STATE OF DELAWARE
OMB / DIVISION OF FACILITIES MANAGEMENT
OMB / DFM CONTRACT #MJ1002000071

SPECIFICATIONS
FOR

LEGISLATIVE HALL PARKING GARAGE

AT

MARTIN LUTHER KING JR BLVD SOUTH &
EAST WATER STREET
DOVER, DE 19901

PREPARED
BY

STUDIO JAED ARCHITECTS AND ENGINEERS
2500 WRANGLE HILL ROAD, BEAR, DE 19701
STUDIOJAED PROJECT #23094

ISSUED FOR BID
APRIL 25, 2025

NOT FOR BIDDING

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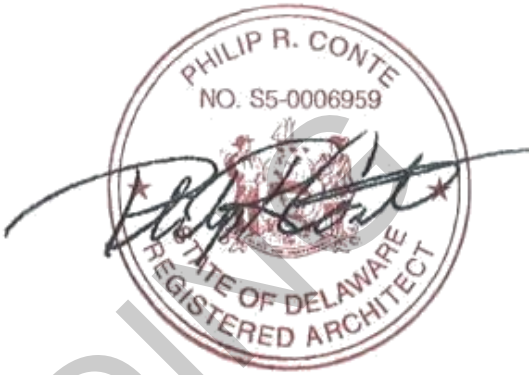
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SEALS PAGE

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(302) 832-1652
RESPONSIBLE FOR DIV. 00 THROUGH DIV. 49
EXCEPT WHERE INDICATED AS PREPARED BY OTHER
DESIGN PROFESSIONALS OF RECORD



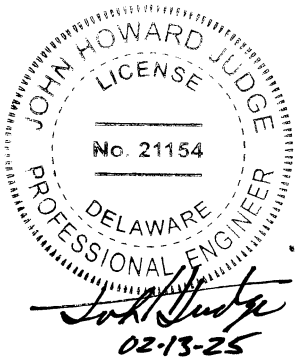
CIVIL ENGINEER:

ALEXANDER E. SCHMIDT, P.E.
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VICE PRESIDENT
CENTURY ENGINEERING, A KLEINFELDER COMPANY
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DOVER, DE, 19901
(302) 738-9188
RESPONSIBLE FOR DIV. 31 THRU DIV. 33



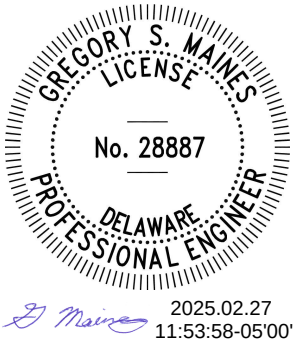
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MCLEAN, VA 22102
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DE LICENSE NO. 28887
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BALTIMORE, MD 21227
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NOT FOR BIDDING

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STUDIO JAED ARCHITECTS & ENGINEERS
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(302) 832-1652
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ELECTRICAL ENGINEER
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BEAR, DE 19701
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RESPONSIBLE FOR DIV. 26 THRU DIV. 28.

END OF SECTION

NOT FOR BIDDING

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INVITATION TO BID

Sealed bids for **OMB/DFM Contract No. MJ1002000071 – Legislative Hall – Legislative Hall Parking Garage** will be received by the State of Delaware, Office of Management and Budget, Division of Facilities Management, by way of the Bonfire Portal at https://DFM.bonfirehub.com until **1:00 PM local time on November 06, 2025**. Bidder bears the risk of late submission.

Bids will be opened and read aloud at 2:00 p.m. local time on November 06, 2025 at the Haslet Armory, 122 Martin Luther King Blvd. S., Dover, DE 19901.

The project consists of the Construction of a new 3-story, 124,800 square foot parking garage, at the corner of East Water Street and Martin Luther King Jr. Blvd. South in Dover, Delaware. The scope of work includes all Civil, Structural, Architectural, Mechanical, Electrical, Plumbing, and Fire Protection Systems as indicated in the Bid Documents.

A **MANDATORY** Pre-Bid Meeting will be held on **October 08, 2025, at 10:00 AM** at the Haslet Armory Building, 122 Martin Luther King Jr. Blvd. South, Dover, DE 19901 for the purpose of establishing the list of subcontractors and to answer questions. Upon arrival, attendees are to check in at front desk for directions to pre-bid meeting room. A site walkthrough will take place immediately following the pre-bid meeting. Representatives of each party to any Joint Venture must attend this meeting. **ATTENDANCE OF THIS MEETING IS A PREREQUISITE FOR BIDDING ON THIS CONTRACT.**

Contract documents may be obtained at Reprographics Center, Inc., 298 Churchmans Road, New Castle, DE 19720, phone (302) 328-5019 upon receipt of $75.00 per electronic set, non-refundable. Checks are to be made payable to “StudioJAED”.

