to remain in place, against unnecessary cutting, breaking or skinning of roots, skinning or bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line.

C. Provide protection for roots over 1-1/2-inch diameter that are cut during construction operations. Coat cut faces with emulsified asphalt, or other acceptable coating, formulated for use on damaged plant tissues. Temporarily cover exposed roots with wet burlap to prevent roots from drying out, cover with earth as soon as possible.

D. Repair or replace trees and vegetation indicated to remain which are damaged by construction operations, in a manner acceptable to Architect.

3.2 SITE CLEARING

A. General: Remove trees, shrubs, grass and other vegetation as required to permit installation of the Work. Cut minor roots and branches of trees indicated to remain in a clean and careful manner, where such roots and branches obstruct installation of the Work.

B. Clearing and Grubbing: Clear site of trees, shrubs and other vegetation within the clearing limits indicated.

1. Completely remove stumps, roots, and other debris.
2. Use only hand methods for grubbing inside drip line of trees indicated to remain.
3. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated. Place fill material in horizontal layers not exceeding 6 inches loose depth, and thoroughly compact to a density equal to adjacent original ground.

C. Selective Clearing: Clear areas designated as “Selective Clearing” of all ground covers, underbrush and trees less than 6-inches in diameter at breast height. Coordinate extent of material removed with Architect.

1. Remove trees that appear to be dying or weakening for any reason and at any point during construction up to and including Substantial Completion at the Architect’s direction.

3.3 TOPSOIL STRIPPING

A. Remove heavy growths of grass from areas before stripping.

B. Strip topsoil to whatever depths are encountered, but to a minimum of at least 4 inches.

C. Strip topsoil in a manner to prevent intermingling with underlying subsoil or other material.

1. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

D. Where existing trees are indicated to remain, leave existing topsoil in place within drip lines to prevent damage to root system.

E. Temporarily stockpile topsoil in storage piles in areas indicated or directed. Construct storage piles to provide free drainage of surface water. Cover storage piles, if required, to prevent wind erosion.

1. Do not stockpile topsoil within tree protection zones.
2. Stockpile surplus topsoil to allow for respreading deeper topsoil.

F. Dispose of unsuitable or excess topsoil in a legal manner off-site.

3.4 DISPOSAL OF WASTE MATERIALS

A. Burning on Owner's Property: Burning is not permitted.

B. Removal from Owner's Property: Remove waste materials generated by clearing operations from Owner's property and dispose of in a legal manner off-site.

1. Remove waste materials and debris from the site in a manner to prevent spillage. Pavements and the area adjacent to the site shall remain free from mud, dirt and debris at all times.
2. Clean up debris resulting from site clearing operations continuously with the progress of the work.

END OF SECTION 311000

SECTION 312000

EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

B. Refer to Section 01 2110 and the Bid Form for information concerning required allowances and unit prices.

C. Refer to Section 31 1000 for topsoil stripping and Section 32 9200 for topsoil placement.

1.2 SUMMARY

A. This Section includes the following:

1. Excavation, filling, backfilling, and grading indicated and necessary for proper completion of the work.
2. Preparing of subgrade for building slabs, walks, and pavements.
3. Drainage/porous fill course for support of building slabs.
4. Excavating and backfilling of trenches.
5. Excavating and backfilling for underground mechanical and electrical utilities and buried mechanical and electrical appurtenances.

1.3 SUBMITTALS

A. VDOT approved Job Mix for stone.

B. Imported fill (if required): Submit location of borrow pit and a sample of the soil for approval to the Owner’s Geotechnical Engineer a minimum of fourteen (14) working days prior to use.

C. Geotextile Fabric

D. Copy of Blasting Permit, approved by authorities having jurisdiction, for record purposes.

1.4 DEFINITIONS

A. Excavation: Removal of all material (except for rock) encountered to design subgrade elevations indicated for cut areas and to subsoil elevations in fill areas. Excavation also includes subsequent respreading, moisture conditioning, compaction, and grading of satisfactory materials removed.

B. Unauthorized Excavation: Removal of materials beyond the limits indicated in the definition of “Excavation” without specific direction of Architect.

C. Additional Excavation: Removal, disposal and replacement of materials beyond the limits indicated in the definition of “Excavation” at the direction of the Architect. Refer to Part 3 of this Section for requirements of Additional Excavation.

D. Subgrade: The undisturbed earth (in cut) or the compacted soil layer (in fill) immediately below granular subbase, drainage fill, or topsoil materials.

E. Subsoil: The undisturbed earth immediately below the existing topsoil layer.

F. Building Pad: The area extending 10 feet beyond the exterior limits of the building/column footings and down to undisturbed soils at a one horizontal to one vertical slope.

G. Structures: The area extending a minimum of ten (10) feet beyond the edge of foundations, slabs, curbs, underground tanks, piping or other man-made stationary features occurring above or below ground surface.

H. Pavements: The area extending 10 feet beyond the exterior limits of paved areas and down to undisturbed soils at a one horizontal to one vertical slope. The area extending 3 feet beyond the exterior limits of walks and down to undisturbed soils at a one horizontal to one vertical slope

I. Subbase Material: Artificially graded mixture of crushed gravel or crushed stone meeting VDOT specifications. Material type is indicated on the drawings.

J. Drainage/Porous Fill: Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel meeting the requirements of VDOT No. 57 Stone.

K. Rock: Hard bed rock, boulders or similar material requiring the use of rock drills and/or explosives for removal. The criteria for classification of general excavation as rock is any material which cannot be dislodged by a Caterpillar D-8 Tractor, or equivalent, equipped with a single tooth hydraulically operated power ripper. The criteria for trench rock shall be that a Caterpillar 345 Backhoe, or equivalent, with a proper width bucket cannot remove the material. Rock does not include boulders less than one cubic yard in volume.

1.5 ADDITIONAL WORK

A. Paragraph 4.3.4 of General Conditions refers to certain conditions that may require additional excavation work. This paragraph is further defined herein and, where there are conflicts, is superseded by this section.

B. Claims for concealed, unknown, or unanticipated subsurface conditions are limited to those circumstances where:

1. Additional excavation work is required below the contract limits indicated to provide acceptable bearing for building pad, structures or pavements.
2. Additional excavation work is required to raise, lower, or revise the footings, foundations or other parts of the building to provide acceptable bearing.
3. Additional excavation work below the utility trench design elevations, for utilities outside the limits of the building, as required to provide acceptable bearing for the utility.
4. Rock is encountered between existing grade and design subgrade.

C. The risks of concealed, unknown, or unanticipated subsurface conditions (except for rock) from existing ground surface to the design subgrade elevations in cut areas and to subsoil elevations in fill areas shall be included in the Contract Amount and shall not be considered

as grounds for additional costs to the Contract. The risks of concealed, unknown, or unanticipated subsurface conditions below the elevations stated above shall be considered as Additional Excavation.

D. During construction, if concealed, unknown, or unanticipated subsurface conditions are encountered which require that footings, foundations or other parts of the building be raised, lowered or revised to provide acceptable bearing for the building or if, outside the building limits, additional depth of utility trench excavation below the design subgrade or subsoil elevations is required, immediately notify the Architect upon discovery of such condition prior to disturbing the material encountered.

E. Payment for additional Work

1. Additional excavation shall be counted toward the unit price allowances established in the Bid Form. The Owner reserves the right to negotiate said unit price allowances prior to the Award of Contract.
2. Lowering of footings shall be paid for at a negotiated amount. The additional excavation involved shall be counted toward the unit price allowance.
3. Rock removal, if required, shall be counted toward the unit price allowances established in the Bid Form. All rock removal required to complete work other than trenching shall be paid for at the unit price for mass rock removal. Rock payment lines are limited to the following:
   a) Two feet outside of concrete work for which forms are required, except footings.
   b) One foot outside perimeter of footings, two feet below bottom of footings.
   c) In pipe trenches, 6 inches below invert elevation of pipe and 2 feet wider than outside diameter of pipe, but not less than 3 feet minimum trench width.
   d) Outside dimensions of concrete work where no forms are required.
   e) Under slabs on grade, 6 inches below bottom of concrete slab.
4. No payment will be made for unauthorized excavation.
5. The expense of surveying quantities of rock removal and additional excavation shall be included in the unit price allowances.

1.6 EARTHWORK BALANCE ADJUSTMENTS

A. Adjustments of grades may be allowed with prior written approval of the Architect in order to accommodate shortfall or surplus of material that may occur. Should adjustments be allowed, maintenance of designed drainage patterns and required adjustments to drainage structures shall be a Contract responsibility. No additional payment will be made for these adjustments.

B. Importation of any required material shall be a Contract responsibility. No additional payment will be made for the importation of this material.

C. Excavation and disposal of any required material off-site in a legal manner shall be a Contract responsibility. **No additional payment will be made for the export and disposal of this material**.

1.7 QUALITY ASSURANCE

A. Codes and Standards: Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.

B. Environmental Compliance:

1. Comply with the requirements of the latest edition of the Virginia Erosion and Sediment Control Handbook for erosion control during earthwork operations.
2. Comply with the permit conditions for all work performed within wetlands.

C. Testing and Inspection Service: Owner will employ and pay for an independent Geotechnical testing and inspection laboratory to perform soil testing and inspection service during earthwork operations. Cooperate with Owner's Geotechnical Engineer as required for testing and inspection of work. These services do not relieve the responsibility for compliance with Contract Document requirements.

1.8 PROJECT CONDITIONS

A. Site Information: Data concerning subsurface materials or conditions, which are based on test borings, have been obtained by the Owner for his use in designing the project. This data is contained in a report titled "GEOTECHNICAL ENGINEERING REPORT, High School Center II, Albemarle County, Virginia" by Schnabel. dated May 31, 2024. This report is included in this project manual for information only.

1. The accuracy or completeness of the data is not warranted or guaranteed by the Owner or the Architect/Engineer, and in no event shall be considered part of the Contract Documents. The Owner and Architect/Engineer expressly disclaim any responsibility for the data as being representative of the conditions and materials that may be encountered.

B. Bidders and interested parties (prior to receipt of bids) are encouraged to conduct their own soil and subsurface investigations, examinations, tests, and exploratory borings to determine the nature of the soil conditions underlying the project site. Contact the Owner's office to make an appointment to enter the site for the purpose of conducting your own investigation prior to bid.

C. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner of others except when permitted under the following conditions and then only after arranging to provide acceptable temporary utility services.

1. Notify Architect not less than 48 hours in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without receiving Architect's written permission.
3. Existing utilities across or along the line of work are indicated only in an approximate location. Locate all underground lines and structures. Call "Miss Utility" at 1-800-552-7001 prior to construction. If utilities are marked that are not shown on the plans, locate utility vertically and horizontally and provide information to architect. Repair and correct any damage to underground lines and structures.

1.9 SAFETY

A. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.

1. Operate warning lights as recommended by authorities having jurisdiction and governing regulations and standards.

2. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Work within the road right-of-way shall meet all requirements of the latest edition of the Virginia Department of Transportation Work Area Protection Manual.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups CL, ML, SC, SM, SP, SW, GC, GP and GW.

B. On-site materials classifying as CH and MH should not be used behind below-grade walls or within 3 ft of pavement subgrades but can be use in other fill locations approved by the owners Geotech inspector.

C. Unsatisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups CH, OL, OH, MH, ML and PT.

D. Backfill and Fill Materials: Satisfactory soil materials free of clay, rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, organics, vegetation and other deleterious matter.

E. Imported material for structural fill shall comply with ASTM D2487 soil classification groups CL, SC, SM, SP, SW, GC, GM, GP, or GW.

2.2 ACCESSORIES

A. Non-woven Geotextile Fabric (for drainage): Mirafi 140N, SRW NM 4.5, Nilex 4546 or equivalent.

B. Woven Geotextile Fabric (for reinforcement): Mirafi 600X, Nilex BX 2020 Geogrid, Terra Tex HD, or equivalent.

PART 3 – EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Section 311000 "Site Clearing."

C. Protect and maintain erosion and sedimentation controls during earthwork operations.

3.2 DEWATERING

A. Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area.

1. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrade and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rainwater and water removed from excavations to collecting or runoff areas. Do not use utility trench excavations as temporary drainage ditches. The cost of quantifying the material shall be included in the unit price allowance(s).

B. Should any springs or running water be encountered in the excavation, notify the Architect and provide discharge by trenches (or other acceptable means) and drain to an appropriate point of disposal. Provide temporary drainage facilities to minimize the flow of rainwater onto adjacent property. Repair any damage to property or to subgrade as a result of construction and/or dewatering (or lack thereof) operations at no additional cost to the Contract. If permanent provision must be made for disposal of water other than as indicated, the Contract price shall be adjusted.

3.3 EXPLOSIVES

A. Blasting is not permitted.

3.4 EXCAVATION

A. Excavation consists of removal, placement and disposal of material encountered when establishing required subgrade or finish grade elevations.

1. Excavation includes removal and disposal of pavements and other obstructions visible on ground surface; underground structures, utilities and other items indicated to be demolished and removed; together with earth and other materials encountered that are not classified as rock or unauthorized excavation.

B. Rock Excavation: If Rock is encountered the Owner’s Geotechnical Engineer will verify that the material qualifies for classification as rock excavation.

1. If rock is encountered in grading, remove to depths as follows:
   a) Under surfaced areas, to 6” under the respective subgrade for such areas.
   b) Under grass and planted areas - 12” minimum.
   c) Under footings – Two feet below bottom of footing, One foot outside of perimeter of footing.
   d) Under trenches – 6” below bottom of trench.

2. Contractor shall employ a surveyor licensed in the Commonwealth of Virginia to calculate the quantity of material removed as Rock Excavation. The quantity of rock calculated shall not exceed the volume determined by the payment limits. The Owner’s

Project Representative shall review the quantity calculated within 48 hours of receiving the survey notes.

3.5 EXCAVATION FOR BUILDING PAD AND STRUCTURES

A. Conform to elevations and dimensions indicated within a tolerance of plus or minus 0.10 foot and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction and for review.

B. Excavations for footings and foundations: Do not disturb bottoms of excavation. Excavate by hand to elevations required just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.

1. Where rock is encountered, carry excavation to required elevations and backfill with VDOT No. 57 stone prior to installation of footing.

C. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Structures: Conform to elevations and dimensions indicated within a tolerance of plus or minus 0.10 foot plus a sufficient distance to permit placing and removal of concrete formwork, installation of services, other construction and for review. Do not disturb bottom of excavations intended for bearing surface.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Cut surface under pavements to comply with cross-sections, elevations and grades as indicated.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches of clearance on both sides of pipe or conduit.

B. Excavate trenches to depth indicated or required to establish indicated slope and invert elevations and to support bottom of pipe or conduit on undisturbed soil. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

1. Where rock is encountered, carry excavation to required elevations and backfill with VDOT #57 crushed stone prior to installation of pipe.
2. For pipes or conduit less than 6 inches in nominal size, and for flat-bottomed, multiple-duct conduit units, do not excavate beyond indicated depths. Hand-excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.
3. For pipes and equipment 6 inches or larger in nominal size, shape bottom of trench to fit bottom of pipe for 90 degrees (bottom 1/4 of the circumference). Fill depressions with tamped sand backfill. At each pipe joint, dig bell holes to relieve pipe bell of loads ensure continuous bearing of pipe barrel on bearing surface.

3.8 EXCAVATION STABILITY

A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction.

B. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

C. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progresses.

3.9 SUBGRADE INSPECTION

A. Notify Architect when mass, trench and footing excavations have reached required subgrade. The Architect will arrange for an inspection of conditions by the Owner's Geotechnical Engineer. Alternative procedures for arranging this review may be implemented at the Owner's written option.

B. If the Owner's Geotechnical Engineer determines that the subgrade bearing conditions are unacceptable, the Architect will authorize additional excavation until suitable bearing conditions are encountered.

C. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Under supervision of the Owner's Geotechnical Engineer, proofroll subgrade in cut areas below the building pad and pavement(s) with a loaded dump truck or other approved pneumatic tired vehicle. Should any unstable sub-soil be encountered below pavement or structures, break up the top eight inches of ground surface, pulverize, moisture-condition to optimum moisture content, and compact to percentage of maximum density as stated in Percentage of Maximum Density Requirements. Perform this work at no additional cost and/or time to the Contract.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.10 ADDITIONAL EXCAVATION

A. Additional Excavation (Mass): Remove excavated materials and dispose of off-site at contractor's expense. Replace this excavated material with satisfactory material placed and compacted according to the requirements of the "Placement and Compaction" section.

B. Additional Excavation in Trenches: Remove excavated materials and dispose of Remove excavated materials and dispose of off-site at contractor's expense. Replace this excavated material with stone.

C. Additional Excavation in Footings: Remove excavated materials and dispose of off-site at contractor's expense. Replace this excavated material with lean concrete/flowable fill or with stone extending 12 inches laterally beyond the footing in all directions.

D. The quantity of material removed as Additional Excavation (Mass, Trench or Footing) shall be calculated (on an in-situ basis) by a surveyor licensed in the Commonwealth of Virginia and employed by the Contractor. The Owner's Project Representative shall review the quantity calculated within 48 hours of receiving the survey notes.

E. Protect the subgrade during construction. During wet conditions, the subgrade soils may become saturated and soften, possibly resulting in damage to the subgrade if disturbed by equipment. Correct subgrade damaged in this manner. **No additional payment will be made to correct subgrade damaged in this manner**.

3.11 UNAUTHORIZED EXCAVATION

A. Correct Unauthorized Excavation as follows:

1. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position when acceptable to Architect.
2. Elsewhere, backfill and compact unauthorized excavations as indicated for authorized excavations of same classification unless otherwise directed by Architect.

3.12 STORAGE OF EXCAVATED MATERIALS

A. Temporarily stockpile excavated materials acceptable for use as backfill and fill. Place, grade, and shape stockpiles for proper drainage. Cover to prevent windblown dust.