Bidders will not be subject to discrimination on the basis of race, creed, color, sex, sexual orientation, gender identity or national origin in consideration of this award, and Minority Business Enterprises, Disadvantaged Business Enterprises, Women-Owned Business Enterprises and Veteran-Owned Business Enterprises will be afforded full opportunity to submit bids on this contract. Each bid must be accompanied by a bid security equivalent to ten percent of the bid amount and all additive alternates. The successful bidder must post a performance bond and payment bond in a sum equal to 100 percent of the contract price upon execution of the contract. The Owner reserves the right to reject any or all bids and to waive any informalities therein. The Owner may extend the time and place for the opening of the bids from that described in the advertisement, with not less than two calendar days’ notice by certified delivery, facsimile machine or other electronic means to those bidders receiving plans.

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INSTRUCTIONS TO BIDDERS

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ARTICLE 1: GENERAL

1.1 DEFINITIONS

1.1.1 Whenever the following terms are used, their intent and meaning shall be interpreted as follows:

1.2 STATE: The State of Delaware.

1.3 AGENCY: Contracting State Agency as noted on cover sheet.

1.4 DESIGNATED OFFICIAL: The agent authorized to act for the Agency.

1.5 BIDDING DOCUMENTS: Bidding Documents include the Bidding Requirements and the proposed Contract Documents. The Bidding Requirements consist of the Advertisement for Bid, Invitation to Bid, Instructions to Bidders, Supplementary Instructions to Bidders (if any), General Conditions, Supplementary General Conditions, General Requirements, Special Provisions (if any), the Bid Form (including the Non-collusion Statement), and other sample bidding and contract forms. The proposed Contract Documents consist of the form of Agreement between the Owner and Contractor, as well as the Drawings, Specifications (Project Manual) and all Addenda issued prior to execution of the Contract.

1.6 CONTRACT DOCUMENTS: The Contract Documents consist of the, Instructions to Bidders, Supplementary Instructions to Bidders (if any), General Conditions, Supplementary General Conditions, General Requirements, Special Provisions (if any), the form of agreement between the Owner and the Contractor, Drawings (if any), Specifications (Project Manual), and all addenda.

1.7 AGREEMENT: The form of the Agreement shall be AIA Document A101, Standard Form of Agreement between Owner and Contractor where the basis of payment is a STIPULATED SUM. In the case of conflict between the instructions contained therein and the General Requirements herein, these General Requirements shall prevail.

1.8 GENERAL REQUIREMENTS (or CONDITIONS): General Requirements (or conditions) are instructions pertaining to the Bidding Documents and to contracts in general. They contain, in summary, requirements of laws of the State; policies of the Agency and instructions to bidders.

1.9 SPECIAL PROVISIONS: Special Provisions are specific conditions or requirements peculiar to the bidding documents and to the contract under consideration and are supplemental to the General Requirements. Should the Special Provisions conflict with the General Requirements, the Special Provisions shall prevail.

1.10 ADDENDA: Written or graphic instruments issued by the Owner/Architect prior to the execution of the contract which modify or interpret the Bidding Documents by additions, deletions, clarifications or corrections.

1.11 BIDDER OR VENDOR: A person or entity who formally submits a Bid for the material or Work contemplated, acting directly or through a duly authorized representative who meets the requirements set forth in the Bidding Documents.

1.12 SUB-BIDDER: A person or entity who submits a Bid to a Bidder for materials or labor, or both for a portion of the Work.

1.13 BID: A complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

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1.14 BASE BID: The sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents as the base, to which Work may be added or from which Work may be deleted for sums stated in Alternate Bids (if any are required to be stated in the bid).

1.15 ALTERNATE BID (or ALTERNATE): An amount stated in the Bid, where applicable, to be added to or deducted from the amount of the Base Bid if the corresponding change in the Work, as described in the Bidding Documents is accepted.

1.16 UNIT PRICE: An amount stated in the Bid, where applicable, as a price per unit of measurement for materials, equipment or services or a portion of the Work as described in the Bidding Documents.

1.17 SURETY: The corporate body which is bound with and for the Contract, or which is liable, and which engages to be responsible for the Contractor's payments of all debts pertaining to and for his acceptable performance of the Work for which he has contracted.