1. Stockpile excavated materials away from edge of excavations. Do not store within the drip line of trees to remain.

3.13 BACKFILL AND FILL

A. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Acceptance by local authority having jurisdiction of construction below finished grade, including perimeter insulation.
2. Review, approval, and recording of the locations of underground utilities.
3. Removal of concrete formwork.
4. Removal of shoring and bracing (including backfilling of voids with satisfactory materials).
5. Removal of trash and debris from excavation.
6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow or ice.

C. Ground Surface Preparation: Remove vegetation, debris, obstructions, and deleterious materials from ground surface prior to placement of fills.

D. Bench sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material. Plow, scarify, bench or break up sloped surfaces flatter than 1 vertical to 4 horizontal so fill material will bond with existing material.

E. Place soil material in layers to required subgrade elevations, for each area classification listed below, using materials indicated in Part 2 of this Section.

1. Under grassed areas, use satisfactory excavated or borrow material.
2. Under walks, curbs, and pavements, use satisfactory excavated or borrow material.
3. Under building slabs, use satisfactory excavated or borrow materials and drainage/porous fill material as indicated.

3.14 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings and that are carried below bottom of such footings or that pass under wall footings. Place concrete to level of bottom of adjacent footing.

D. Provide 4-inch- thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.

E. Place and compact initial backfill of subbase material satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the utility pipe or conduit.

G. Backfill voids with satisfactory soil while installing and removing shoring and bracing.

H. Place and compact final backfill of satisfactory soil to final subgrade elevation.

I. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

J. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

K. Do not backfill trenches until any required testing and inspections have been completed and Architect authorizes backfilling. Backfill carefully to avoid damage or displacement of pipe systems.

L. Under piping and conduit and equipment, use crushed stone where required over rock bearing surface and for correction of unauthorized excavation. Shape excavation bottom to fit bottom 90 degrees of cylinder.

M. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

3.15 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 3 percentage points of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 3 percentage points and is too wet to compact to specified dry unit weight.

B. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations. Maintain the moisture content of the structural fill materials to within 3 percentage points of the optimum moisture content until permanently covered.

C. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to required density.

1. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.
2. Work wet materials as directed by the Owner’s Geotechnical Engineer. Base bids on working material daily for a maximum of five days of acceptable weather.
3. No additional payment will be made for these operations.

3.16 COMPACTION OF SOIL BACKFILL AND FILLS

A. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

C. Control soil and fill compaction, providing minimum percentage of density indicated for each area classification indicated below. Correct improperly compacted areas or lifts as directed by Architect if soil density tests indicate inadequate compaction.

D. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density at a moisture content within 2 percentage points of optimum in accordance with ASTM D698:

1. Under structures, building pad and pavements, compact each layer of backfill or fill material at 95 percent maximum density. This includes ground under future expansion areas.
2. Under grass or unpaved areas, compact each layer of backfill or fill material at 90 percent maximum density.

E. Seal all fill areas at the end of each working day, utilizing a smooth drum roller.

3.17 GRADING

A. General: Rough grading of areas within the Project, including cut and fill sections and adjacent transition areas, shall be reasonably smooth, compacted and free from irregular surface changes. The degree of finish shall be that ordinarily obtainable from either blade-grader or motor patrol except as otherwise indicated. The finished subgrade surface from the grassed areas generally shall be not more than 0.2 feet above or below the final grade or approved cross section, with due allowance for topsoil.

B. The tolerance for areas within 10 feet of building perimeter, walks and all areas to be paved shall not exceed 0.10 feet above or below the established subgrade. Finish all ditches, swales and gutters to drain readily. Unless otherwise indicated, evenly slope the subgrade to provide drainage away from building walls in all directions at a grade not less than ¼ inch per foot. Provide rounding at top and bottom of cut and fill slopes and at other breaks in grade.

C. Protection of Graded Areas: Protect newly graded areas and areas of cut, fill and design/subgrade elevations from the actions of the elements and from deterioration as a result of construction operations and weather conditions (frost, rains, snow, sleet, hail, etc.). Repair any settlement or washing that occurs prior to or after acceptance of the work. Fill to required subgrade levels any areas where settlement occurs. Protect trees to remain, and, at all areas of the Site where construction operations are in progress, provide protection for the safety of occupants of the existing facilities.

D. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

E. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.

3. Pavements: Plus or minus 1/2 inch.

F. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.18 PAVEMENT SUBBASE COURSE:

A. General: Place subbase material, in layers of indicated thickness, over subgrade surface to support a pavement base course.

B. Grade Control: During construction, maintain lines and grades including crown and cross-slope of subbase course.

C. Shoulders: Place shoulders along edges of subbase course to prevent lateral movement. Construct shoulders of acceptable soil materials, placed in such quantity to compact to thickness of each subbase course layer. Compact and roll at least at 12” width of shoulder simultaneously with compacting and rolling each layer of subbase course.

D. Placing: Place subbase course material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting subbase material during placement operations.

E. When a compacted subbase course is 6” thick or less, place material in a single layer. When more than 6” thick, place material in equal layers, except no single layer more than 6” or less than 3” in thickness when compacted.

F. Place subbase and base course on subgrades free of mud, frost, snow, or ice.

G. On prepared subgrade, place subbase and base course under pavements and walks as follows:

1. Place base course material over subbase course under hot-mix asphalt pavement.
2. Shape subbase and base course to required crown elevations and cross-slope grades.
3. Place subbase and base course 6 inches or less in compacted thickness in a single layer.
4. Place subbase and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
5. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

H. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.19 BUILDING SLAB DRAINAGE COURSE

A. General: Place drainage/porous fill material, over subgrade surface to support concrete building slabs and sidewalks areas indicated.

B. Place drainage course on subgrades free of mud, frost, snow, or ice.

C. Placing: Place drainage/porous fill material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting material during placement operations.

D. When a compacted drainage course is indicated to be 6 inches thick or less, place material in a single layer. When indicated to be more than 6 inches thick, place material in equal layers, except no single layer more than 6 inches or less than 3 inches in thickness when compacted.

3.20 FIELD QUALITY CONTROL

A. Quality Control Testing During Construction: Allow testing service to inspect and approve each subgrade and fill layer before further backfill or construction work is performed.

1. If in the opinion of the Architect, based on testing service reports and inspection, subgrade or fills have been placed that are below required density, perform additional compaction and testing until required density is obtained.

B. The Owner will engage, and pay for, the services of a Geotechnical Engineer whose function shall be to afford complete engineering control by testing of the conditions of all footing subgrades, the placement of all structural fills under structures, building pad and pavement areas, and all compaction where required, and to observe the proof rolling of the building pad and pavement areas.

C. The Owner’s Geotechnical Engineer will be present as deemed necessary during all phases of the Work requiring filling, compaction operations or testing. The Geotechnical Engineer will provide the Architect with written certification that fill and compaction was completed with accepted materials in accordance with the Documents, and give a professional opinion regarding shrinkage or settlement of fill and safe load bearing capacity of fill.

D. Site Preparation and Proofrolling: The Owner’s Geotechnical Engineer will determine if any additional excavation or in-place densification is necessary to prepare a subgrade for fill placement for slab or pavement support.

E. Fill Placement and Compaction: The Owner’s Geotechnical Engineer will witness all fill operations and take sufficient in-place density tests to verify that the indicated degree of fill compaction is achieved. The Owner’s Geotechnical Engineer will observe and approve borrow materials used and shall determine if their existing moisture contents are suitable/acceptable.

F. Footing Excavation Review: The Owner’s Geotechnical Engineer will review the footing excavations for the building foundations. He will verify that the design bearing pressures are available and that no loose or soft areas exist beneath the bearing surfaces of the footing excavations.

G. The Owner’s Geotechnical Engineer will submit two (2) copies each of his reports, recommendations and/or opinions to the Architect/Engineer and the Owner. Pertinent information will be provided to the Contractor as required.

3.21 EROSION CONTROL:

A. Provide erosion control methods in accordance with requirements of authorities having jurisdiction, the Virginia Erosion and Sediment Control Handbook, and as indicated in the Contract Documents.

3.22 PROTECTION

A. Repair and reestablish grades in settled, eroded, and rutted areas to indicated tolerances.

B. Reconditioning Compacted Areas: Where subsequent construction operations or adverse weather disturbs completed compacted areas, scarify surface, reshape, and compact to required density prior to further construction.

C. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work and eliminate evidence of restoration to greatest extent possible.

D. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

3.23 DISPOSAL OF WASTE MATERIALS

A. Removal from Owner's Property: Remove excess and/or waste materials, including trash and debris, and dispose of it off Owner's property in a legal manner.

B. Dispose of excess material and materials not acceptable for use as backfill or fill legally offsite.

C. Do not remove topsoil from site until it has been demonstrated to the Owner’s satisfaction that it is excess.

D. Disposal of waste material will be at the contractor’s expense and will not be grounds for requesting additional compensation.

END OF SECTION 312000

SECTION 312500

EROSION CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The provisions of the Contract Documents apply to the work of this Section.

B. The Virginia Erosion and Sediment Control Handbook, latest edition.

1.2 SUMMARY

A. This Section includes the installation, maintenance and removal of erosion control measures required for prevention of sediment leaving the project site.

B. This Section also includes the requirement to file the Virginia Stormwater Management Program (VSMP) General Permit Registration Statement for Storm Water Discharges from Construction Activities with the State Department of Environmental Quality.

1.3 EROSION AND SEDIMENT CONTROL PERMIT

A. Prior to commencement of work, obtain a copy of the approved Erosion and Sediment Control Plan from the Local Gov't Approval Agency.

B. Apply for the Land Disturbance Permit from the Local Gov't Approval Agency.

C. Post Erosion and Sediment Control Bond with the Local Gov't Approval Agency.

D. Schedule a pre-construction conference on-site with the Architect and Local Gov't Environmental Inspector. Hold this meeting prior to the start of any construction activities.

1.4 VSMP REGISTRATION

A. Prior to commencement of work, register /transfer the existing registration for the site with the State Department of Environmental Quality (DEQ)/local reviewing authority per the requirements of the Virginia Stormwater Management Program (VSMP). The site must be registered to the Contractor's Responsible Land Disturber prior to the start of construction activities. Contractor is responsible for all VSMP related fees.

B. During construction, the following requirements shall be met:

1. A copy of the Stormwater Pollution Prevention Plan (SWPPP) shall be kept at the job site at all times.
2. Amend the SWPPP as necessary to account for significant changes in design, construction or maintenance that would increase the pollution potential of the site. File a copy of the amended plan with DEQ and with the Architect.
3. The Responsible Land Disturber shall perform weekly inspections of the erosion and sediment control measures. Inspection reports shall be filed as an appendix to the SWPPP.
4. Contractor is responsible for required VSMP renewals.

C. Following final acceptance of the site by the Owner and sign off by the County Environmental Inspector, file a Notice of Termination with the Virginia Department of Environmental Quality/local reviewing authority.

1.5 Submittals

A. Responsible Land Disturber registration information.

B. A copy of the VSMP registration application and a copy of the Stormwater Pollution Prevention Plan. A copy of the VSMP transfer application.

C. Copies of the weekly Erosion Control Measure inspection reports. Inspection reports should be maintained in the onsite SWPPP binder for review at the monthly progress meetings.

D. A copy of the Notice of Termination with the Virginia Department of Environmental Quality/ local reviewing authority.

E. Silt Fence

F. Safety Fence

1.6 PAYMENT PROCEDURES FOR EROSION CONTROL MEASURES

A. Establish a line item in the Schedule of Values for Erosion Control Maintenance. This line item shall represent a minimum of thirty percent (30%) of the total value of the erosion control for the project.

B. Erosion control maintenance will be paid on a monthly basis, following the satisfactory installation and maintenance of the erosion control measures.

PART 2 - PRODUCTS

2.1 EROSION CONTROL PRODUCTS:

A. Safety Fence

1. Six-foot-high chain link fence, complying with the requirements of Standard and Specification 3.01 of the Virginia Erosion and Sediment Control Handbook.
2. Post appropriate warning signs along the Safety Fence.

B. Construction Entrance

1. Heavy-duty stone aggregate and filter fabric construction entrance, complying with the requirements of Standard and Specification 3.02 of the Virginia Erosion and Sediment Control Handbook.
2. Reinforced concrete wash-rack, draining to a sediment trap.
3. The water source for washing operations shall be the responsibility of the Contractor.

C. Silt Fence

1. Synthetic filter fabric, complying with the requirements of Standard and Specification 3.05 of the Virginia Erosion and Sediment Control Handbook.
2. Wooden stakes shall be 2” oak, a minimum length of five feet.

D. Wire Reinforced Silt Fence

1. Synthetic filter fabric, complying with the requirements of Standard and Specification 3.05 of the Virginia Erosion and Sediment Control Handbook.
2. Wooden stakes shall be 2” oak, a minimum length of five feet.
3. Wire fence reinforcement shall be a minimum of 14-guage and have a maximum mesh spacing of six inches.

E. Storm Drain Inlet Protection

1. Block and Gravel Drop Inlet Sediment Filter, complying with the requirements of Standard and Specification 3.07 of the Virginia Erosion and Sediment Control Handbook.
2. Gravel Curb Inlet Sediment Filter {Block and Gravel Curb Inlet Sediment Filter}, complying with the requirements of Standard and Specification 3.07 of the Virginia Erosion and Sediment Control Handbook.

F. Culvert Inlet Protection

1. Silt Fence {Stone Combination} Culvert Inlet Protection {Culvert Inlet Sediment Trap}, complying with the requirements of Standard and Specification 3.08 of the Virginia Erosion and Sediment Control Handbook.

G. Temporary Diversion Dike

1. Berm of compacted soil material, stabilized with vegetation, complying with the requirements of Standard and Specification 3.09 of the Virginia Erosion and Sediment Control Handbook.

H. Temporary Fill Diversion

1. A channel with a berm on the lower side, placed at the top of a fill slope, complying with the requirements of Standard and Specification 3.10 of the Virginia Erosion and Sediment Control Handbook.

I. Diversion

1. A channel with a berm on the lower side, stabilized with vegetation, complying with the requirements of Standard and Specification 3.12 of the Virginia Erosion and Sediment Control Handbook.

J. Temporary Sediment Trap

1. A temporary ponding area, formed with an earthen embankment and a stone outlet structure, complying with the requirements of Standard and Specification 3.13 of the Virginia Erosion and Sediment Control Handbook.

K. Temporary Sediment Basin

1. A temporary pond with a controlled outfall release, complying with the requirements of Standard and Specification 3.14 of the Virginia Erosion and Sediment Control Handbook and to the details indicated on the Drawings.
2. The pond shall be constructed for use as a permanent stormwater management facility. Conversion of the pond from a temporary to a permanent facility is required. Refer to the Basin Conversion Narrative on the drawings.

L. Temporary Slope Drain

1. A flexible pipe extending from the top to the bottom of a fill slope, complying with the requirements of Standard and Specification 3.15 of the Virginia Erosion and Sediment Control Handbook.
2. Pipe shall be smooth lined polyethylene, complying with the requirements of ASTM F667 or AASHTO M294.

M. Outlet Protection

1. A level area of riprap, placed over filter fabric, complying with the requirements of Standard and Specification 3.18 of the Virginia Erosion and Sediment Control Handbook.

N. Riprap

1. Graded stone, placed over filter fabric, complying with the requirements of Standard and Specification 3.19 of the Virginia Erosion and Sediment Control Handbook.
2. The size of the stone required is indicated on the drawings.

O. Rock Check Dams

1. Temporary stone dams constructed across a swale or ditch, complying with the requirements of Standard and Specification 3.20 of the Virginia Erosion and Sediment Control Handbook.
2. Check dams shall be placed on filter fabric.

P. Dewatering Structure

1. A temporary filtering device used for dewatering operations, complying with the requirements of Standard and Specification 3.26 of the Virginia Erosion and Sediment Control Handbook.

Q. Temporary Seeding

1. Temporary vegetative cover for disturbed areas, complying with the requirements of

Standard and Specification 3.31 of the Virginia Erosion and Sediment Control Handbook.

R. Permanent Seeding

1. Refer to Section “Lawns and Grasses” for permanent seeding requirements.

S. Soil Stabilization Blanket

1. Biodegradable stabilization blanket, complying with the requirements of Standard and Specification 3.36 of the Virginia Erosion and Sediment Control Handbook.
2. In lieu of plastic netting use East Coast Erosion Blankets (biodegradable single straw) or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION OF EROSION CONTROL MEASURES

A. Install all erosion and sediment control measures per the requirements of the Virginia Erosion and Sediment Control Handbook.

B. Protect all points of construction ingress and egress to the site to prevent tracking of mud onto public streets. Provide temporary construction entrances at all points of access to the site.

C. Clear only those areas necessary for installation of the perimeter erosion control measures. The balance of the site shall not be cleared or otherwise disturbed until the perimeter erosion control measures are installed, functional and approved by the Local Gov’t Environmental Inspector.

D. Follow the construction sequence and install erosion control measures as indicated on the Drawings and as directed by the Local Gov’t Environmental Inspector.

E. Install additional measures as necessary to prevent sediment from leaving the project site.

3.2 MAINTENANCE OF EROSION CONTROL MEASURES

A. Maintain all erosion and sediment control measures per the requirements of the Virginia Erosion and Sediment Control Handbook.

B. At a minimum, the following maintenance is required:

1. Safety Fence
   a) Review fence regularly for damage. Repair any damage immediately.
   b) Secure the fence at the end of each working day. Repair or replace all locking devices as necessary.

2. Construction Entrance

a) Wash and rework stone and/or place additional stone as required to prevent tracking of mud onto the roadways.
b) Clean out the sediment-trapping device for the washrack.
c) Remove all materials spilled, dropped, washed or otherwise tracked onto roadways or into storm sewers immediately. Do not use water trucks to wash the roadways.

3. Silt Fence
   a) Inspect immediately following each rainfall and at least daily during prolonged rainfall.
   b) Make any required repairs immediately. Give special attention to damage resulting from end-runs and undercutting.
   c) Replace fabric that is decomposing or is otherwise ineffective.
   d) Clean out accumulated sediment following every storm event. Do not allow sediment to accumulate higher than one-half the height of the barrier.

4. Wire Reinforced Silt Fence
   a) Inspect immediately following each rainfall and at least daily during prolonged rainfall.
   b) Make any required repairs immediately. Give special attention to damage resulting from end-runs and undercutting.
   c) Replace fabric that is decomposing or is otherwise ineffective.
   d) Clean out accumulated sediment following every storm event. Do not allow sediment to accumulate higher than one-half the height of the barrier.

5. Storm Drain Inlet Protection
   a) Inspect immediately following each rainfall and at least daily during prolonged rainfall.
   b) Remove and clean or replace stone filters that have been clogged with sediment. Make any required repairs immediately
   c) Remove accumulated sediment as required. Do not allow sediment to accumulate higher than one-half the height of the measure.

6. Culvert Inlet Protection
   a) Inspect immediately following each rainfall and at least daily during prolonged rainfall.
   b) Remove and clean or replace stone filters that have been clogged with sediment. Make any required repairs immediately
   c) Remove accumulated sediment as required. Do not allow sediment to accumulate higher than one-half the height of the measure.

7. Temporary Diversion Dike
   a) Inspect immediately following each rainfall and at least daily during prolonged rainfall. Inspect at least once every two weeks, whether or not it has rained. Make any necessary repairs immediately.
   b) Repair damages caused by construction activities by the end of each working day.

8. Temporary Fill Diversion
   a) Review measure at the end of each working day to ensure its effective operation.

9. Diversion
   a) Inspect diversion following every rainfall and at least once every two weeks.
   b) Remove accumulated sediment and make repairs as necessary.
   c) Re-seed as necessary to maintain vegetative cover.

10. Temporary Sediment Trap
   a) Remove sediment and restore the trap to its original dimensions once the sediment accumulates to the cleanout level. Refer to the drawings for the appropriate cleanout level elevations.
   b) Any pumping shall be discharged through an approved dewatering structure.
   c) Remove and clean or replace stone choked with sediment.
   d) Regularly check the structure to ensure that it is structurally sound. Immediately repair any damage discovered.

11. Temporary Sediment Basin
   a) Remove sediment and restore the basin to its original dimensions once the sediment accumulates to the cleanout level. Refer to the drawings for the appropriate cleanout level elevations.
   b) Any pumping shall be discharged through an approved dewatering structure.
   c) Regularly inspect the principal spillway and outfall for proper function. Regularly inspect the emergency spillway to ensure that its lining is well established and erosion resistant. Immediately repair any damage discovered.
   d) Regularly check the embankment to ensure that it is structurally sound. Immediately repair any damage discovered.

12. Temporary Slope Drain
   a) Inspect the temporary slope drains weekly and following every storm event. Immediately make any necessary repairs to ensure a free flow through the pipe.

13. Outlet Protection
   a) Inspect outlet protection following every storm event. Re-lay riprap as necessary to prevent concentrated flow from running across the outlet protection.

14. Riprap
   a) Inspect riprap following every storm event. Re-lay riprap as necessary to prevent concentrated flow from running under or around the riprap.
   b) Clean out accumulated sediment from the riprap.

15. Rock Check Dams
   a) Inspect immediately following each rainfall and at least daily during prolonged rainfall.
   b) Remove and clean or replace stone that has been clogged with sediment.
   c) Inspect for evidence of by-pass flows. Make any required repairs immediately
   d) Remove accumulated sediment as required. Do not allow sediment to accumulate higher than one-half of the height of the dam.

16. Dewatering Structure
   a) Repair or replace the filtering media to prevent sediment accumulation from affecting the filtering capacity of the structure.

17. Temporary Seeding
    a) Re-seed and mulch areas where cover is inadequate to protect against erosion until adequate cover is obtained.

C. Remove accumulated sediment as required and at appropriate intervals to maintain the effective function of all erosion control measures.

D. Inspect, repair and remove accumulated sediment from erosion control measures following significant (greater than ½") rainfall events.

E. If erosion control measures become clogged, causing the impoundment of water, restore the measures immediately. Ponded water poses a potential drowning hazard and shall be relieved immediately by either pumping (through an approved dewatering structure) or by removal of the blockage.

3.3 REMOVAL OF EROSION CONTROL MEASURES

A. Remove all temporary erosion control measures following the stabilization of the site. Do not remove erosion control measures until authorized by the Local Gov't Environmental Inspector.

B. Topsoil, permanently seed and stabilize areas occupied by erosion control measures.

END OF SECTION 312500

SECTION 313116

TERMITE CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The provisions of the Contract Documents apply to the work of this Section.

1.2 SUMMARY

A. This Section includes soil treatment for termite control.

1.3 SUBMITTALS

A. Product data and application instructions.

B. Certification that products used comply with U.S. Environmental Protection Agency (EPA) regulations for termiticides.

1.4 QUALITY ASSURANCE

A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for preparing substrate and application.

B. Engage a professional pest control operator who is licensed according to regulations of governing authorities to apply soil treatment solution.

C. Use only termiticides that bear a federal registration number of the EPA and are approved by local authorities having jurisdiction.

1.5 JOB CONDITIONS

A. Restrictions: Do not apply soil treatment solution until excavating, filling, and grading operations are completed, except as otherwise required in construction operations.

B. To ensure penetration, do not apply soil treatment to frozen or excessively wet soils or during inclement weather. Comply with handling and application instructions of the soil toxicant manufacturer.

1.6 WARRANTY

C. Warranty: Furnish written warranty, executed by Applicator and Contractor, certifying that applied soil termiticide treatment will prevent infestation of subterranean termites. If subterranean termite activity is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

D. Warranty Period: 5 years from date of Substantial Completion. Also, include a renewable warranty for the Owner's future consideration.

E. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT SOLUTION:

A. Use an emusible concentrate insecticide for dilution with water, specially formulated to prevent infestation by termites. Fuel oil will not be permitted as a diluent. Provide a working solution of one of the following chemical elements and concentrations:

1. Cypermethrin (Demon TC) 0.5% in water emulsion.

B. Other solutions may be used as recommended by Applicator and if acceptable to local governing authorities. Use only soil treatment solutions that are not injurious to planting.

PART 3 - EXECUTION

3.1 APPLICATION

A. Surface Preparation: Remove foreign matter that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and foundations. Toxicants may be applied before placing compacted fill under slabs if recommended by toxicant manufacturer.

B. Application Rates: Apply soil treatment solution as follows:

1. Under slab-on-grade structures, treat soil before concrete slabs are placed, using the following application rates:
   a) Apply 4 gallons of chemical solution per 10 linear feet (5.1 L of chemical solution per meter) to soil in critical areas under slab, including entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers.

   b) Apply 1 gallon of chemical solution per 10 sq. ft. (4.1 L of chemical solution per sq. m) as an overall treatment under slab and attached slab areas where fill is soil or unwashed gravel. Apply 1-1/2 gallon of chemical solution per 10 sq. ft. (6.1 L of chemical solution per sq. m) to areas where fill is washed gravel or other coarse absorbent material.

c) Apply 4 gallons of chemical solution per 10 linear feet (5.1 L of chemical solution per meter) of trench for each 12 inches (300 mm) of depth from grade to footing, along outside edge of building. Dig a trench 6 to 8 inches (150 to 200 mm) wide along outside of foundation to a depth of not less than 12 inches (300 mm). Punch holes to top of footing at not more than 12 inches (300 mm) o.c. and apply chemical solution. Mix chemical solution with the soil as it is being replaced in the trench.

2. Under crawlspace and basement structures, treat soil along exterior and interior walls of foundations with shallow footings as specified above for exterior of slab-on-grade structures.
3. Treat soil under or around crawlspace structures as follows:
   a) Apply 4 gallons of chemical solution per 10 linear feet (5.1 L of chemical solution per meter) of trench along inside of foundation walls, along both sides of interior partitions, and around piers and plumbing. Do not apply an overall treatment in crawlspaces.
   b) Apply 4 gallons of chemical solution per 10 linear feet (5.1 L of chemical solution per meter) of trench, for each 12 inches (300 mm) of depth from grade to footing, along outside of foundation walls, including part beneath entrance platform porches, etc.
   c) Apply 4 gallons of chemical solution per 10 linear feet (5.1 L of chemical solution per meter) along the inside and outside of foundation walls of porches.
   d) Apply 1 gallon of chemical solution per 10 sq. ft. (4.1 L of chemical solution per sq. m) of soil surface as an overall treatment only where attached concrete platform and porches are on fill or ground.
4. At hollow masonry foundations or grade beams, treat voids at rate of 2 gallons per 10 linear feet 2.6 L per meter, poured directly into the hollow spaces.
5. At expansion joints, control joints, and areas where slabs will be penetrated, apply at rate of 4 gallons per 10 linear feet (5.1 L per linear m) of penetration.

B. Post signs in areas of application to warn workers that soil termiticide treatment has been applied. Remove signs after areas are covered by other construction.

C. Reapply soil treatment solution to areas disturbed by subsequent excavation, landscape grading, or other construction activities following application.

D. Allow not less than 12 hours drying time after application before beginningconcrete placement or other construction activities.

END OF SECTION 313116

SECTION 321216

ASPHALT PAVEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Hot-mix asphalt paving over prepared subbase.
2. Hot –mix asphalt patching.
3. Hot-mix asphalt overlays.
4. Asphalt surface treatments
   a) Coal tar sealant

1.3 SUBMITTALS

A. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

B. Material Certification: Certification signed by Contractor certifying that each material complies with requirements.

C. Traffic maintenance and Work Area Protection Plan: Submit a plan indicating sequencing and measures to be used for the maintenance and protection of traffic during operations within or immediately adjacent to existing roadways open to vehicular traffic. The Architect and the Virginia Department of Transportation must approve this plan prior to commencement of work within the Right-of-Way.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed hot-mix asphalt paving similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Asphalt paving materials and installation shall conform to the requirements of the latest edition of the Virginia Department of Transportation (VDOT) Road and Bridge Specifications and Road and Bridge Standards.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if substrate is wet or excessively damp or if the following conditions are not met:

1. Prime and Tack Coats: Minimum ambient temperature of 50 deg F (10 deg C), and when temperature has not been below 35 deg F (1 deg C) for 12 hours immediately prior to application.
2. Asphalt Base Course: Minimum surface temperature of 40 deg F (4 deg C) and rising at time of placement.
3. Asphalt Surface Course: Minimum surface temperature of 40 deg F (4 deg C) and rising at time of placement.

1.6 TESTING AND INSPECTION

A. Within the road Right-of-Way and in the bus loop, VDOT inspectors shall observe the asphalt placement. Coordinate the necessary inspection schedule with the local Residency.

B. The Owner's testing agency will observe the asphalt placement in the parking lots and on-site areas not in Right-of-Way.

PART 2 - PRODUCTS

2.1 ASPHALT-AGGREGATE MIXTURE

A. General: Provide plant-mixed, hot-laid asphalt-aggregate mixture complying with the requirements of the VDOT Road and Bridge Specifications and as recommended by local paving authorities to suit project conditions.

2.2 ASPHALT MATERIALS

A. Tack Coat: ASTM D 977, emulsified asphalt or ASTM D 2397, cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.

B. Prime Coat: Asphalt emulsion prime conforming to VDOT requirements.

2.3 AUXILIARY MATERIALS

A. Paving Geotextile: Nonwoven polypropylene, specifically designed for paving applications, resistant to chemical attack, rot, and mildew.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.

B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

C. Notify Architect in writing of any unsatisfactory conditions. Do not begin paving installation until these conditions have been satisfactorily corrected.

3.2 MAINTENANCE AND PROTECTION OF TRAFFIC

A. Utilize flagmen, barricades, warning signs and warning lights as required by the Virginia Work Area Protection Manual.

3.3 PATCHING AND REPAIRS

A. Patching: Saw cut perimeter of patch and excavate existing pavement section to sound base. Recompact new subgrade. Excavate rectangular or trapezoidal patches, extending 12 inches (300 mm) into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically.

1. Tack coat faces of excavation and allow to cure before paving.
2. Fill excavation with dense-graded, hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.

B. Leveling Course: Install and compact leveling course consisting of dense-graded, hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch (25 mm) in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches (75 mm) thick.

C. Crack and Joint Filling: Remove existing filler material from cracks or joints to a depth of 1/4 inch (6 mm). Refill with asphalt joint-filling material to restore watertight condition. Remove excess filler that has accumulated near cracks or joints.

D. Tack Coat: Apply uniformly to existing surfaces of previously constructed asphalt or Portland cement concrete paving and to surfaces abutting or projecting into new, hot-mix asphalt pavement. Apply at a uniform rate of 0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m) of surface.

1. Allow tack coat to cure undisturbed before paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillage and clean affected surfaces.

3.4 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

C. Prime Coat: For asphalt sections less than 4” thick, apply uniformly over surface of compacted-aggregate base at a rate of 0.15 to 0.50 gal./sq. yd. (0.7 to 2.3 L/sq. m). Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure for 24 hours minimum.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use just enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
2. Protect primed substrate from damage until ready to receive paving.

3.5 GEOTEXTILE INSTALLATION

A. Apply bond coat, consisting of asphalt cement, uniformly to existing surfaces at a rate of 0.20 to 0.30 gal./sq. yd. (0.8 to 1.2 L/sq. m).

B. Place paving geotextile promptly according to manufacturer's written instructions. Broom or roll geotextile smooth and free of wrinkles and folds. Overlap longitudinal joints 4 inches (100 mm) and transverse joints 6 inches (150 mm).

1. Protect paving geotextile from traffic and other damage and place overlay paving the same day.

3.6 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt mix on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness, when compacted.

1. Place hot-mix asphalt base course in number of lifts and thickness indicated.
2. Spread mix at minimum temperature of 225 deg F (107 deg C).

B. Place paving in consecutive strips not less than 10 feet (3 m) wide, except where infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete asphalt base course for a section before placing intermediate or surface courses.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.7 JOINTS

A. Construct joints between old and new pavement, or between successive days work, to ensure continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat.
2. Offset longitudinal joints in successive courses a minimum of 6 inches (150 mm).
3. Offset transverse joints in successive courses a minimum of 24 inches (600 mm).
4. Construct transverse joints as required by the VDOT Road and Bridge Specifications.
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.

3.8 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg F (85 deg C).

B. Breakdown Rolling: Accomplish breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Repair surfaces by loosening displaced material, filling with hot-mix asphalt, and rerolling to required elevations.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling, while hot-mix asphalt is still hot enough to achieve indicated density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 95 percent of reference laboratory density according to ASTM D 1559.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm. Surface course average density shall be 95 percent of reference laboratory density.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while still hot, with back of rake or smooth iron. Compact thoroughly using tamper or other satisfactory method. Edges adjacent to curbs and curb and gutter sections shall be flush with the edge of concrete.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials. Remove paving course over area affected and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.9 INSTALLATION TOLERANCES

A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch (13 mm).
2. Surface Course: Plus 1/4 inch (6 mm), no minus.

B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch (6 mm).
2. Surface Course: 3/16 inch (3 mm).

3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch (6 mm).

C. Check surface areas at intervals as directed by Architect.

3.10 FIELD QUALITY CONTROL

A. Within the VDOT Right-of-Way and in the bus loop, coordinate required inspections with the local Residency of the Virginia Department of Transportation.

B. Testing Agency: Owner will engage a qualified independent testing agency to perform field inspections and tests and to prepare test reports.

1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from requirements.

C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with requirements.

D. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with requirements.

END OF SECTION 321216

SECTION 321313

SITE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

1.2 DESCRIPTION OF WORK:

A. Extent of Portland cement concrete paving is shown on drawings, including:

1. Curbs and gutters
2. Concrete Medians
3. Walkways
4. Service area pavement.
5. Paved Ditches

1.3 SUBMITTALS

A. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.

B. Material Certification: Certification signed by Contractor certifying that each material complies with requirements.

C. Concrete scoring plan. (unless shown in the drawings)

1.4 JOB CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.

1. Use flexible spring steel forms or laminated boards to form radius bends as required.

2. Coat forms with a nonstaining form release agent that will not discolor or deface surface of concrete.

B. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A 185.

C. Reinforcing Steel: ASTM A 615, Grade 60, deformed

D. Concrete Materials: Comply with requirements of applicable Division 3 sections for concrete materials, admixtures, bonding materials, curing materials, and others as required.

E. Expansion Joint Materials: Comply with requirements of applicable Division 7 sections for preformed expansion joint fillers and sealers.

F. Antispalling Compound: Combination of boiled linseed oil and mineral spirits, complying with AASHTO M-233.

G. Liquid-Membrane Forming and Sealing Curing Compound: Comply with VDOT Road and Bridge Specifications.

2.2 CONCRETE MIX, DESIGN, AND TESTING

A. Comply with requirements of applicable Division 3 sections for concrete mix design, sampling and testing, and quality control or VDOT Road and Bridge Specifications whichever is more stringent.

B. Design mix to produce normal-weight concrete consisting of Portland cement, aggregate, water-reducing or high-range water-reducing admixture (superplasticizer), air-entraining admixture, and water to produce the following properties:

1. Comply with the requirements of VDOT Std. Class A3 Concrete, unless otherwise indicated.

PART 3 - EXECUTION

3.2 SURFACE PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

B. Proof-roll prepared subbase surface to check for unstable areas and need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving,

3.3 FORM CONSTRUCTION

A. Set forms to required grades and lines, braced and secured. Install forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.

B. Check completed formwork for grade and alignment to following tolerances:

1. Top of forms not more than 1/8 inch in 10 feet.
2. Vertical face on longitudinal axis, not more than 1/4 inches in 10 feet.