1.18 BIDDER'S DEPOSIT: The security designated in the Bid to be furnished by the Bidder as a guaranty of good faith to enter into a contract with the Agency if the Work to be performed or the material or equipment to be furnished is awarded to him.

1.19 CONTRACT: The written agreement covering the furnishing and delivery of material or work to be performed.

1.20 CONTRACTOR: Any individual, firm or corporation with whom a contract is made by the Agency.

1.21 SUBCONTRACTOR: An individual, partnership or corporation which has a direct contract with a contractor to furnish labor and materials at the job site, or to perform construction labor and furnish material in connection with such labor at the job site.

1.22 CONTRACT BOND: The approved form of security furnished by the contractor and his surety as a guaranty of good faith on the part of the contractor to execute the work in accordance with the terms of the contract.

1.23 CUSTOM FABRICATION: As defined in 29 Del. C. § 6902, the term “custom fabrication” means the offsite fabrication, assembly, or other production of non-standard goods or materials, including components, fixtures or parts thereof, specifically for a public works project. Such goods and materials shall include those used in the following trades or systems: (1) Plumbing or pipe fitting systems, including heating, ventilating, air-conditioning, refrigeration systems, sheet metal or other duct systems; (2) Electrical systems; (3) Mechanical insulation work; (4) Ornamental iron work; and (5) Commercial signage that does not attempt or appear to direct the movement of traffic on highways or roadways or interfere with, imitate, or resemble any official traffic sign, signal or device.

ARTICLE 2: BIDDER'S REPRESENTATION

2.1 PRE-BID MEETING

2.1.1 A pre-bid meeting for this project will be held at the time and place designated. Attendance at this meeting is a pre-requisite for submitting a Bid, unless this requirement is specifically waived elsewhere in the Bid Documents.

2.2 By submitting a Bid, the Bidder represents that:

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2.2.1 The Bidder has read and understands the Bidding Documents and that the Bid is made in accordance therewith.

2.2.2 The Bidder has visited the site, become familiar with existing conditions under which the Work is to be performed, and has correlated the Bidder's personal observations with the requirements of the proposed Contract Documents.

2.2.3 The Bid is based upon the materials, equipment, and systems required by the Bidding Documents without exception.

2.2.4 Bidder has accounted for the possibility of price increases due to the direct and indirect effect of tariffs, other international events, inflation, and supply chain interruptions. Change Orders will be denied if they are based upon any of these events. Bidder is expected to account for these possibilities and include them in the bid.

2.3 JOINT VENTURE REQUIREMENTS

2.3.1 For Public Works Contracts, each Joint Venturer shall be qualified and capable to complete the Work with their own forces.

2.3.2 Included with the Bid submission, and as a requirement to bid, a copy of the executed Joint Venture Agreement shall be submitted and signed by all Joint Venturers involved.

2.3.3 All required Bid Bonds, Performance Bonds, Material and Labor Payment Bonds must be executed by both Joint Venturers and be placed in both of their names.

2.3.4 All required insurance certificates shall name both Joint Venturers.

2.3.5 Both Joint Venturers shall sign the Bid Form.

2.3.6 Both Joint Venturers shall include their Federal E.I. Number with the Bid.

2.3.7 In the event of a mandatory Pre-bid Meeting, each Joint Venturer shall have a representative in attendance.

2.3.8 Due to exceptional circumstances and for good cause shown, one or more of these provisions may be waived at the discretion of the State.

2.4 ASSIGNMENT OF ANTITRUST CLAIMS

2.4.1 As consideration for the award and execution by the Owner of this contract, the Contractor hereby grants, conveys, sells, assigns and transfers to the State of Delaware all of its right, title and interests in and to all known or unknown causes of action it presently has or may now or hereafter acquire under the antitrust laws of the United States and the State of Delaware, relating to the particular goods or services purchased or acquired by the Owner pursuant to this contract.

ARTICLE 3: BIDDING DOCUMENTS

3.1 COPIES OF BID DOCUMENTS

3.1.1 Bidders may obtain complete sets of the Bidding Documents from the Architectural/Engineering firm designated in the Advertisement or Invitation to Bid in the number and for the deposit sum, if any, stated therein.

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3.1.2 Bidders shall use complete sets of Bidding Documents for preparation of Bids. The issuing Agency nor the Architect assumes no responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

3.1.3 Any errors, inconsistencies or omissions discovered shall be reported to the Architect immediately.

3.1.4 The Agency and Architect may make copies of the Bidding Documents available on the above terms for the purpose of obtaining Bids on the Work. No license or grant of use is conferred by issuance of copies of the Bidding Documents.