C. Clean forms after each use and coat with form release agent as required to ensure separation from concrete without damage.

3.4 REINFORCEMENT

A. Locate, place and support reinforcement as specified in Division 3 sections, unless otherwise indicated.

3.5 CONCRETE PLACEMENT

A. General: Comply with requirements of applicable Division 3 sections for mixing and placing concrete or VDOT Road and Bridge Specifications whichever is more stringent.

B. Do not place concrete until subbase and forms have been checked for line and grade. Moisten subbase if required to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

C. Place concrete by methods that prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.

D. Deposit and spread concrete in a continuous operation between transverse joints as far as possible. If interrupted for more than 1/2 hour, place a construction joint.

E. Fabricated Bar Mats: Keep mats clean and free from excessive rust, and handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities or replace units as required before placement. Set mats for a minimum 2-inch overlap to adjacent mats.

F. Place concrete in 2 operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.

G. Remove and replace portions of bottom layer of concrete that have been placed more than 15 minutes without being covered by top layer or use bonding agent if acceptable to Architect.

H. Curbs and Gutters: Automatic machine may be used for curb and gutter placement. If machine placement is to be used, submit revised mix design and laboratory test results that meet or exceed minimums indicated. Machine placement must produce curbs and gutters to required cross-section, lines, grades, finish, and jointing as indicated for formed concrete. If results are not acceptable, remove and replace with formed concrete meeting requirements.

3.6 JOINTS

A. General: Construct expansion, weakened-plane (contraction), and construction joints true to line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated.

B. Weakened-Plane (Contraction) Joints: Provide weakened-plane (contraction) joints, sectioning concrete into approximately 10’ areas or as shown on drawings. Construct weakened-plane joints for a depth equal to at least 1/4 concrete thickness, as follows:

1. Tooled Joints: Form weakened-plane joints in fresh concrete by grooving top portion with a recommended cutting tool and finishing edges with a jointer.
2. Sawed Joints: Form weakened-plane joints with powered saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into hardened concrete as soon as surface will not be torn, abraded, or otherwise damaged by cutting action.

C. Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for more than 1/2 hour, except where such placements terminate at expansion joints.

1. Construct joints as indicated or, if not indicated, use standard metal keyway-section forms.

D. Expansion Joints: Provide premolded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks, and other fixed objects, unless otherwise indicated.

E. Locate expansion joints at 50 feet o.c. for each pavement lane unless otherwise indicated.

F. Extend joint fillers full width and depth of joint, not less than 1/2 inch or more than 1 inch below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surface.

G. Provide joint fillers in one-piece lengths for full width being placed wherever possible. Where more than one length is required, lace or clip joint filler sections together.

H. Protect top edge of joint filler during concrete placement with a metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.

I. Fillers and Sealants: Comply with requirements of applicable Division 7 sections for preparation of joints, materials, installation, and performance.

J. Refer to Drawings for scoring patterns for:

1. Selected sidewalk areas
2. Service Areas
3. Patios
4. Courtyard

3.7 CONCRETE FINISHING

A. After striking-off and consolidating concrete, smooth surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.

B. After floating, test surface for trueness with a 10-ft. straightedge. Distribute concrete as required to remove surface irregularities and refloat repaired areas to provide a continuous smooth finish.

C. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/2-inch radius, unless otherwise indicated. Eliminate tool marks on concrete surface.

D. After completion of floating and when excess moisture or surface sheen has disappeared, complete troweling and finish surface as follows:

1. Broom finish by drawing a fine-hair broom across concrete surface perpendicular to line of traffic. Repeat operation if required to provide a fine line texture acceptable to Architect.
2. Exposed-Aggregate Finish: At handicap ramps and where indicated on drawings, by applying an approved retardant curing compound to the surface. Allow minimum 12 hours of setting time before washing surface to expose a maximum of (1/3) one-third of stone surface. Aggregate shall be brown Riverstone having a uniform size and color for each subsequent concrete pour. Aggregate size shall range between 1/2” and 3/4”.

E. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Architect.

3.8 CURING

A. Protect and cure finished concrete paving in compliance with applicable requirements of Division 3 sections. Use membrane-forming curing and sealing compound or approved moist-curing methods.

3.9 REPAIRS AND PROTECTIONS

A. Repair or replace cracked, broken or defective concrete curbs and curb and gutter, as directed by Architect.

B. Replace cracked, broken or defective concrete sidewalks.

C. Repair or replace cracked, broken or defective concrete pavement, as directed by Architect.

D. Drill test cores where directed by Architect when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to pavement with epoxy adhesive.

E. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

F. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just before final inspection.

END OF SECTION 321313

SECTION 321413

PRECAST CONCRETE UNIT PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-interlocking concrete paver units.

B. Sand setting bed.

C. Polymeric sand joint filler.

1.02 RELATED REQUIREMENTS

A. Section 312000 - Earthwork: Preparation of subsoil for pavers.

B. Section 321313 - Concrete Paving: Concrete subbase for pavers.

1.03 REFERENCE STANDARDS

A. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2023.

B. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2018.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide characteristics of paver unit, dimensions, and special shapes.

C. Product Data: Provide characteristics of polymeric sand, including base material, additive(s), compressive strength, and color.

D. Samples: Submit two samples of each paver type, illustrating style, size, color range and surface texture of units being provided.

E. Manufacturer's Installation Instructions: Indicate substrate requirements and installation methods.

F. Maintenance Materials: Provide the following for Owner's use in maintenance of project.

1. See Section 016000 - Product Requirements, for additional provisions.
2. Extra Pavers: 10 of each type and size.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Concrete Pavers: The design is based on the following product: Subject to compliance with requirements, provide Hanover Architectural Products, Traditional Prest Brick . Also acceptable, subject to compliance with specified requirements:

1. Techo-Bloc, Inc.; Victorien.
2. Oldcastle; Holland Stone: www.oldcastle.com/#sle.
3. Unilock; Hollandstone: www.unilock.com/#sle.
4. Substitutions: See Section 016000 - Product Requirements.

2.02 MATERIALS

A. Non-interlocking Pavers: Precast concrete.
   1. Compressive Strength: Minimum of 7200 pounds per square inch (50 MPa).
   2. Absorption: 5 percent average, with maximum of 7 percent.
   3. Air Entrainment: 5 to 7 percent.
   4. Size: 4 x 8 inches nominal.
   5. Thickness: 2-3/8 inches.
   6. Color: Provide mix of three colors as indicated on Drawings.

B. Sand for Setting Bed: Clean washed natural sand or crushed stone complying with gradation requirements of ASTM C33/C33M for fine aggregates.

C. Polymeric Sand: Fine sand complying with ASTM C144 combined with polymer binders for creating semi-solid joints between pavers.
   1. Material: Sand.
   2. Additive(s): Portland Cement.
   3. Compressive Strength: 750 pounds per square inch (5 MPa).
   4. Adhesion by Tensile Load: 100 pounds per square inch (0.7 MPa).
   5. Color: As selected by Landscape Architect.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate is level or to correct gradient, smooth, capable of supporting pavers and imposed loads, and ready to receive work of this Section.

B. Verify gradients and elevations of substrate are correct.

C. Verify dry weather forecast without rain for a minimum of 24 hours with temperatures above 55 degrees Fahrenheit (13 degrees Celsius).

D. Verify that pavers are completely dry prior to polymeric sand installation.

3.02 PREPARATION

A. Treat soil with herbicide to retard plant growth.

B. Wear clothing and equipment to protect from excessive exposure to polymeric sand.

C. See Section 312000 - Earthwork for preparation of subsoil for pavers.

D. See Section 321313 for concrete subbase.

3.03 INSTALLATION OF SOLID PAVER UNITS

A. Spread sand bedding evenly over prepared substrate surface to a maximum thickness as indicated on drawings.

B. Dampen and roller compact sand to level and even surface.

C. Screed and scarify top 1 inch to 1 1/2 inch (12 mm) of sand.

D. Place paver units in pattern indicated on drawings creating staggered joints, from straight reference edge.
E. Cut paver units at edges with masonry saw.
F. Place half units at edge and interruptions. Maintain tight joints.
G. Spread polymeric sand uniformly over surface. Use a push broom to fill joints and remove excess while not sweeping long distances. Sweep all excess with a fine bristle brush and remove residues with a leaf blower.
H. Tamp and level paver units with mechanical vibrator until units are firmly bedded, level, and to correct elevation and gradients. Do not tamp unrestrained edges.
I. Using a sprayer set to shower, apply water on specific areas between 100 square feet (10 m) and 500 square feet (50 m) to a depth of 1 1/2 inches (4 cm). Complete one section at a time and avoid flooding the pavers.

3.04 CLEANING

A. Do not clean pavers until pavers and mortar are dry.
B. Clean soiled surfaces using cleaning solution. Do not harm pavers, joint materials, or adjacent surfaces.
C. Use non-metallic tools in cleaning operations.
D. Rinse surfaces with clean water.
E. Broom clean paving surfaces. Dispose of excess sand.
F. See Section 017419 for construction waste management and disposal.

3.05 PROTECTION

A. Do not permit traffic over unprotected paver surface.
B. Protect paver surface with sheets of plywood.
C. Do not permit traffic for 48 hours after pavement placement.

3.06 MAINTENANCE

A. See Section 017000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

END OF SECTION

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SECTION 321416
BRICK UNIT PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Brick Pavers.
B. Cementitious Materials.
C. Accessories.
D. Mixes.

1.02 RELATED REQUIREMENTS

A. Section 312000 Earthwork: Compacted subbase preparation.
B. Section 321313 - Concrete Paving: Concrete paving for brick paver base; concrete curbs.

1.03 REFERENCE STANDARDS

A. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2023.
B. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.
C. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.
D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
E. ASTM C1272 - Standard Specification for Heavy Vehicular Paving Brick; 2022a.
F. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2023.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittals procedures.
B. Product Data: Provide data on characteristics of paver unit, special shapes, dimensions, setting and grouting materials.
C. Shop Drawings: Indicate on shop drawings, layout of pavers, special design layout, dimensions of paved areas, control jointing, elevations, and affected adjacent construction.
D. Samples: Submit two sample paver units illustrating color, surface finish, and texture for each color.
E. Maintenance Materials: Provide the following for Owner's use in maintenance of project.
    1. See Section 016000 - Product Requirements, for additional provisions.
    2. Extra Pavers: 10 of each type and size.

1.05 MOCK-UP

A. See Section 014000 - Quality Requirements, for general requirements for mock-up.
B. Size: 10 linear feet of funnel, adjacent to concrete paving section.
C. Install setting bed, brick pavers, curbs and border, and accessories to pattern indicated.
    1. Show range of shades, color, and texture of brick pavers relative to concrete pavers.
D. Mock-up may remain as part of the Work.

1.06 FIELD CONDITIONS

A. Do not install mortar when surrounding air or substrate surface temperature is below 50 degrees F (10 degrees C) prior to, during, and 48 hours after completion of work.
B. Do not install mortar when surrounding air or substrate surface temperature is above 90 degrees F (32 degrees C) during and 48 hours after completion of the work.
C. At end of working day, or during rainy weather, cover work exposed to weather with waterproof coverings, securely anchored.

PART 2 PRODUCTS

2.01 PAVERS - APPLICATION

A. Brick Pavers: Provide brick pavers suitable for use in runnels adjacent to vehicular roadway.

2.02 MANUFACTURERS

A. Basis-of-Design: Subject to compliance with requirements, provide Pine Hall Brick Pavers, 4 x 8 inches, or comparable product from one
    1. Belden Brick: www.beldenbrick.com/#sle.
    2. Glen-Gery Corp: www.glengerybrick.com/#sle.
    3. Substitutions: See Section 016000 - Product Requirements.

2.03 BRICK PAVERS

A. Pavers For Vehicular Traffic: Extruded fire clay.
    1. Grade: ASTM C1272, Type R, dimensional tolerances complying with Application PS.
    2. Face Size: 4 by 8 inches (102 by 204 mm).
    3. Thickness: 2-5/8 inches (67 mm).
    4. Exposed Surface Texture: Wirecut.
    5. Edges: Square.
    6. Color: As selected by Architect from manufacturer's standard colors.

2.04 CEMENTITIOUS MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I; white color.

B. Sand: ASTM C33/C33M, sharp, clean, screened sand free from deleterious material.

C. Premixed Grout Mortar: Type S. Subject to compliance with requirements Provide Portland Cement and Lime - Colored manufactured by Workrite Cements . See Section 042000 - Unit Masonry, Mortar and Grout for acceptable alternative manufacturers.

D. Water: Potable and not detrimental to mortar.

2.05 ACCESSORIES

A. Cleaning Solution: Type recommended by paver manufacturer.

B. Sealant: ASTM C920, self-leveling or nonsag polyurethane or silyl-terminated polyether/polyurethane (STPE/STPU) sealant approved by manufacturer for traffic exposure without being recessed below the top of substrate surface.

1. Color: As selected by Architect from manufacturer's full color range.

C. Backer Rod: ASTM C1330, closed-cell polyethylene, 25 to 33 percent larger in diameter than joint width.

2.06 MIXES

A. Cementitious Bed: Portland cement mix complying with the following:

1. Compressive Strength (28 day): 2000 psi (15 MPa).
2. Slump: 3 to 4 inches (75 to 100 mm).

B. Joint Mortar: ASTM C270, Type M, using the Proportion Specification.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify substrate is ready to support pavers and imposed loads.

B. Verify gradients and elevations of substrate are correct.

C. Verify dry weather forecast without rain for a minimum of 24 hours with temperatures above 55 degrees Fahrenheit (13 degrees Celsius).

3.02 PREPARATION

A. See Section 312000 for subbase preparation.

B. See Section 321313 for concrete subbase.

3.03 INSTALLATION - MORTAR SETTING BED

A. Locate control and expansion joints directly above joints in structural base and where indicated on drawings; use joint filler to form full depth joint before laying mortar bed.

1. Control Joints: 1/2 inch (13 mm) wide.

B. Place a full cementitious mortar bed of minimum 1 inch (25 mm) thickness over entire paver area.
C. Place paver units in running bond pattern from straight reference line.
D. Place half units or special shaped units at edges and interruptions. Machine saw partial units.
E. Maintain uniform joint width of 3/8 inch (9 mm) between pavers, and at abutting vertical surfaces and protrusions.
F. Keep control and expansion joints free of mortar, for sealant installation.
G. Fill joints with mortar; pack and work into voids; neatly tool surface to flush joint.
H. Seal control and expansion joints with sealant, in accordance with sealant manufacturer's instructions; use joint filler, backer rod, and or bond breaker tape to achieve width-to-depth ratio recommended by sealant manufacturer.

3.04 CLEANING

A. Do not clean pavers until pavers and mortar are dry.
B. Clean soiled surfaces using cleaning solution. Do not harm pavers, joint materials, or adjacent surfaces.
C. Use non-metallic tools in cleaning operations.
D. Rinse surfaces with clean water.
E. Broom clean paving surfaces. Dispose of excess sand.

3.05 PROTECTION

A. Do not permit traffic over unprotected paver surface.
B. Do not permit traffic for 48 hours after pavement placement.

END OF SECTION

SECTION 321700

PAVEMENT MARKINGS, SIGNS AND SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

1.2 SUMMARY

A. This Section includes, but is not limited to, the following:

1. Establishing the location of pavement markings and applying pavement markings for parking space lines, traffic control, fire lane and accessible spaces.

2. Installation of signs for traffic control and accessible spaces.

3. Installation of wheel stops at parking spaces.

1.3 QUALITY ASSURANCE

A. All work and materials shall conform to the requirements of the latest edition of the Virginia Department of Transportation (VDOT) Road and Bridge Specifications and Road and Bridge Standards.

B. All materials for signs shall conform to the requirements of the latest edition of the Virginia Department of Transportation (VDOT) Road and Bridge Specifications and Road and Bridge Standards and to the requirements of the latest edition of the Manual of Uniform Traffic Control Devices for traffic signs.

C. Installer Qualifications: Engage an experienced installer, who has successfully completed striping and signage projects similar in size and complexity to this project. The installer's primary business (defined as a minimum of 60% of total billings) shall be striping and signage.

1.4 SUBMITTALS

A. Product Data and written confirmation that the following materials are included on VDOT's list of approved construction materials:

1. Pavement marking paint
2. Wheel stops

3. Signs
4. Posts

PART 2 - PRODUCTS

2.1 PAVEMENT MARKING PAINT

A. Paint shall be Type A, water emulsion base, traffic paint conforming to the requirements of Section 704 of the VDOT Road and Bridge Specifications and Federal Specification TT-P-1952. Color shall be white unless otherwise indicated.

B. Curb painting color along fire lanes shall be yellow, unless otherwise indicated.

C. Type B thermoplastic lane markings are required within VDOT rights-of-way.

2.2 PAINT APPLICATOR

A. Provide hand-operated push-type applicator machine of a type commonly used for application of paint to pavement surfaces. Paint applicator machine shall be acceptable for marking small street and parking areas. Applicator machine shall be equipped with the necessary paint tanks and spraying nozzles and shall be capable of applying paint uniformly at coverage specified.

2.3 WHEEL STOPS

A. Wheel stops shall be made of 3,000 psi precast concrete and be 6 inches high, 8 inches wide and approximately 6 feet long. Provide chamfered corners and edges and two holes for anchoring.

2.4 SIGNS AND POSTS

A. Signs shall conform to the requirements of Section 701 of the VDOT Road and Bridge Specifications. Signs shall be fabricated with encapsulated lens sheeting.

B. Signposts for traffic control signage shall be 4” x 4” treated wood conforming to the requirements of Section 236 of the VDOT Road and Bridge Specifications.

C. Utilize metal posts for fire-lane signage and for signage at accessible parking spaces.

2.5 CONCRETE

A. Concrete shall be Class A3, General concrete, conforming to the requirements of Section 217 of the VDOT Road and Bridge Specifications.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION FOR PAVEMENT MARKING

A. Apply pavement markings only when the ambient temperatures is above 50°F and less than 95°F, unless otherwise approved.

B. Allow pavement to cure for a period of not less than 7 days before applying pavement marking.

C. Clean surfaces thoroughly before application of paint. Remove, dust, dirt and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods as required.

D. Remove existing pavement markings, residual curing compounds and other coating adhering to the pavement with scrapers, wire brushes, waterblasting, sandblasting or mechanical abrasion as required. Areas of existing pavement affected by oil or grease shall be scrubbed with an approved chemical and rinsed thoroughly. Seal oil-soaked areas with shellac or primer after cleaning.

E. Pavement surfaces shall be dry and clean prior to painting. Pavement markings shall not be applied within 24 hours following rain or other inclement weather or when rain is imminent.

F. Apply seal coat across the existing pavement to provide a uniform surface appearance.

3.2 APPLICATION OF PAVEMENT MARKING

A. Apply paint in accordance with the requirements of Section 704 of the VDOT Road and Bridge Specifications.

B. Lay out lines and markings to the width and length as indicated. All parking space lines shall be 4 inches wide.

C. Apply paint with an approved paint applicator.

D. Apply paint at manufacturer recommended rates to provide a minimum 15 mil wet thickness (depending on manufacturer, may require 2 applications).

3.3 FIRE LANE MARKINGS AND SIGNAGE

A. Mark fire lanes and install fire lane signage in accordance with the requirements of the local Fire Marshall.

3.4 INSTALLATION OF WHEEL STOPS

A. Secure wheel stops with two 1/2-inch diameter steel reinforcing rods. Rods shall be a minimum of 18 inches in length and be embedded into the pavement, base and subgrade a minimum of 12 inches and be flush with the top of the bumper block.

3.5 INSTALLATION OF SIGNS

A. Install signs on signposts in accordance with the requirements of Section 701 of the VDOT Road and Bridge Specifications.

B. Install signposts in concrete foundation to a depth of 3 feet minimum by 12 inches in diameter.

END OF SECTION 321700

SECTION 323113.19

CHAIN-LINK FENCES AND GATES (PVC CLAD)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

1.2 WORK INCLUDED

A. Polyvinyl Chloride (PVC) clad chain link fence and gates

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's technical data and installation instructions for fencing, fabric, gates and accessories.

B. Shop Drawings: Submit shop drawings indicating location of fence (with dimensions), height, post locations, details of post installation, gate swing, hardware and accessories. Identify PVC touch up paint.

C. Samples: None required

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed chain-link fences and gates similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Source Limitations for Chain-Link Fences and Gates: Obtain each color, grade, finish, type, and variety of component for chain-link fences and gates from one source with resources to provide chain-link fences and gates of consistent quality in appearance and physical properties.

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates indicated in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 - PRODUCTS

2.1 GENERAL:

A. Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. PVC Coated Steel Fencing and Fabric:

a) Colorguard Fence Products, Inc.
b) American Chain Link Fence Company
c) Semmerling Fence & Supply, Inc.
d) Anchor Fence, Inc.

2.2 FABRIC:

A. Steel Fabric: Comply with Chain Link Fence Manufacturers Institute (CLMFI) Product Manual. Provide one-piece fabric widths. Wire size includes zinc coating.

B. Size: 2-inch diamond mesh, 9-gauge (0.148-inch diameter) wire.

C. PVC Coating: ASTM F668, Class 2B (fused and adhered) PVC coating, black color. Bonded or extruded & glued fabric may not be used.

D. Selvage shall be knuckled at the top and bottom.

2.3 FRAMING:

A. Strength requirements for posts and rails shall conform to ASTM F 669.

B. Pipe shall be straight, true to section, material and sizes specified.

C. Steel Framework, General: Posts, rails, braces and gate frames.

1. Type II Pipe: Manufactured from steel conforming to ASTM A 569 or A 446, grade D, cold formed, electric welded with minimum yield strength of 50,000 p.s.i. and triple coated with minimum 0.9 oz. Zinc per square foot after welding, a chromatic conversion coating and a clear polymer overcoat. Corrosion protection on inside surfaces shall protect the metal from corrosion when subjected to the salt spray test of ASTM B 117 for 300 hours with the end point of 5% Red Rust.
2. PVC-Coating finish: In accordance with ASTM F668, Class 2B (fused and adhered) apply supplemental color coating of 10 to 15 mils (0.254 – 0.38mm) of thermally fused PVC in color to match fabric.

D. End, Corner and Pull Posts:

1. For fabric height up to 6’ - 2.375” OD Type II steel pipe (3.12 lb/ft). [2.875”, 73mm, 5.79 lb/ft.]
2. For fabric height over 6’ - 2.875” OD Type II steel pipe. (4.64 lb/ft). [4.00”, 101.6mm, 9.11 lb/ft]

E. Line Posts:

1. For fabric height up to 6’ - 1.90” OD Type II steel pipe (2.28 lb/ft).
2. For fabric height over 6’ - 2.375” OD Type II steel pipe (3.65 lb/ft).

F. Gate Posts:

1. Provide posts for supporting single gate leaf, or one leaf of a double gate installation, for nominal gate widths as follows:
   a) 6' or Under: 2.875" OD Type II steel pipe (4.64lb/ft).
   b) Over 6': 4.000" OD Type II steel pipe (8.65 lb/ft).

G. Top & Bottom Rail:

1. Manufacturer's longest lengths, with expansion-type couplings, approximately 6" long, for each joint. Provide means for attaching rail securely to each gate corner, pull, & end post.
   a) 1-1/4" NPS (1.66" OD) Type II steel pipe.

H. Intermediate and/or Center Rail:

1. Same material as top rail. Manufacturer's standard galvanized steel cap required for each end.

2.4 FITTINGS AND ACCESSORIES:

A. Material: Comply with ASTM F 626. Mill finished galvanized steel, to suit manufacturer's standards.

1. Zinc Coating: Unless specified otherwise, galvanize steel fence fittings and accessories in accordance with ASTM A 153, with zinc weights indicated.
2. Supplemental Color Coating: In accordance with ASTM F668, Class 2B (fused and adhered), apply supplemental color coating of 10 to 15 mils (0.254 – 0.38mm) of thermally fused PVC in color to match fabric. Apply to exterior surfaces and, except inside cap shapes, to exposed interior surfaces. Color to match chain link fabric.

B. Tension Wire: 7 gauge (0.177" diameter) metallic coated steel marcelled tension wire conforming to ASTM A 824 with finish to match fabric.

1. PVC-Coated finish: In accordance with ASTM F668, Class 2B (fused and adhered), apply supplemental color coating of 10 to 15 mils (0.254 – 0.38mm) of thermally fused PVC in color to match fabric.

C. Wire Ties:

1. 9 gauge [0.148" (3.76mm)] galvanized steel wire for attachment of fabric to line posts.

2. Double wrap 13 gauge [0.092" (2.324mm)] for rails and braces.
3. Hog ring ties of 12-1/2 gauge [0.0985" (2.502mm)] for attachment of fabric to tension wire

D. Post Brace Assembly:

1. Manufacturer's standard adjustable brace at end of gate posts and at both sides of corner and pull posts, with horizontal brace located at mid height of fabric. Provide same material as top rail for brace, and truss to line posts with 0.375" diameter rod and adjustable tightener. Manufacturer's standard galvanized steel cap required for each end.

E. Post and Line Caps: Weathertight closure cap required for each post. If top rail is required, use line post caps with loop.

F. Tension or Stretcher Bars: Hot-dip galvanized steel with minimum length 2" less than full height of fabric, minimum cross section of 3/16" by ¾" and minimum 1.2 oz. zinc coating

per sq. ft. of surface area. One bar is required for each gate and end post and two for each corner and pull post, except where fabric is integrally woven into post.

G. Tension and Brace Bands: Minimum ¾" wide hot-dip galvanized steel with minimum 1.2 oz. zinc coating per sq. ft. of surface area.

1. Tension bands: Minimum 14 gauge (0.074") thick.
2. Tension and Brace bands: Minimum 12 gauge (0.105") thick.

H. Nuts and bolts shall be galvanized but not vinyl coated. Provide touch up paint and color coat nuts and bolts to match fabric.

2.5 POST Setting MATERIALS

A. Comply with the requirements for VDOT Std. Class A3 concrete.

2.6 GATES:

A. Fabrication:

1. Fabricate perimeter frames of gates from metal and finish to match fence framework. Utilize Fusion or stainless-steel welded connections to form a rigid one-piece unit. Assemble gate frames by welding, providing security against removal or breakage connections. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware and accessories. Space frame members maximum of 8' apart unless otherwise indicated.
2. Provide same fabric as for fence. Install fabric with stretcher bars at vertical edges and at top and bottom edges. Attach stretcher hooks to gate frame at not more than 15" o.c.
3. Install diagonal cross-bracing consisting of 3/8" diameter adjustable length truss rods on gates to ensure frame rigidity without sag or twist.

B. Swing Gates: Comply with ASTM F 900.

1. Fabricate perimeter frames of minimum 1.90" OD Type II steel pipe.

C. Gate Hardware: Provide hardware and accessories for each gate, galvanized per ASTM A 153, and in accordance with the following:

1. Hinges: Size and material to suit gate size, non-lift-off type, offset to permit 180 degrees gate opening. Provide 1-1/2 pair of hinges for each leaf over 6' nominal height.
2. Latch: Forked type to permit operation from either side of gate, with padlock eye as integral part of latch.
3. Keeper: Provide keeper that automatically engages gate leaf and holds it in open position until manually released.
4. Double Gates: Provide gate stops for double gates, consisting of mushroom type flush plate with anchors, set in concrete, and designed to engage center drop rod or plunger bar. Ensure plunger bar cannot be removed without tools. Include locking device and padlock eyes as integral part of latch, permitting both gate leaves to be locked with single padlock.
5. Hardware materials: Provide hot dipped galvanized steel or malleable iron shapes to suit gate size. Field coat hardware parts (e.g. hinges, latch, keeper and drop bar) with PVC touch up paint, provided by manufacturer, to match adjacent finishes.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. General: Install fence in compliance with ASTM F 567 and manufacturers recommendations. Do not begin installation and erection before final grading is completed, unless otherwise permitted. Apply fabric to outside of framework, unless otherwise indicated.

B. Locate terminal post at each fence termination and change in horizontal or vertical direction of 30º or more, or as indicated on plans.

C. Excavation:

1. Drill or hand excavate (using post hole digger) holes for posts to diameters and spacing indicated, in firm, undisturbed or compacted soil.
2. Holes in asphalt or concrete surfaces will be cut by core-drilling with a bit of diameter at least equal to the required hole diameter. Holes in concrete may be formed prior to placing concrete.
3. Excavate holes for each post to minimum diameter recommended by fence manufacturer, but not less than 4 times largest cross-section of post.
4. Excavate hole to depths approximately 6” lower than post bottom, with bottom of posts set not less than 36” below finish grade surface.

D. Setting Posts:

1. Space 10’ o.c. maximum, unless otherwise indicated.
2. Center and align posts in hole, 6” above bottom of excavation.
3. Protect portions of concrete posts above ground from concrete splatter. Place concrete around post and vibrate or tamp for consolidation. Check each post for vertical and top alignment and hold in position during placement and finishing operations.
4. Extend concrete above grade and slope all around (dome) to allow for drainage away from post. Uniformly and neatly texture the concrete surface with a broom finish. Remove any spilled or splashed concrete from the post and surrounding area immediately.

E. Top Rails:

1. Run rail continuously through line post caps, bending to radius for curved runs and at other posts terminating into rail end attached to posts or post caps fabricated to receive rail. Provide expansion couplings as recommended by fencing manufacturer.

F. Center Rails:

1. Install in one place between posts and flush with post on fabric side, using rail ends and special offset fittings where necessary. Provide center rails for fence 12’ or taller, or as indicated on drawings.

G. Bottom Rails:

1. Install in one piece between posts and flush with post on fabric side, using rail ends and special offset fittings when necessary.

H. Brace Assemblies:

1. Install braces so posts are plumb when diagonal rod is under proper tension.

I. Top and Bottom Tension Wire:

1. Install tension wires through post cap loops before stretching fabric and tie to each post cap with not less than same gauge and type of wire. Pull wire taut, without sags. Fasten fabric to tension wire, using 11 - ga. galvanized steel hog rings spaced maximum 24” o.c. Install where top and/or bottom rails are not specified on plans.

J. Fabric:

1. Leave approximately 2” between finish grade and bottom selvage. Pull fabric taut and tie to posts, rails and tension wires. Attach fabric with wire ties to line posts at 12”-15” (381mm) o.c. and to rails, braces, and tension wire at 24” (600 mm) o.c. Install fabric on security side of fence, unless otherwise indicated, and anchor to framework so that fabric remains in tension after pulling force is released.
2. For athletic field fencing, install fabric on the field side of the fence unless otherwise indicated.

K. Stretcher Bars:

1. Thread through fabric 4” o.c., and secure to end, corner, pull and gate posts with tension bands spaced maximum 15” o.c.

L. Accessories

1. Tie Wires: Use U-shaped wire, conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least 2 full turns. Bend ends of wire to minimize hazard to persons or clothing.

M. Fasteners:

1. Install nuts for tension bands and hardware bolts on site of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

N. Gates:

1. Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.2 FINISHING

A. Remove and replace sections of fence and fittings with damaged PVC coating. Minor aesthetic damage may be touched up with a suitable spray on material provided by the manufacturer.

B. Clean up debris and unused material and remove from the site.

END OF SECTION 323113.19

SECTION 323119

DECORATIVE METAL FENCES AND GATES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Decorative steel fences.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For fencing and gates.

1. Include plans, elevations, sections, post spacing, and mounting attachment details.

PART 2 PRODUCTS

2.01 DECORATIVE STEEL FENCES

A. Decorative Steel Fences: Fences made from steel tubing bars and shapes , hot-dip galvanized.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ameristar Perimeter Security; ASSA ABLOY.

b. Ametco Manufacturing Corporation.

c. BarnettBates Corporation.

d. Builders Fence Company, Inc.

B. Fence Design:

1. Details as noted on the Drawings.

C. Infill: Custom design as indicated on Drawings.

D. Fasteners: Stainless-steel carriage bolts and tamperproof nuts.

E. Fabrication: Fabricate bar grating infill into sections of size indicated.

1. Fabricate rails with clips welded to rails for field fastening to posts.

2. Drill posts , clips, and bar grating for fasteners before finishing to maximum extent possible.

F. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay .

G. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A 123/A 123M. For hardware items, hot-dip galvanize to comply with ASTM A 153/A 153M.

1. Hot-dip galvanize posts and rails.

H. Finish for Bar Grating Infill: Powder coating.

I. Finish for Steel Items : Power coated.

2.02 STEEL AND IRON

A. Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Bars (Pickets): Hot-rolled, carbon steel complying with ASTM A 29/A 29M, Grade 1010.

C. Tubing: ASTM A 500/A 500M, cold-formed steel tubing.

D. Bar Grating: NAAMM MBG 531.

1. Bars: Hot-rolled steel strip, ASTM A 1011/A 1011M, Commercial Steel, Type B.
2. Wire Rods: ASTM A 510/A 510M.

E. Uncoated Steel Sheet: Hot-rolled steel sheet, ASTM A 1011/A 1011M, Structural Steel, Grade 45.

2.03 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for strength and compatibility in fabricated items.

B. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Section 033000 "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch maximum aggregate size or dry, packaged, normal-weight concrete mix complying with ASTM C 387/C 387M mixed with potable water according to manufacturer's written instructions.

C. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M and specifically recommended by manufacturer for exterior applications.

2.04 STEEL FINISHES

A. Surface Preparation: Clean surfaces according to SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning." After cleaning, apply a conversion coating compatible with the organic coating to be applied over it.

B. Powder Coating: Immediately after cleaning, apply manufacturer's standard two-coat finish consisting of epoxy primer and TGIC polyester topcoat to a minimum total dry film thickness of not less than 8 mils. Comply with coating manufacturer's written instructions.

1. Color and Gloss: As selected by Architect from manufacturer's full range .

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.

B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

1. Construction layout and field engineering are specified in Section 017300 "Execution."

3.03 DECORATIVE FENCE INSTALLATION

A. Install fences according to manufacturer's written instructions.

B. Install fences by setting posts as indicated and fastening rails and infill panels to posts.

C. Post Setting: Set posts at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
    a. Concealed Concrete: Top 2 inches below grade to allow covering with surface material. Slope top surface of concrete to drain water away from post.

END OF SECTION

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SECTION 323300
SITE FURNISHINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Benches.
B. Utilitarian Bollards.
C. Decorative Bollards
D. Tables.
E. Waste receptacles.
F. Recycling receptacles.
G. Tree guards.
H. Bicycle racks.