3.2 INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS

3.2.1 The Bidder shall carefully study and compare the Bidding Documents with each other, and with other work being bid concurrently or presently under construction to the extent that it relates to the Work for which the Bid is submitted, shall examine the site and local conditions, and shall report any errors, inconsistencies, or ambiguities discovered to the Architect.

3.2.2 Bidders or Sub-bidders requiring clarification or interpretation of the Bidding Documents shall make a written request to the Architect at least seven days prior to the date for receipt of Bids. Interpretations, corrections and changes to the Bidding Documents will be made by written Addendum. Interpretations, corrections, or changes to the Bidding Documents made in any other manner shall not be binding.

3.2.3 The apparent silence of the specifications as to any detail, or the apparent omission from it of detailed description concerning any point, shall be regarded as meaning that only the best commercial practice is to prevail and only material and workmanship of the first quality are to be used. Proof of specification compliance will be the responsibility of the Bidder.

3.2.4 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for all permits, labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for the proper execution and completion of the Work.

3.2.5 The Owner will bear the costs for all impact and user fees associated with the project.

3.3 SUBSTITUTIONS

3.3.1 The materials, products and equipment described in the Bidding Documents establish a standard of quality, required function, dimension, and appearance to be met by any proposed substitution. The specification of a particular manufacturer or model number is not intended to be proprietary in any way. Substitutions of products for those named will be considered, providing that the Vendor certifies that the function, quality, and performance characteristics of the material offered is equal or superior to that specified. It shall be the Bidder's responsibility to assure that the proposed substitution will not affect the intent of the design, and to make any installation modifications required to accommodate the substitution.

3.3.2 Requests for substitutions shall be made in writing to the Architect at least ten days prior to the date of the Bid Opening. Such requests shall include a complete description of the proposed substitution, drawings, performance and test data, explanation of required installation modifications due the substitution, and any other information necessary for an evaluation. The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect’s decision of approval or disapproval shall be final. The Architect is to notify Owner prior to any approvals.

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3.3.3 If the Architect approves a substitution prior to the receipt of Bids, such approval shall be set forth in an Addendum. Approvals made in any other manner shall not be binding.

3.3.4 The Architect shall have no obligation to consider any substitutions after the Contract award.

3.4 ADDENDA

3.4.1 Addenda will be mailed or delivered to all who are known by the Architect to have received a complete set of the Bidding Documents.

3.4.2 Copies of Addenda will be made available for inspection wherever Bidding Documents are on file for that purpose.

3.4.3 No Addenda will be issued later than 2 calendar days prior to the date for receipt of Bids except an Addendum withdrawing the request for Bids or one which extends the time or changes the location for the opening of bids.

3.4.4 Each bidder shall ascertain prior to submitting his Bid that they have received all Addenda issued, and shall acknowledge their receipt in their Bid in the appropriate space. Not acknowledging an issued Addenda could be grounds for determining a bid to be non-responsive.

ARTICLE 4: BIDDING PROCEDURES

4.1 PREPARATION OF BIDS

4.1.1 Submit the bids on the Bid Forms included with the Bidding Documents.

4.1.2 Submit the original Bid Form for each bid. Bid Forms may be removed from the project manual for this purpose.

4.1.3 Execute all blanks on the Bid Form.

4.1.4 Where so indicated by the makeup on the Bid Form, express sums in both words and figures, in case of discrepancy between the two, the written amount shall govern.

4.1.5 BID ALL REQUESTED ALTERNATES AND UNIT PRICES, IF ANY. If there is no change in the Base Bid for an Alternate, enter “No Change”. The Contractor is responsible for verifying that they have received all addenda issued during the bidding period. Work required by Addenda shall automatically become part of the Contract.

4.1.6 Make no additional stipulations on the Bid Form and do not qualify the Bid in any other manner.

4.1.7 Each copy of the Bid shall include the legal name of the Bidder and a statement whether the Bidder is a sole proprietor, a partnership, a corporation, or any legal entity, and each copy shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further give the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current Power of Attorney attached, certifying agent's authority to bind the Bidder.

4.1.8 Bidder shall complete the Non-Collusion Statement form included with the Bid Forms and include it with their Bid.

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4.1.9 In the construction of all Public Works projects for the State of Delaware or any agency thereof, preference in employment of laborers, workers or mechanics shall be given to bona fide legal citizens of the State who have established citizenship by residence of at least 90 days in the State.

4.1.10 Each bidder shall include a signed Affidavit for the Bidder certifying compliance with OMB Regulation 4104 - "Regulations for the Drug Testing of Contractor and Subcontractor Employees Working on "Large Public Works Projects." "Large Public Works" is based upon the current threshold required for bidding Public Works as set by the Purchasing and Contracting Advisory Council.

4.2 BID SECURITY

4.2.1 All bids shall be accompanied by a deposit of either a good and sufficient bond to the agency for the benefit of the agency, with corporate surety authorized to do business in this State, the form of the bond and the surety to be approved by the agency, or a security of the bidder assigned to the agency, for a sum equal to at least 10% of the bid plus all add alternates, or in lieu of the bid bond a security deposit in the form of a certified check, bank treasurer's check, cashier's check, money order, or other prior approved secured deposit assigned to the State. The bid bond need not be for a specific sum, but may be stated to be for a sum equal to 10% of the bid plus all add alternates to which it relates and not to exceed a certain stated sum, if said sum is equal to at least 10% of the bid. The Bid Bond form used shall be the standard OMB form (attached). The bid bond may be an electronic bond and need not be transmitted as a paper document.

4.2.2 The Agency has the right to retain the bid security of Bidders to whom an award is being considered until either a formal contract has been executed and bonds have been furnished or the specified time has elapsed so the Bids may be withdrawn or all Bids have been rejected.

4.2.3 In the event of any successful Bidder refusing or neglecting to execute a formal contract and bond within 20 days of the awarding of the contract, the bid bond or security deposited by the successful bidder shall be forfeited.

4.3 SUBCONTRACTOR LIST

4.3.1 In accordance with Title 29, Chapter 69, Section 6962(d)(10)b of the Delaware Code, each Bidder shall submit with their Bid a completed List of Sub-Contractors included with the Bid Form. NAME ONLY ONE SUBCONTRACTOR FOR EACH TRADE. The bidder must list **in each category** the full name and address (City & State) of the sub-contractor that the Bidder will be using to perform the work and provide material for that subcontractor category. Should the Bidder's listed subcontractor intend to provide any of their subcontractor category of work through a third-tier contractor, the Bidder shall list that third-tier contractor's full name and address (City & State). **If the Bidder intends to perform any category of work itself, it must list its full name and address.** For clarification, if the Bidder intends to perform the work themselves, the Bidder **may not** insert "not applicable", "N/A", "self" or anything other than its own full name and address (City & State). To do so shall cause the bid to be rejected. In addition, the failure to produce a completed subcontractor list with the bid submittal shall cause the bid to be rejected. If you have more than three (3) third-tier contractors to report in any subcontractor category, print out additional page(s) containing the appropriate category, complete the rest of your list of third-tier contractors for that category, notate the addition in parentheses as (CONTINUATION) next to the subcontractor category and an asterisk (*) next to any additional third-tier contractors, and submit it with your bid.

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4.3.2 It is the responsibility of the Contractor to ensure that their Subcontractors are in compliance with the provisions of this law. Also, if a Contractor elects to list themselves as a Subcontractor for any category, they must specifically name themselves on the Bid Form and be able to document their capability to act as Subcontractor in that category in accordance with this law.

4.4 AFFIDAVIT OF CONTRACTOR QUALIFICATIONS

4.4.1 In accordance with Title 29, Chapter 69, Section 6962(d)(10)b.3 of the Delaware Code, each Bidder shall submit with their Bid the Affidavit of Contractor Qualifications certifying that the Bidder will abide by the contractor's qualifications outlined in the construction bid specifications for the duration of the contract term. After a contract has been awarded the successful bidder shall not substitute another subcontractor whose name was submitted on the Subcontractor Form except for the reasons in the statute and not without written consent from the awarding agency. Failure to utilize the subcontractors on the list will subject the successful bidder to penalties as outlined in the General Requirements Section 5.2 of the contract.

4.5 AFFIDAVIT OF CRAFT TRAINING COMPLIANCE

4.5.1 In accordance with Title 29, Chapter 69, Section 6962(c)(13) of the Delaware Code, contractors and subcontractors must provide craft training for journeyman and apprentice levels if **all** of the following apply:

A. A project meets the prevailing wage requirement under Title 29, Chapter 69, Section 6960 of the Delaware Code.
B. The contractor employs 10 or more total employees.
C. The project is not a federal highway project

Failure to provide required craft training on the project may subject the successful contractor and/or subcontractor(s) to penalties as outlined in Title 29, Chapter 69, Section 6962(c)(13) of the Delaware Code.