1.02 RELATED REQUIREMENTS

A. Section 033000 - Cast-in-Place Concrete: Concrete footings and embedments
B. Section 055000 - Metal Fabrications: Anchors to attach site furnishings to mounting surfaces.
C. Section 055000 - Metal Fabrications: Utilitarian concrete filled steel pipe bollards.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.
B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.
D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.
E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.
F. ASTM A999/A999M - Standard Specification for General Requirements for Alloy and Stainless Steel Pipe; 2018.
G. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.
H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
I. ASTM B211/B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire; 2019.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's specifications and descriptive literature, installation instructions, and maintenance information.
C. Shop Drawings: Indicate plans for each unit or group of units, elevations with model number, overall dimensions, construction, and anchorage details.
D. Samples: Submit two sets of manufacturer's available colors for metal furnishings.
E. Samples: Submit two sets of manufacturer's available colors and finishes for precast furnishings.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
B. Provide manufacturer’s warranty against defects in materials or workmanship for ductile iron castings for a period of 10 years from Date of Substantial Completion.
C. Provide manufacturer’s standard warranty against defects in materials or workmanship for all products

PART 2 PRODUCTS

2.01 METAL FURNISHINGS

A. Metal Furnishings, General:
    1. Steel components: Plates, bars, and shapes complying with ASTM A36/A36M and tubing complying with ASTM A500/A500M; cleaned, treated, and powder-coated.
    2. Aluminum Components: ASTM B211/B211M.
    3. Hardware: Stainless steel.
B. Benches: Metal frame and seat section with and without back as indicated on drawings.
    1. Bench 'A': Knight bench by Forms + Surfaces (www.forms-surfaces.com). Solid aluminum frame, aluminum seat slats, backless, color to be selected by Architect from manufacturer's standard colors, 6'-0" length, surface mounted.
    2. Bench 'B': Knight bench by Forms + Surfaces, seat only. Materials and finishes as per above, dimensions as indicated on drawings.
C. Waste and Recycling Receptacles: Steel frame with steel slats and removable lid.
    1. Dispatch Litter and Recycling Receptacle by Forms + Surfaces (www.forms-surfaces.com), 36-gallong capacity, liner, powder-coated steel, surface mounted, color to be selected by Architect from manufacturer's standard range.

D. Metal Tables and Seating:
   1. Metal Tables with Connected Seats. Basis-of-Design: Carousel by Landscape Forms (landscapeforms.com)
   2. Height: Dining
   3. Surfaces: Perforated Metal
   4. Finish: Manufacturer's standard powdercoat finish
   5. Color: To be selected by Architect from manufacturer's full range
   6. Seating: Compliant with ADA Standards.
      a. (7) units shall be provided with (4) attached, backless seats
      b. (3) units shall be provided with (3) attached, backless seats
   7. Mounting: Surface, using concealed anchor rods.

E. Bike Racks: Steel pipe rack, 1.5" diam. x 28.25" x 32" tall.
   1. Shape: Inverted 'V' shape.
   2. Height: ____ inches (____ mm).
   3. Mounting: Embedded mount.
   4. Finish: Manufacturer's standard powdercoat finish
   5. Color: To be selected by Architect from manufacturer's full range
   6. Basis of Design Products:

2.02 PRECAST CONCRETE FURNISHINGS

A. Precast Concrete Furnishings, General:
   1. Precast Concrete Components: Mixture of cement, aggregates, water, and mineral colors; molded to shape, and reinforced with steel bars.
      a. Finish:
         1) Horizontal Surfaces: Smooth for seats and table tops.
         2) Vertical Surfaces: Smooth for supports and sides.
      b. Color: As selected by Architect from manufacturer's standard range.
      c. Clear Sealers: Anti-graffiti.
   2. Hardware: Stainless steel.

B. Benches:
   1. Bench B: Galet 1 bench by Wausau Tile (www.wausautile.com), acid wash finish, color to be selected by Architect from manufacturer's standard range.
   2. Seat: Precast concrete.

2.03 BOLLARDS

A. Utilitarian Bollards:
   1. 6" diam. x 42'" tall, schedule 40 steel, shop-primed and painted black.

2. Materials:
    a. Steel Pipe: ASTM A53/A53M, standard weight.
    b. Factory Finish: Primed.
    c. Color: Black
3. Mounting: In-ground.

B. Decorative Steel Pipe Bollards: Hollow steel pipe, plain shaft
1. Shape: Round.
2. Diameter: 4"
3. Height: 42"
4. Cap: Flat
5. Material: Schedule 40 steel pipe
6. Mounting: In-ground.
7. Finish: Powdercoated. Color TBD. Submit range of manufacturer's standard color selections.
8. Products:
    a. Series B-2 by Tournesol Siteworks (www.tournesol.com)
    b. Removeable Bollards: Series B-2 by Tournesol Siteworks, with integral handles and galvanized steel receiver. Match dimensions and finish of embedded bollards

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify proper installation of mounting surfaces, preinstalled anchor bolts, and other mounting devices; and ready to receive site furnishing items.
B. See Section 055000 for anchors to attach site furnishings to mounting surfaces.
C. Do not begin installation until unacceptable conditions are corrected.

3.02 INSTALLATION

A. Install site furnishings in accordance with approved shop drawings, and manufacturer's installation instructions.
B. See Section 033000 for bollard infill and underground encasement.
C. Provide level mounting surfaces for site furnishing items.

END OF SECTION

SECTION 329113
SOIL PREPARATION

PART 1 GENERAL

1.01 SUMMARY

A. Section includes preparation of Planting Mixes for landscape planting beds.

B. Related Requirements:

1. Section 329300 "Plants" for installing Planting Mix for landscape planting material.

1.02 DEFINITIONS

A. Backfill: The material used to replace, or the act of replacing, existing earth in an excavation.

B. CEC: Cation exchange capacity.

C. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.

D. Duff Layer: A surface layer of soil, typical of forested areas, that is composed primarily of decayed leaves, twigs, and detritus.

E. Imported (Borrow) Soil: Soil that is transported to Project site for use.

F. Manufactured Soil: Soil produced on-site or off-site by blending soils, sand, stabilized organic soil amendments, and other materials to produce satisfactory Planting Mix soil.

G. NAPT: North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through interlaboratory sample exchanges and statistical evaluation of analytical data.

H. Organic Matter: The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."

I. Planting Mix: Satisfactory soil that has been modified in accordance with testing agency recommendations in order to produce a suitable planting mix for proper plant growth.

J. RCRA Metals: Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.

K. SSSA: Soil Science Society of America.

L. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

M. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

N. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil"; but in disturbed areas such as urban environments, the surface soil can be subsoil.

O. Topsoil: In undisturbed areas, the soil material beneath the duff layer, and above subsoil, typified by an organic matter content of between 1.5 and 10.0 percent.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include recommendations for application and use.
   2. Include test data substantiating that products comply with requirements.
   3. Include sieve analyses for soil and aggregate materials.
   4. Material Certificates: For each type of aggregate, imported soil, lime and fertilizer, and all other soil amendments before delivery to the site, according to the following:
      a. Manufacturer's qualified testing agency's certified analysis of standard products.
      b. Analysis of lime and fertilizer, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.
      c. Analysis of nonstandard materials, by a qualified testing agency, made according to SSSA methods, where applicable.

B. Lime, Fertilizer and Soil Amendments: Furnish two (2) copies of all invoices for lime, fertilizer and soil amendments used on the Project. Invoices for fertilizer shall show the grade furnished. Invoices for lime shall show total minimum carbonates and minimum percentages of the material furnished that pass 100 and 200-mesh sieve. Soil amendments shall indicate all the components incorporated.

C. Topsoil Analysis and Certifications:

1. Topsoil Analysis Reports: Topsoil samples shall be taken from ALL topsoil whether it is obtained from on-site or an off-site location. All topsoil analysis shall be performed within three (3) months of the date of installation, conducted and certified by a recognized soil testing facility, and shall contain the information specified in the “Testing Requirements” Article. Submit two (2) copies of the topsoil analysis reports to the Architect and Landscape Architect for review and approval.
2. Topsoil Certifications: Contractor shall submit two (2) copies to the Architect and Landscape Architect containing specific recommendations of amendments for both on-site and off-site borrow topsoil. APPROVAL OF REPORTS AND CERTIFICATIONS WILL BE REQUIRED PRIOR TO COMMENCEMENT OF ANY INSTALLATION OF PLANT MATERIAL. Provide certifications by a qualified testing agency
    a. The organic content of the topsoil;
    b. Topsoil has a pH of 6.0 to 7.0;
    c. Topsoil shall not have soluble salts greater than 500 parts per million;
    d. Topsoil shall be classified as “Sandy Loam” in accordance with the USDA Textural Triangle.
3. Borrow Topsoil: Prior to delivery of satisfactory borrow topsoil, the following information shall be submitted to the Architect and Landscape Architect for review and approval:
    a. Source and location of the borrow topsoil;
    b. Certified copies of the test results;
    c. Two (2) one pound representative samples (in bags) of the borrow soil.
4. Manufactured Topsoil: Prior to delivery of satisfactory manufactured soil, the following information shall be submitted to the Architect and Landscape Architect for review and approval.
    a. Source and location of the manufactured soil components;
    b. Gradation and sieve analysis of the manufactured soil;
    c. Two (2) one pound representative samples (in bags) of the manufactured soil.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For each testing agency.
B. Preconstruction Test Reports: For preconstruction soil analyses specified in "Preconstruction Testing" Article.

C. Field quality-control reports.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent, state-operated, or university-operated laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.
   1. Multiple Laboratories: At the Contractor's option, work may be divided among one or more qualified testing laboratories.

B. AAPFCO: Association of American Plant Food Control Officials.

C. AASHTO: American Association of State Highway and Transportation Officials.

D. ASTM: American Society for Testing and Materials.

E. NAPT: North American Proficiency Testing Program.

F. SSSA: Soil Science Society of America.

G. USCC: U.S. Composting Council.

H. USDA-NRCS: United States Department of Agriculture-Natural Resources Conservation Service.

I. EPA: United States Environmental Protection Agency.

1.06 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction analyses on existing on-site topsoil, imported borrow soil and topsoil, and manufactured soil.
   1. Notify Architect and Landscape Architect seven days in advance of the dates and times when laboratory samples will be taken.
   2. All testing shall be performed and submitted for review and approval in accordance with “Action Submittals” Article.

B. Preconstruction Topsoil and Soil Analyses: For each soil type and source, in accordance with “Action Submittals” Article.
   1. Testing agency shall identify and label samples and test reports according to sample collection and labeling requirements.

1.07 SOIL-SAMPLING REQUIREMENTS

A. General: Extract soil samples accordance with “Action Submittals” and “Preconstruction Testing” Articles.

B. Sample Collection and Labeling: Have samples taken and labeled by state-certified, -licensed, or –registered soil scientist under the direction of the testing agency.

1. Number and Location of Samples: Minimum of three (3) representative soil samples, at varied locations for each soil to be used or amended for planting and turf establishment purposes.
2. Procedures and Depth of Samples: According to USDA-NRCS's "Field Book for Describing and Sampling Soils."
3. Labeling: Label each sample with the date, location keyed to the project site plan or other appropriate Drawing, visible soil condition, and sampling depth.

1.08 TESTING REQUIREMENTS

A. General: Perform tests on soil samples in accordance with "Action Submittals" and "Preconstruction Testing" Articles.

B. Physical Testing:
   1. Soil Texture: Soil-particle, size-distribution analysis by one of the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":
      a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.
      b. Hydrometer Method: Report percentages of sand, silt, and clay.
   2. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
   3. Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
   4. Saturated Hydraulic Conductivity: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods"; at 85% compaction according to ASTM D698 (Standard Proctor).

C. Chemical Testing:
   1. CEC: Analysis by sodium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."
   2. Clay Mineralogy: Analysis and estimated percentage of expandable clay minerals using CEC by ammonium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 1- Physical and Mineralogical Methods."

3. Metals Hazardous to Human Health: Test for presence and quantities of RCRA metals including aluminum, arsenic, barium, cadmium, chromium, cobalt, copper, lead, lithium, and vanadium. If RCRA metals are present, include recommendations for corrective action.
4. Phytotoxicity: Test for plant-available concentrations of phytotoxic minerals including aluminum, arsenic, barium, cadmium, chlorides, chromium, cobalt, copper, lead, lithium, mercury, nickel, selenium, silver, sodium, strontium, tin, titanium, vanadium, and zinc.

D. Fertility Testing: Soil-fertility analysis according to standard laboratory protocol of SSSA NAPT NEC-67, including the following:
1. Percentage of organic matter.
2. CEC, calcium percent of CEC, and magnesium percent of CEC.
3. Soil reaction (acidity/alkalinity pH value).
4. Buffered acidity or alkalinity.
5. Nitrogen ppm.
6. Phosphorous ppm.
7. Potash.
8. Potassium ppm.
9. Manganese ppm.
10. Manganese-availability ppm.
11. Zinc ppm.
12. Zinc availability ppm.
13. Copper ppm.
14. Sodium ppm and sodium absorption ratio.
15. Soluble-salts ppm.
16. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.
17. Other deleterious materials, including their characteristics and content of each.

E. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."

F. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting mixes. Planting mixes shall be used as the proper medium to produce healthy, viable plants for this Project. Include the necessary recommendations for nitrogen, phosphorous, potassium fertilization, treatments, amendments and micronutrients.
   1. Fertilizers and Soil Amendment Rates: Provide fertilizer recommendations in pounds per 1000 square feet (lbs / S.F.).
   2. Soil Reaction: Provide the recommended liming rated for raising the pH or sulfur for lowering the pH according to the buffered acidity or buffered alkalinity in pounds per 1000 square feet (lbs / S.F.).

1.09 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.

B. Bulk Materials:
   1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, plants or plant beds.
   2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways in accordance with the approved Erosion and Sediment Control drawings.
   3. Do not move or handle materials when they are wet or frozen.
   4. Accompany each delivery of bulk materials with the required certificates and invoices.

PART 2 PRODUCTS

2.01 PLANTING SOILS SPECIFIED BY COMPOSITION

A. General: Soil amendments, fertilizers, and rates of application specified in this Article are guidelines that may need revision based on testing agency’s recommendations after preconstruction soil analyses are performed.

B. Planting Mix: Satisfactory existing on-site topsoil or subsoil, satisfactory imported topsoil, or manufactured soil that has been modified in accordance with testing agency recommendations with soil amendments and fertilizers in order to produce a suitable planting mix for proper plant growth. Blend satisfactory topsoil, manufactured soil, and soil amendments in the following ratios to produce Planting Mixes for landscape plant materials and turf establishment.

1. Ratio of Loose Compost to Soil: 1:3 by volume.
2. Ratio of Loose Topsoil: 1:3 by volume.
3. Ratio of Loose Excavated Subsoil: 1:3 by volume.

2.02 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
   1. Class: T, with a minimum of 99 percent passing through a No. 8 sieve and a minimum of 75 percent passing through a No. 60 sieve.
   2. Class: O, with a minimum of 95 percent passing through a No. 8 sieve and a minimum of 55 percent passing through a No. 60 sieve.

B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent elemental sulfur, with a minimum of 99 percent passing through a No. 6 sieve and a maximum of 10 percent passing through a No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through a No. 50 sieve.

2.03 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter produced by composting feedstock, and bearing USCC's "Seal of Testing Assurance," and as follows:
   1. Feedstock: Limited to leaves.
   2. Reaction: pH of 5.5 to 8.
   3. Soluble-Salt Concentration: Less than 4 dS/m.
   4. Moisture Content: 35 to 55 percent by weight.
   5. Organic-Matter Content: 50 to 60 percent of dry weight.
   6. Particle Size: Minimum of 98 percent passing through a 2-inch sieve.

B. Coarse Sand: MSMT 356 Sampling and Testing of Landscape Soils.
   1. Coarse Sand shall be washed silica sand or crushed glass that conforms to ASTM C-33 for Fine Aggregate. Coarse Sand shall include less than 1% by weight of clay or silt size particles, and less than 5% by weight of any combination of diabase, Greystone, calcareous or dolomitic sand.

C. Fine Bark: Shall be bark from harvesting healthy hardwood trees, milled and screened to a uniform particle size of 2 inches or less. Fine Bark shall be composted and aged for 6 months or longer, and shall be free from sawdust, foreign materials, and chemicals Dyed bark will not be permitted.

2.04 FERTILIZERS

A. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
   1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.

PART 3 EXECUTION

3.01 GENERAL

A. Install Planting Mix in accordance with the requirements of Specification Section 329300-Plants.
B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.
C. Proceed with placement only after unsatisfactory conditions have been corrected.

3.02 PREPARATION OF SOIL PRIOR TO AMENDMENT

A. Excavation: Excavate and stockpile satisfactory soils, cover and protect until amended.
B. Unacceptable Materials: Soil with concrete slurry or washings, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and all materials that are harmful to plant growth.
C. Unsuitable Materials: Soil exceeding 8 percent by dry weight of stones, roots, plants, sod, clay lumps, and pockets of coarse sand.
D. Screening: Screen unamended soil through a 2-inch sieve to remove large materials.

3.03 MIXING AND INSTALLATION OF PLANTING MIX

A. General: Mix satisfactory on-site and borrow soils with amendments in designated on-site location, approved by the Architect or Landscape Architect, as required to prepare Planting Mix for installation of plants. Do not apply materials or till if soils or subgrade is frozen, muddy, or excessively wet.
   1. Minimum Depth of Planting Mix for trees, shrubs, and other plant material as indicated on the Drawings.

B. Subgrade Preparation: Till subgrade to a minimum depth of 4 inches. Remove stones larger than 2 inches in any dimension, plus sticks, roots, rubbish, and other extraneous matter. Legally dispose of off Owner's property.

C. Spread Planting Mix to depth as indicated, but not less than required to meet finish grades. Do not spread if Planting Mix or subgrade is frozen, muddy, or excessively wet.

1. Lifts: Install Planting Mix in lifts not exceeding 4 inches in loose depth for all plant material, and 4 inched in loose depth for turf establishment.

D. Compaction:

1. Landscape Plants: Hand tamp each lift of Planting Mix to consolidate the mix around each plant to minimize settlement and air pockets. Compaction by mechanized equipment shall not be allowed.
2. Turf Establishment: Compact each lift of Planting Mix to within 75 to 82 percent of maximum dry density in accordance with ASTM D 698 (Standard Proctor).

E. Finish Grading: Completed Planting Mix shall have a smooth, uniform surface finish grade. Lightly roll and rake to remove ridges, and fill depressions as necessary to meet proposed finish grades.

3.04 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections for this scope of work.

B. Prepare and submit test reports.

C. Label each sample and test report with the date, location keyed to the applicable Drawing, the visibility conditions when sample and test was taken, and sampling depth.