Bidders shall submit the Affidavit of Craft Training Compliance prior to contract execution.

4.6 EQUALITY OF EMPLOYMENT OPPORTUNITY ON PUBLIC WORKS

4.6.1 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, creed, sex, color, sexual orientation, gender identity or national origin. The Contractor will take affirmative action to ensure the applicants are employed, and that employees are treated during employment, without regard to their race, creed, sex, color, sexual orientation, gender identity or national origin. Such action shall include, but not be limited to, the following: Employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places available to employees and applicants for employment notices to be provided by the contracting agency setting forth this nondiscrimination clause.

B. The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, creed, sex, color, sexual orientation, gender identity or national origin."

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4.7 PREVAILING WAGE REQUIREMENT

4.7.1 Wage Provisions: For renovation and new construction projects whose costs exceed the thresholds contained in Delaware Code, Title 29, Section 6960, the minimum wage rates for various classes of laborers and mechanics shall be as determined by the Department of Labor, Division of Industrial Affairs of the State of Delaware.

4.7.2 The employer shall pay all mechanics and labors employed directly upon the site of work, or engaged in custom fabrication work, as that term is defined in Article 1.23 herein and as also as defined in 29 Del. C § 6902 and described in 29 Del. C. § 6960(b), regardless of where the work is performed, unconditionally and not less often than once a week and without subsequent deduction or rebate on any account, the full amounts accrued at time of payment, computed at wage rates not less than those stated in the specifications, regardless of any contractual relationship which may be alleged to exist between the employer and such laborers and mechanics.

4.7.3 As per 29 Del. C. § 6960(b), the scale of the wages to be paid must be posted by the employer in a prominent and easily accessible place at the site of the work. There may be withheld from the employer so much of accrued payments as may be considered necessary by the Department of Labor to pay laborers and mechanics employed by the employer the difference between the rates of wages required by the contract to be paid laborers and mechanics on the work and rates of wages received by such laborers and mechanics to be remitted to the Department of Labor for distribution upon resolution of any claims.

4.7.4 Every contract based upon these specifications shall contain a stipulation that sworn payroll information, as required by the Department of Labor, be furnished weekly. The Department of Labor shall keep and maintain the sworn payroll information for a period of 6 months from the last day of the work week covered by the payroll.

4.8 SUBMISSION OF BIDS

4.8.1 Enclose the Bid, the Bid Security, and any other documents required to be submitted with the Bid.

4.8.2 Deposit Bids at the designated location prior to the time and date for receipt of bids indicated in the Advertisement for Bids. Bids received after the time and date for receipt of bids will be marked “LATE BID” and returned.

4.8.3 Bidder assumes full responsibility for timely delivery at location designated for receipt of bids.

4.8.4 Oral, telephonic, paper or telegraphic bids are invalid and will not receive consideration.

4.8.5 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids, provided that they are then fully in compliance with these Instructions to Bidders.

4.8.6 Compliance with Federal Bureau of Investigation rules mandates training for Contractors, Subcontractors, their employees, and custodial workers with access to locations that have access to Criminal Justice Information Services (CJIS). The contract awardee must have fingerprinting and background checks done for all Subcontractors and employees.

4.9 MODIFICATION OR WITHDRAW OF BIDS

4.9.1 Prior to the closing date for receipt of Bids, a Bidder may withdraw a Bid by personal request and by showing proper identification to the Architect. A request for withdraw by letter or fax, if the Architect is notified in writing prior to receipt of fax, is acceptable. A fax directing a

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modification in the bid price will render the Bid informal, causing it to be ineligible for consideration of award. Telephone directives for modification of the bid price shall not be permitted and will have no bearing on the submitted proposal in any manner.

4.9.2 Bidders submitting Bids that are late shall be notified as soon as practicable and the bid shall be returned.

4.9.3 A Bid may not be modified, withdrawn or canceled by the Bidder during a thirty (30) day period following the time and date designated for the receipt and opening of Bids, and Bidder so agrees in submitting their Bid. Bids shall be binding for 30 days after the date of the Bid opening.

ARTICLE 5: CONSIDERATION OF BIDS

5.1 OPENING/REJECTION OF BIDS

5.1.1 Unless otherwise stated, Bids received on time will be publicly opened and will be read aloud. An abstract of the Bids will be made available to Bidders.

5.1.2 The Agency shall have the right to reject any and all Bids. A Bid not accompanied by a required Bid Security or by other data required by the Bidding Documents, or a Bid which is in any way incomplete or irregular is subject to rejection.