D. Contractor shall perform regular inspections and documentation at the following specified stages of construction in accordance with the following:

1. During excavation to subgrade.
2. During placement and backfill of underdrain system.
3. During placement or geotextiles and all other filter media.
4. During construction of appurtenant conveyance systems such as diversion structures, pre-filters, filters, outlets, and flow distribution structures.
5. Upon completion of final grading and establishment or permanent stabilization.

3.05 PROTECTION

A. Protect areas of completed installation from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:
   1. Storage of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.
   3. Vehicle traffic.
   4. Foot traffic.
   5. Erection of sheds or structures.
   6. Impoundment of water.
   7. Excavation and other disturbances, unless otherwise approved.

B. If subgrade or Planting Mix is over compacted, disturbed, or contaminated by foreign or deleterious materials or liquids:
   1. Remove contamination;
   2. Restore the subgrade as directed by the Architect or Landscape Architect;
   3. Correct contaminated and improperly prepared subgrade as required;
   4. Replace contaminated Planting Mix with satisfactory Planting Mix.

3.06 CLEANUP AND REMOVAL OF DEBRIS AND EXCESS MATERIALS

A. Protect areas with installed Planting Mix from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.

B. Remove surplus Planting Mix and waste materials, including excess subsoil, unsuitable materials, trash, and debris, and legally dispose of them off of the Owner’s property.
   1. Excess topsoil shall be removed from the site unless otherwise directed in writing by Owner.

END OF SECTION

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SECTION 329200
TURF AND GRASSES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Seeding
   2. Turf Renovation

B. Related Sections:
   1. Division 31 Section "Site Clearing" for topsoil stripping and stockpiling.
   2. Division 31 Section "Earthwork" for excavation, filling and backfilling, and rough grading.
   3. Division 32 Section “Soil Preparation” for topsoil and planting soils.
   4. Division 32 Section "Plants" for plant materials.

1.02 DEFINITIONS

A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

B. Finish Grade: Elevation of finished surface of planting soil.

C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

F. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.

H. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

I. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to this Project.
   2. Certification of each mixture for turfgrass sod. Include identification of source and name and telephone number of supplier.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf establishment.
   1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
   2. Experience: Five years' experience in turf installation in addition to requirements in Division 01 Section "Quality Requirements."
   3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
   4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:
      a. Certified Landscape Technician - Exterior, with installation specialty area(s), designated CLT-Exterior.
      b. Certified Turfgrass Professional, designated CTP.
   5. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to project site.
   6. Pesticide Applicator: State licensed, commercial.

B. Soil-Testing Laboratory Qualifications: An independent laboratory or university laboratory, recognized by the Commonwealth of Virginia, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

C. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of the soil.

1. Testing methods and written recommendations shall comply with USDA's Handbook No. 60.
2. The soil-testing laboratory shall oversee soil sampling, with depth, location, and number of samples to be taken per instructions from Landscape Architect. A minimum of three representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.
3. Report suitability of tested soil for turf growth.
    a. Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. (92.9 sq. m) for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
    b. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Protect sod from breakage and drying.

B. Bulk Materials:
    1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
    2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
    3. Accompany each delivery of bulk materials and soil amendments with appropriate certificates.
    4. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.

1.06 PROJECT CONDITIONS

A. Planting Restrictions: Coordinate planting periods with initial maintenance periods to provide required maintenance from date of planting completion.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

1.07 MAINTENANCE SERVICE

A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:

1. Sodded Turf: 30 days from date of planting completion.

PART 2 PRODUCTS

2.01 TURFGRASS SOD

A. Turfgrass Sod: Approved Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.

B. Turfgrass Species: Sod of grass species as follows, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed:

1. Turf-type Tall Fescue. Submit species mix for approval by Landscape Architect.

2.02 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: O, with a minimum of 95 percent passing through No. 8 (2.36-mm) sieve and a minimum of 55 percent passing through No. 60 (0.25-mm) sieve.
2. Provide lime in form of ground dolomitic limestone.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, and with a minimum of 99 percent passing through No. 6 (3.35-mm) sieve and a maximum of 10 percent passing through No. 40 (0.425-mm) sieve.

C. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 (0.30-mm) sieve.

D. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

2.03 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing 1/2-inch (12.5-mm) sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
   1. Organic Matter Content: 50 to 60 percent of dry weight.

2.04 FERTILIZERS

A. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
   1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.05 PLANTING SOILS

A. Planting Soil: Existing, native surface topsoil formed under natural conditions with the duff layer retained during excavation process and stockpiled on-site. Verify suitability of native surface topsoil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
   1. Supplement with imported topsoil when quantities are insufficient.
   2. Mix existing, native surface topsoil with soil amendments and fertilizers as recommended by the soils reports to produce planting soil.

B. Imported topsoil: Imported topsoil or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches (100 mm) deep; do not obtain from agricultural land, bogs or marshes.

1. Additional Properties of Imported Topsoil or Manufactured Topsoil: Screened and free of stones 1 inch (25 mm) or larger in any dimension; free of roots, plants, sod, clods, clay lumps, pockets of coarse sand, paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials harmful to plant growth; free of obnoxious weeds and invasive plants including quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and bromegrass; not infested with nematodes, grubs, other pests, pest eggs, or other undesirable organisms and disease-causing plant pathogens; friable and with sufficient structure to give good tilth and aeration. Continuous, air-filled, pore-space content on a volume/volume basis shall be at least 15 percent when moisture is present at field capacity. Soil shall have a field capacity of at least 15 percent on a dry weight basis.
2. Mix imported topsoil or manufactured topsoil with soil amendments and fertilizers as recommended by the soils reports to produce planting soil.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.
   1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
   2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
   3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
   4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
B. Proceed with installation only after unsatisfactory conditions have been corrected.
C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Landscape Architect and replace with new planting soil.

3.02 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
   1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
   2. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.03 TURF AREA PREPARATION

A. Limit turf subgrade preparation to areas to be planted.

B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 8 inches (200 mm). Remove stones larger than 1 inch (25 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
   1. Spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
      a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
      b. Mix lime with dry soil before mixing fertilizer.
   2. Spread planting soil to a depth of 12 inches (300 mm but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
      a. Reduce elevation of planting soil to allow for soil thickness of sod.

C. Unchanged Subgrades: If turf is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:
   1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
   2. Loosen surface soil to a depth of at least 8 inches (200 mm). Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 6 inches (150 mm) of soil. Till soil to a homogeneous mixture of fine texture.
   3. Remove stones larger than 1 inch (25 mm) in any dimension and sticks, roots, trash, and other extraneous matter.

4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.

D. Finish Grading: Grade areas to be sodded to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch (13 mm) of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be sodded in the immediate future.

E. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

F. Before planting, obtain Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.04 TURF RENOVATION

A. Renovate existing turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.

1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
2. Install new planting soil as required.

B. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.

C. Remove topsoil containing foreign materials such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.

D. Mow, dethatch, core aerate, and rake existing turf.

E. Remove weeds before sodding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.

F. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.

G. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches (150 mm).

H. Apply soil amendments and initial fertilizers required for establishing new turf and mix thoroughly into top 4 inches (100 mm) of existing soil. Install new planting soil to fill low spots and meet finish grades.

I. Apply sod as required for new turf.

J. Water newly planted areas and keep moist until new turf is established.

3.05 TURF MAINTENANCE

A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
   1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
   2. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches (100 mm).
   1. Water turf with fine spray at a minimum rate of 1 inch (25 mm) per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain a height of 2 ½ to 3 inches (60 to 75 mm).

3.06 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Landscape Architect:
   1. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.07 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents in accordance with requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.08 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

C. Remove nondegradable erosion-control measures after grass establishment period.

END OF SECTION

SECTION 329300
PLANTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Trees and Shrubs.
   2. Perennials and groundcover.

B. Related Requirements:
   1. Section 329113 Soil Preparation.

1.02 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with a ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.

C. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required.

D. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

E. Finish Grade: Elevation of finished surface of planting soil.

F. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.

G. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

H. Planting Area: Areas to be planted.

I. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

J. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

K. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

L. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

M. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.03 INFORMATIONAL SUBMITTALS

A. Qualification Data: For landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.

B. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:

1. Manufacturer's certified analysis of standard products.
2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

C. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

D. Sample Warranty: For special warranty.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before expiration of required maintenance periods.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
2. Experience: Three years' experience in landscape installation in addition to requirements in Section 014000 "Quality Requirements."
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
4. Personnel Certifications: Installer's personnel assigned to the Work shall have certification in the following categories from the Professional Landcare Network:
    a. Landscape Industry Certified Technician - Exterior.
5. Pesticide Applicator: State licensed, commercial.

B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

C. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.
1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container-grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches (150 mm) above the root flare for trees up to 4-inch (100-mm) caliper size, and 12 inches (300 mm) above the root flare for larger sizes.
2. Other Plants: Measure with stems, petioles, and foliage in their normal position.

D. Plant Material Observation: The Landscape Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. The Landscape Architect may also observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and may reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
1. Notify Landscape Architect of sources of planting materials seven days in advance of delivery to site.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

C. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

D. Handle planting stock by root ball.

E. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F (16 to 18 deg C) until planting.

F. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

G. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
2. Do not remove container-grown stock from containers before time of planting.
3. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

1.07 FIELD CONDITIONS

A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

1. Spring Planting: March 15- June 1
2. Fall Planting: Sept. 15-Nov. 15

C. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

1.08 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:
    a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner.
    b. Structural failures including plantings falling or blowing over.
2. Warranty Periods: From date of substantial completion.
    a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
    b. Ground Covers, Biennials, Perennials, and Other Plants: 12months.
3. Include the following remedial actions as a minimum:
    a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
    b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
    c. A limit of one replacement of each plant is required except for losses or replacements due to failure to comply with requirements.
    d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

PART 2 - PRODUCTS

2.01 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
   1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch (19 mm) in diameter; or with stem girdling roots are unacceptable.
   2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.

C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

D. Labeling: Label at least one plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant.

E. If formal arrangements or consecutive order of plants is indicated on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

2.02 FERTILIZERS

A. Planting Tablets: Tightly compressed chip-type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.

1. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

2.03 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees, shrubs, and perennials, consisting of one of the following:
   1. Type: Shredded hardwood bark.
   2. Size Range: 3 inches maximum, 1/2 inch minimum.
   3. Color: Natural.

2.04 PESTICIDES

A. General: Pesticide registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

2.05 MISCELLANEOUS PRODUCTS

A. Burlap: Non-synthetic, biodegradable.

B. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb (0.45 kg) of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb (0.45 kg) of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.
   1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
   2. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.

3. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.

D. Lay out plants at locations directed by Landscape Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

3.03 PLANTING AREA ESTABLISHMENT

A. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

B. Application of Mycorrhizal Fungi: At time directed by Architect, broadcast dry product uniformly over prepared soil at application rate according to manufacturer's written recommendations.

3.04 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Trenches: Excavate circular planting pits.

1. Excavate planting pits as shown on planting plan. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
2. Maintain supervision of excavations during working hours.
3. Keep excavations covered or otherwise protected when unattended by Installer's personnel.

B. Backfill Soil: Subsoil and topsoil removed from excavations may not be used as backfill soil unless compliance with the requirements of Section 329113 “Soil Preparatoin”.

C. Obstructions: Notify Landscape Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

D. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.

E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.05 TREE, SHRUB, AND VINE PLANTING

A. At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

B. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

C. Balled and Burlapped Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch – 2 inches (25 mm) above adjacent finish grades.

1. Backfill: Planting soil.
2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Continue backfilling process. Water again after placing and tamping final layer of soil.

D. Container-Grown Stock: Set each plant plumb and in center of planting pit as shown on planting details.

1. Backfill: Planting soil
2. Carefully remove root ball from container without damaging root ball or plant.

3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Continue backfilling process. Water again after placing and tamping final layer of soil.

3.06 TREE, SHRUB, AND VINE PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.
B. Prune, thin, and shape trees, shrubs, and vines as directed by Landscape Architect.
C. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Landscape Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.
D. Do not apply pruning paint to wounds.

3.07 TREE STABILIZATION

A. Stabilize trees only when specifically permitted by Landscape Architect.
1. Upright Staking and Tying: Stake trees only as required to prevent wind tip out. Use a minimum of two stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation and to extend one-third of trunk height above grade. Set vertical stakes and space to avoid penetrating root balls or root masses.
2. Upright Staking and Tying: Stake trees with two stakes for trees up to 12 feet high and 2-1/2 inches or less in caliper; three stakes for trees less than 14 feet high and up to 4 inches in caliper. Space stakes equally around trees.
3. Support trees with bands of flexible ties at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

3.08 GROUND COVER AND PLANT PLANTING

A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on Drawings in even rows with triangular spacing.
B. Use planting soil for backfill.
C. Dig holes large enough to allow spreading of roots.
D. For rooted cutting plants supplied in flats, plant each in a manner that minimally disturbs the root system but to a depth not less than two nodes.
E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.09 PLANTING AREA MULCHING

A. Mulch backfilled surfaces of planting areas.

1. Organic Mulch in Planting Areas: Apply organic mulch to 3-inch (75-mm) average thickness. Do not place mulch within 3 inches (75 mm) of trunks or stems of woody plants.

3.10 PLANT MAINTENANCE

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.

B. Fill in, as necessary, soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.11 REPAIR AND REPLACEMENT

A. General: Repair or replace existing or new trees and other plants that are damaged by construction operations, in a manner approved by Landscape Architect.

1. Submit details of proposed pruning and repairs.
2. Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.
3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Landscape Architect.

B. Remove and replace trees that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Landscape Architect determines are incapable of restoring to normal growth pattern.

1. Provide new trees of same size as those being replaced.
2. Species of Replacement Trees: Same species being replaced.

3.12 CLEANING AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

C. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

D. After installation and before Substantial Completion remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

END OF SECTION

SECTION 331000

EXTERIOR WATER SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

1.2 SUMMARY

A. This section includes water service piping, fire protection service mains and appurtenances from the source of water to a point 5 feet outside the building.

1.3 SUBMITTALS

A. Product data for piping, valves, vaults, fire hydrants, and identification devices.

1.4 QUALITY ASSURANCE

A. Comply with local utility department and fire department standards pertaining to materials, meter boxes, hose threads and installation.

B. Comply with the requirements of the latest edition of the Albemarle County Service Authority's Construction Specifications.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, for shipping as follows:

1. Ensure valves are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends, flange faces, and weld ends.
3. Set valves in best position for handling. Set gate valves and fire hydrants closed to prevent rattling.

B. Storage: Use the following precautions for valves, including fire hydrants, during storage:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
2. Protect valves from weather. Store valves indoors. Maintain valve temperature higher than the ambient dew point temperature. If outdoor storage is necessary, support valves off the ground or pavement in watertight enclosures.

C. Handling: Use a sling to handle valves, including fire hydrants, whose size requires handling by crane or lift. Rig valves to avoid damage to exposed valve parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.6 PROJECT CONDITIONS

A. Site Information: Perform site surveys, research public utility records, and verify existing utility locations. Verify that exterior water system may be installed in compliance with the original design and referenced standards. Notify Architect immediately of any discrepancies.

B. Coordinate connection to the existing water service with

1.7 SEQUENCING AND SCHEDULING

A. Coordinate with interior water piping and interior fire protection piping.

B. Coordinate with other utility work.

C. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions:

1. Notify Architect not less than two days in advance of the proposed interruption.
2. Do not proceed with the interruption without Architects written permission.
3. Provide temporary utility service to the facility.

PART 2 - PRODUCTS

2.1 GENERAL

A. All piping, valves, fittings, fire hydrants, meters, meter vaults, appurtenances and other products shall conform to the requirements of the latest edition of the Albemarle County Service Authority’s Construction Specifications.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation of the exterior water system shall comply with the requirements of the latest edition of the Albemarle County Service Authority's Construction Specifications.

3.2 PREPARATION OF BURIED PIPE FOUNDATION

A. Grade trench bottom to provide a smooth, firm, stable, and rock-free foundation throughout the length of the pipe.

B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with clean sand or pea gravel to indicated level.

C. Shape bottom of trench to fit bottom of pipe. Fill unevenness with tamped sand backfill. Dig bell holes at each pipe joint to relieve the bells of all loads and to ensure continuous bearing of the pipe barrel on the foundation.

3.3 PIPE AND PIPE FITTINGS INSTALLATION

A. Depth of Cover: Provide minimum cover over piping of 18 inches below average local frost depth or 42 inches below finished grade, whichever is greater.

B. Water Service Termination: Terminate water service piping 5'-0" from building foundation in location and invert as indicated. Coordinate location with interior water piping and interior fire service piping. Provide temporary pipe plug for piping extension into building.

3.4 IDENTIFICATION INSTALLATION

A. Install underground warning tape and tracing wire for underground water service piping, as required by the latest edition of the Albemarle County Service Authority's Construction Specifications.

3.5 FIELD QUALITY CONTROL

A. Testing and Disinfection: Disinfect, flush and test in accordance with the requirements of the latest edition of the Albemarle County Service Authority's Construction Specifications.

END OF SECTION 331000

SECTION 333000

SANITARY SEWERAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

1.2 SUMMARY

A. This Section includes sanitary sewerage system piping and appurtenances from a point 5 feet outside the building to the point of disposal.

1.3 SUBMITTALS

A. Product data for sewer piping specialties.

B. Shop drawings for precast concrete sanitary manholes, including frames and covers.

C. Shop drawings for cast-in-place concrete or field-erected masonry sanitary manholes, including frames and covers.

D. Inspection and test reports specified in the "Field Quality Control" Article

1.4 QUALITY ASSURANCE

A. Environmental Compliance: Comply with applicable portions of local environmental agency regulations pertaining to sanitary sewerage systems, and to the requirements of the Virginia Erosion and Sediment Control Handbook for erosion control during installation.

B. Utility Compliance: Comply with the requirements of the latest edition of the Albemarle County Service Authority’s Construction Specifications.

1.5 DELIVERY, STORAGE, AND HANDLING

1. Do not store plastic structures in direct sunlight.
2. Do not store plastic pipe or fittings in direct sunlight.
3. Protect pipe, pipe fittings, and seals from dirt and damage.
4. Handle precast concrete manholes and other structures according to manufacturer's rigging instructions.

1.6 PROJECT CONDITIONS

A. Site Information: Perform site surveys, research public utility records, and verify existing utility locations. Verify that sanitary sewerage system piping may be installed in compliance with original design and referenced standards.

B. Locate existing structures and piping to be closed and abandoned.

C. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted under the following conditions and then only after arranging to provide acceptable temporary utility services.

1. Notify Architect not less than 48 hours in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without receiving Architect's written permission.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate with interior building sanitary drainage piping.

B. Coordinate with other utility work.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. General: Provide pipe and pipe fitting materials compatible with each other. All materials shall comply with the requirements of the latest edition of the Albemarle County Service Authority's Construction Specifications.

B. PVC (Polyvinyl Chloride) Sewer Pipe and Fittings: ASTM D 3034, SDR 35, elastomeric gasket joints.

1. Gaskets: ASTM F 477, elastomeric seal.

C. Ductile-Iron Pipe: AWWA C151, Class 50 minimum, for push-on joints.

1. Standard-Pattern, Ductile-Iron and Cast-Iron Fittings: AWWA C110, for push-on joints.
2. Compact-Pattern, Ductile-Iron Fittings: AWWA C153, for push-on joints.
3. Pipe and Fitting Interior Coating: AWWA C104, asphaltic-material seal coat, minimum 1-mil (0.025-mm) thickness.
4. Gaskets: AWWA C111, rubber.

2.2 MANHOLES

A. Precast Concrete Manholes: Shall comply with the latest edition of the Albemarle County Service Authority's Construction Specifications.

B. Manhole Steps shall comply with the latest edition of the Local Utility Standards.

C. Manhole Frames and Covers: Shall comply with the latest edition of the Local Utility Standards.

2.3 CLEANOUTS

A. General: Provide cast-iron ferrule and countersunk brass cleanout plug, with round cast-iron access frame and heavy-duty, secured, scoriated cast-iron cover.

B. Sewer pipe fitting and riser to cleanout: 4" dia. ductile iron pipe.

PART 3 - EXECUTION

3.1 PREPARATION OF FOUNDATION FOR BURIED SANITARY SEWERAGE SYSTEMS

A. Grade trench bottom to provide a smooth, firm, stable, and rock-free foundation, throughout the length of the pipe.

B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with clean sand or pea gravel to indicated level.

C. Install pipe bedding as required by the latest edition of the Albemarle County Service Authority’s Construction Specifications.

3.2 PIPE INSTALLATION

A. Install the sanitary sewerage system in accordance with the requirements of the latest edition of the Local Utility Standards.

B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.

C. Use manholes for changes in direction, except where a fitting is indicated. Use fittings for branch connections, except where direct tap into existing sewer is indicated.

D. Use proper size increasers, reducers, and couplings, where different size or material of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.

E. Install piping pitched down in direction of flow, at minimum slope of 2 percent, except where indicated otherwise.

F. Extend sanitary sewerage system piping to connect to building sanitary drains, of sizes and in locations indicated.

3.3 PIPE JOINT CONSTRUCTION AND INSTALLATION

A. Join and install PVC pipe as follows:

1. Pipe and gasketed fittings, joining with elastomeric seals, in accordance with ASTM D 3212.
2. Installation in accordance with ASTM D 2321.

B. Join different types of pipe with standard manufactured couplings and fittings intended for that purpose.

3.4 MANHOLES

A. Install precast concrete manholes in accordance with the latest edition of the Local Utility Standards.

B. Provide rubber joint gasket complying with ASTM C 443 at joints of sections.

C. Apply bituminous mastic coating at joints of sections.

3.5 CLEANOUTS

A. Provide cleanouts as indicated, and as required by authorities having jurisdiction. Set cleanout frame and cover in concrete block 12 by 12 by 6 inches deep, except where location is in concrete paving. Set top of cleanout 1 inch above surrounding earth grades or flush with grade when installed in paving.

3.6 FIELD QUALITY CONTROL

A. Cleaning: Clear interior of piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.

1. In large, accessible piping, brushes and brooms may be used for cleaning.
2. Place plugs in ends of uncompleted pipe at end of day or whenever work stops.
3. Flush piping between manholes, if required by local authority, to remove collected debris.

B. Interior Inspection: Inspect piping to determine whether line displacement or other damage has occurred.

1. Make inspections after pipe between manholes and manhole locations has been installed and approximately 2 feet of backfill is in place, and again at completion of project.
2. If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects correct such defects, and reinspect.

C. Test new piping systems and parts of existing systems that have been altered, extended, or repaired for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to the requirements of the Local Utility Standards.

3. Schedule tests, and their inspections by authorities having jurisdiction, with at least 24 hours' advance notice.
4. Submit separate reports for each test.

END OF SECTION 333000

SECTION 334100

STORM DRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The provisions of the Contract Documents apply to the work of this Section.

1.2 SUMMARY:

A. This Section includes the roof drainage collection system, the storm sewerage system piping and appurtenances from a point 5 feet outside the building to the point of disposal, and the outfall structures of the underground detention.

1.3 SUBMITTALS

A. Product data for:

1. Concrete pipe
2. Polyethylene pipe
3. Ductile iron pipe
4. Frames and covers.
5. Grates
6. Couplings for connection into concrete pipe.

B. Certification, signed by material producer and contractor, that standard precast and cast in place concrete storm drainage manholes and Drop Inlets comply with VDOT standards and specifications.

C. VDOT approved job mix for bedding stone.

D. Shop drawings for:

1. Non-standard precast or cast-in-place concrete storm drainage manholes and Drop Inlets.
2. Trench drain system.
3. Cleanouts
4. Underdrains
5. Stormwater Management Basin Outlet structures, including Riser pipe, outfall pipe, riser anchoring, anti-seep collars, trash rack and anti-vortex device.

E. Record drawings of installed storm drainage system.

1.4 QUALITY ASSURANCE

A. Environmental Compliance: Comply with applicable portions of local environmental agency regulations pertaining to storm sewerage systems.

B. Utility Compliance: Comply with state and local regulations and standards pertaining to storm sewerage systems.

C. All materials shall be new and free of defects (i.e. pipe shall not have chipped spigots or bells).

1.5 PROJECT CONDITIONS

A. Site Information: Perform site surveys, research public utility records, and verify existing utility locations. Verify that storm sewerage system piping may be installed in compliance with original design and referenced standards.

B. Locate existing structures and piping to be closed and abandoned.

C. Existing Utilities: Do not interrupt existing storm sewer serving facilities occupied by the Owner of others except when permitted under the following conditions and then only after arranging to provide acceptable temporary storm sewer services.

1. Notify Architect not less than 48 hours in advance of proposed storm sewer interruptions.
2. Do not proceed with storm sewer interruptions without receiving Architect's written permission.

D. Existing utilities across or along the line of work are indicated only in an approximate location. Locate all underground lines and structures. Call "Miss Utility" at 1-800-552-7001 prior to construction. If utilities are marked that are not shown on the plans, locate utility vertically and horizontally and provide information to architect.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate with interior building storm drainage piping.

B. Coordinate with other utility work.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials used for construction of the storm sewerage system shall comply with the requirements of the latest edition of the Virginia Department of Transportation Road and Bridge Standards and Road and Bridge Specifications.

2.2 PIPE AND FITTINGS

A. Provide pipe and pipe fitting materials compatible with each other. Pipe materials are indicated on the drawings.

B. Reinforced Concrete Pipe (RCP): Shall conform to the requirements of ASTM C76/AASHTO M170, Class III, unless otherwise indicated. All RCP shall be gasketed.

C. O-Ring Gasket Reinforced Concrete Pipe: Shall conform to the requirements of ASTM C76/AASHTO M170, Class III, unless otherwise indicated. Joints shall conform to the requirements of ASTM C443/AASHTO M198.

D. Corrugated Polyethylene Pipe (P.E.): Shall have a smooth lined interior and meet the requirements of ASTM F405 or AASHTO M252 for 10" diameter and smaller, and ASTM F667 or AASHTO M294 for 12" diameter and larger.

E. PVC Storm Sewer Pipe: Shall conform to the requirements of ASTM D3034, SDR-35 with bell and spigot ends for gasketed joints with ASTM F 477 elastrometric seals

1. Connections to the building downspouts shall be made with Schedule 40 PVC, with bell and spigot ends for gasketed joints with ASTM F 477 elastrometric seals.

F. Ductile Iron Storm Sewer Pipe: Shall conform to the requirements of AWWA C151, Class 52. Flanged joints shall conform to the requirements of AWWA C115.

2.3 MANHOLES

A. Precast Concrete Manholes: Comply with the requirements of the latest edition of the Virginia Department of Transportation's Road and Bridge Standards, and Road and Bridge Specifications.

B. Cast-in-Place Manholes: Comply with the requirements of the latest edition of the Virginia Department of Transportation's Road and Bridge Standards, and Road and Bridge Specifications.

C. Manhole Steps, Safety Slabs and Inlet Shaping: Comply with the requirements of the latest edition of the Virginia Department of Transportation's Road and Bridge Standards, and Road and Bridge Specifications.

D. Manhole Frames and Covers: Comply with the requirements of the latest edition of the Virginia Department of Transportation's Road and Bridge Standards, and Road and Bridge Specifications.

2.4 CLEANOUTS

A. Cast-iron ferrule and countersunk brass cleanout plug, with round cast-iron access frame and heavy-duty, secured, scoriated cast-iron cover.

2.5 DROP INLETS

A. Precast Concrete Drop Inlets: Comply with the requirements of the latest edition of the Virginia Department of Transportation's Road and Bridge Standards, and Road and Bridge Specifications.

B. Cast-in-Place Drop Inlets: Comply with the requirements of the latest edition of the Virginia Department of Transportation's Road and Bridge Standards, and Road and Bridge Specifications.

C. Drop Inlet Steps, Safety Slabs and Inlet Shaping: Comply with the requirements of the latest edition of the Virginia Department of Transportation's Road and Bridge Standards, and Road and Bridge Specifications.

D. Drop Inlet Frames and Grates: Comply with the requirements of the latest edition of the Virginia Department of Transportation's Road and Bridge Standards, and Road and Bridge Specifications.

E. Plastic Drain Basins: ADS or approved equal.

2.6 TRENCH DRAIN SYSTEM

A. Curving Trench Drain in Courtyard - Basis of design product shall be Dura Trench (https://www.duratrench.com)
1. Body shall be fiber-reinforced polymer concrete, 6" width, urethane caulk sealant
2. Depth shall be 8 inches.
3. Frame shall be medium-duty galvanized steel, load class C
4. Grate shall be 8" wide ADA/Heel-proof ductile iron slotted or solid as shown on plans.
5. Radius shall be as noted on plans
6. Outfall structures shall be as shown on plans

2.7 CONCRETE AND REINFORCEMENT

A. Concrete: Conform to the requirements of VDOT Standard Class A3 concrete.

B. Reinforcement: Steel conforming to the following:

2. Fabric: ASTM A 185 welded wire fabric, plain.
3. Reinforcement Bars: ASTM A 615, Grade 60, deformed.

2.8 UNDERDRAINS

A. Underdrains and combination underdrains: Conform to the requirements of the latest edition of the VDOT Road and Bridge Specifications and the VDOT Road and Bridge Standards for the type of underdrain, unless otherwise indicated.

1. PVC underdrains shall conform to the requirements of ASTM F758, Type PS 28 or ASTM F949.
2. PE corrugated underdrain pipe shall conform to AASHTO M252.

B. Provide a filter fabric "sock" wrapping for all underdrain pipe.

2.9 END WALLS AND END SECTIONS

A. End walls: Conform to the requirements of the latest edition of the VDOT Road and Bridge Specifications and the VDOT Road and Bridge Standards.

B. End sections: Conform to the requirements of the latest edition of the VDOT Road and Bridge Specifications and the VDOT Road and Bridge Standards for the size of pipe indicated.

PART 3 - EXECUTION

3.1 GENERAL

A. Install the storm sewerage system in accordance with the latest edition of the Virginia Department of Transportation's Road and Bridge Standards and Road and Bridge Specifications.

3.2 PREPARATION OF FOUNDATION FOR BURIED STORM SEWERAGE SYSTEMS

A. Grade trench bottom to provide a smooth, firm, stable, and rock-free foundation, throughout the length of the pipe.

B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with clean sand or pea gravel to indicated level.

C. Install pipe bedding conforming to the requirements of the latest edition of the Virginia Department of Transportation's Road and Bridge Standards and Road and Bridge Specifications.

3.3 PIPE INSTALLATION

A. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.

B. Use proper size increasers, reducers, and couplings, where different size or material of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.

C. Extend storm sewerage system piping to connect to building storm drains, of sizes and in locations indicated.

D. Join and install concrete pipe and fittings per VDOT specifications.

E. Join and install PE pipe and fittings per manufacturer's recommendations.

F. Join different types of pipe with standard manufactured couplings and fittings intended for that purpose.

3.4 MANHOLES

A. General: Install manholes complete with accessories as indicated. Form continuous concrete or split pipe section channel and benches between inlets and outlet. Set tops of frames and covers flush with finish grade, unless otherwise indicated.

B. Place precast concrete manhole sections as indicated and install in accordance with ASTM C 891.

C. Construct cast-in-place manholes as indicated.

D. Apply bituminous mastic coating at joints of sections.

3.5 CLEANOUTS

A. Install cleanouts and extension from sewer pipe to cleanout at grade as indicated. Set cleanout frame and cover in concrete block 12 by 12 by 6 inches deep or as indicated on the plans, except where location is in concrete paving. Set top of cleanout flush with finish grade.

3.6 DROP INLETS

A. Construct drop inlets to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.7 INLET SHAPING

A. Construct inlet shaping conforming to VDOT Standard IS-1 at all drop inlets and manholes.

3.8 TRENCH DRAIN INSTALLATION

A. Installation of the trench drain shall comply with the manufacturer’s recommendations.

B. Verify connection to the storm sewer system. Utilize manufacturers standard outlet connections to make connection to the storm sewer system.

C. Install trench drain system starting from the downstream end, working towards the upstream end.

D. Verify proper placement and alignment prior to placement of concrete.

E. Place concrete around suspended trench channel. Do not chute concrete directly against channel walls, as this may cause displacement. Work concrete under channels and vibrate with a finger-type vibrator.

F. Finish surface to be flush with the adjoining surfaces and to allow for positive drainage into the grates.

G. Install grate tops.

3.9 FIELD QUALITY CONTROL

A. Cleaning: Clear interior of piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.

1. In large, accessible piping, brushes and brooms may be used for cleaning.
2. Place plugs in ends of uncompleted pipe at end of day or whenever work stops.
3. Flush piping between manholes and drop inlets to remove collected debris. Flush pipes through an approved erosion and sediment control measure.

B. Interior Inspection: Inspect piping to determine whether line displacement or other damage has occurred.

1. Make inspections after pipe between manholes and manhole locations has been installed and approximately 2 feet of backfill is in place, and again at completion of project.
2. If inspection indicates poor alignment, debris, displaced pipe, infiltration, or other defects correct such defects and reinspect.

END OF SECTION 334100

SECTION 334613

FOUNDATION DRAINAGE SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

1.2 SUMMARY

A. This Section includes underground foundation drainage systems, as follows:

1. Footing drainage system.
2. Elevator pit drainage system

1.3 SUBMITTALS

A. Product data for each type of foundation drainage material required.

B. Shop drawings for interfacing with total site drainage system.

C. Certification signed by Contractor and foundation drainage system Installer that installed materials conform to requirements and system was successfully checked and tested prior to covering with filter fabric and drainage fill.

PART 2 - PRODUCTS

2.1 DRAINAGE PIPE AND FITTINGS

A. Provide drainage pipes complete with bends, reducers, adapters, couplings, collars, and joint materials.

1. Perforated Polyvinyl Chloride Pipe: ASTM D 2729.
2. Perforated Polyethylene Pipe: ASTM F405.

2.2 SOIL & MISCELLANEOUS MATERIALS

A. General: Bedding, backfill, and porous fill materials are indicated in Section 31 2000, Earthwork.

B. Filter Fabric: Manufacturer’s standard non-woven geotextile fabric of polypropylene or polyester fibers, or a combination thereof.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine adjacent surfaces to receive foundation drainage system to verify suitability. Do not begin installation until subsurface conditions are satisfactory to accept drainage system.

3.2 INSTALLATION

A. Inspect pipe trench for line, level (or slope as required) and pipe support conditions.

B. Laying Drainpipe: Lay drain pipe solidly bedded. Provide full bearing for each pipe section throughout its length to true grades and alignment, and continuos slope in direction of flow.

1. Lay perforated pipe with perforations down and joints tightly closed in accordance with pipe manufacturer's recommendations. Provide collars and couplings as required.
2. Provide recesses in excavation bottom to receive bells for drainpipe having bell and spigot ends. Lay pipe with bells facing up slope and with spigot end entered fully into adjacent bell. Seal joint in accordance with requirements of local building official.

C. Testing Drain Lines: Test and check lines before backfilling to assure free flow. Remove obstructions, replace damaged components, and retest system until satisfactory.

D. Drainage Fill: Place drainage fill (material indicated in Section 02300) over drain lines after satisfactory testing. Completely cover drain lines to a width of at least 6 inches on each side and above top of pipe to within 12 inches of finish grade. Place fill material in layers not exceeding 3 inches in loose depth and compact each layer placed.

1. Overlay drainage fill material with one layer of filter fabric, overlapping edges at least 4 inches.

E. Fill to Grade: Install fill material over compacted drainage fill at footing drains, placing material in layers not exceeding 6 inches in loose depth and thoroughly compacting each layer, as indicated in Section 02300.

END OF SECTION 334613