5.1.3 If the Bids are rejected, it will be done within thirty (30) calendar days of the Bid opening.

5.2 COMPARISON OF BIDS

5.2.1 After the Bids have been opened and read, the bid prices will be compared and the result of such comparisons will be made available to the public. Comparisons of the Bids may be based on the Base Bid plus desired Alternates. The Agency shall have the right to accept Alternates in any order or combination.

5.2.2 The Agency reserves the right to waive technicalities, to reject any or all Bids, or any portion thereof, to advertise for new Bids, to proceed to do the Work otherwise, or to abandon the Work, if in the judgment of the Agency or its agent(s), it is in the best interest of the State.

5.2.3 An increase or decrease in the quantity for any item is not sufficient grounds for an increase or decrease in the Unit Price.

5.2.4 The prices quoted are to be those for which the material will be furnished F.O.B. Job Site and include all charges that may be imposed during the period of the Contract.

5.2.5 No qualifying letter or statements in or attached to the Bid, or separate discounts will be considered in determining the low Bid except as may be otherwise herein noted. Cash or separate discounts should be computed and incorporated into Unit Bid Price(s).

5.2.6 Bidder must account for the possibility of price increases due to the direct and indirect effect of tariffs or other international events, inflation, and supply chain interruptions. Change Orders will be denied if they are based upon any of these events. Bidder is expected to account for these possibilities and include them in the bid.

5.3 DISQUALIFICATION OF BIDDERS

5.3.1 An agency shall determine that each Bidder on any Public Works Contract is responsible before awarding the Contract. Factors to be considered in determining the responsibility of a Bidder include:

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A. The Bidder's financial, physical, personnel or other resources including Subcontracts;

B. The Bidder's record of performance on past public or private construction projects, including, but not limited to, defaults and/or final adjudication or admission of violations of the Prevailing Wage Laws in Delaware or any other state;

C. The Bidder's written safety plan;

D. Whether the Bidder is qualified legally to contract with the State;

E. Whether the Bidder supplied all necessary information concerning its responsibility; and,

F. Any other specific criteria for a particular procurement, which an agency may establish; provided however, that, the criteria be set forth in the Invitation to Bid and is otherwise in conformity with State and/or Federal law.

G. Any Bidder who is debarred in another State and/or by the United States Government is also debarred in Delaware.

5.3.2 If an agency determines that a Bidder is nonresponsive and/or nonresponsible, the determination shall be in writing and set forth the basis for the determination. A copy of the determination shall be sent to the affected Bidder within five (5) working days of said determination.

5.3.3 In addition, any one or more of the following causes may be considered as sufficient for the disqualification of a Bidder and the rejection of their Bid or Bids.

5.3.3.1 More than one Bid for the same Contract from an individual, firm or corporation under the same or different names.

5.3.3.2 Evidence of collusion among Bidders.

5.3.3.3 Unsatisfactory performance record as evidenced by past experience.

5.3.3.4 If the Unit Prices are obviously unbalanced either in excess or below reasonable cost analysis values.

5.3.3.5 If there are any unauthorized additions, interlineation, conditional or alternate bids or irregularities of any kind which may tend to make the Bid incomplete, indefinite or ambiguous as to its meaning.

5.3.3.6 If the Bid is not accompanied by the required Bid Security and other data required by the Bidding Documents.

5.3.3.7 If any exceptions or qualifications of the Bid are noted on the Bid Form.

5.4 ACCEPTANCE OF BID AND AWARD OF CONTRACT

5.4.1 A formal Contract shall be executed with the successful Bidder within twenty (20) calendar days after the award of the Contract.

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5.4.2 Per Section 6962(d)(13)a., Title 29, Delaware Code, "The contracting agency shall award any public works contract within thirty (30) days of the bid opening to the lowest responsive and responsible Bidder, unless the Agency elects to award on the basis of best value, in which case the election to award on the basis of best value shall be stated in the Invitation To Bid. Any public school district and its board shall award public works contracts in accordance with this section's requirements except it shall award the contract within 60 days of the bid opening."

5.4.3 Each Bid on any Public Works Contract must be deemed responsive by the Agency to be considered for award. A responsive Bid shall conform in all material respects to the requirements and criteria set forth in the Contract Documents and specifications.

5.4.4 The Agency shall have the right to accept Alternates in any order or combination, and to determine the low Bidder on the basis of the sum of the Base Bid, plus accepted Alternates.

5.4.5 The successful Bidder shall execute a formal contract, submit the required Insurance Certificate, and furnish good and sufficient bonds, unless specifically waived in the General Requirements, in accordance with the General Requirement, within twenty (20) days of official notice of contract award. The successful Bidder shall provide, at least two business days prior to contract execution, copies of the Employee Drug Testing Program for the Bidder and all listed Subcontractors. Bonds shall be for the benefit of the Agency with surety in the amount of 100% of the total contract award. Said Bonds shall be conditioned upon the faithful performance of the contract. Bonds shall remain in affect for period of two (2) years after the date of the Certificate of Final Payment.

5.4.6 If the successful Bidder fails to execute the required Contract, Bond and all required information, as aforesaid, within twenty (20) calendar days after the date of official Notice of the Award of the Contract, their Bid guaranty shall immediately be taken and become the property of the State for the benefit of the Agency as liquidated damages, and not as a forfeiture or as a penalty. Award will then be made to the next lowest qualified Bidder of the Work or readvertised, as the Agency may decide.

5.4.7 Each bidder shall supply with its bid its taxpayer identification number (i.e., federal employer identification number or social security number) and should the vendor be awarded a contract, such vendor shall provide to the agency the taxpayer identification license numbers of such subcontractors. Such numbers shall be provided on the later of the date on which such subcontractor is required to be identified or the time the contract is executed. The successful Bidder shall provide to the agency to which it is contracting, within 30 days of entering into such public works contract, copies of all Delaware Business licenses of subcontractors and/or independent contractors that will perform work for such public works contract. However, if a subcontractor or independent contractor is hired or contracted more than 20 days after the Bidder entered the public works contract the Delaware Business license of such subcontractor or independent contractor shall be provided to the agency within 10 days of being contracted or hired.

5.4.8 The Bid Security shall be returned to the successful Bidder upon the execution of the formal contract. The Bid Securities of unsuccessful bidders shall be returned within thirty (30) calendar days after the opening of the Bids.

ARTICLE 6: POST-BID INFORMATION

6.1 CONTRACTOR'S QUALIFICATION STATEMENT

6.1.1 Bidders to whom an award of a Contract is under consideration shall, if requested by the Agency, submit a properly executed AIA Document A305, Contractor's Qualification Statement, unless such a statement has been previously required and submitted.

NOT FOR BIDDING

6.2 Bidders to whom an award of a Contract has been made must produce their Delaware Business License before the Contract can be executed.

ARTICLE 7: PERFORMANCE BOND AND PAYMENT BOND

7.1 BOND REQUIREMENTS

7.1.1 The cost of furnishing the required Bonds, that are stipulated in the Bidding Documents, shall be included in the Bid.

7.1.2 If the Bidder is required by the Agency to secure a bond from other than the Bidder's usual sources, changes in cost will be adjusted as provide in the Contract Documents.

7.1.3 The Performance and Payment Bond forms used shall be the standard OMB forms (attached).

7.2 TIME OF DELIVERY AND FORM OF BONDS

7.2.1 The bonds shall be dated on or after the date of the Contract.

7.2.2 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix a certified and current copy of the power of attorney.

7.2.3 The Performance Bond and/or the Payment Bond may be electronic bonds and need not be transmitted as paper documents.

ARTICLE 8: FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

8.1 Unless otherwise required in the Bidding Documents, the Agreement for the Work will be written on AIA Document A101, Standard Form of Agreement Between Owner and Contractor Where the Basis of Payment is a Stipulated Sum.

END OF SECTION

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SECTION 00 31 00

AVAILABLE PROJECT INFORMATION

PART 1 GENERAL

1.01 EXISTING CONDITIONS

A. Certain information relating to existing surface and subsurface conditions and structures is available to bidders, as follows:
   1. Geo-technical Report: dated March 19, 2025 (Verdantas Project # 30180).

B. Geotechnical Report: Entitled Proposed 3 Story Parking Garage for Legislative Hall Dover, Delaware., dated 3/21/24..
   1. A copy of the report is included as part of the bid documents.
   2. This report identifies properties of below grade conditions and offers recommendations for the design of foundations, prepared primarily for the use of Architect.
   3. The recommendations described shall not be construed as a requirement of this Contract, unless specifically referenced in the Contract Documents.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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5400 Limestone Road
Wilmington, Delaware 19808
+1 302-239-6634

March 19, 2025

Mr. Robert Purnell
State of Delaware
Division of Facilities Management
122 Martin Luther King Blvd South, 2nd Floor
Dover, DE 19901

RE: Limited Geotechnical Evaluation
Legislative Hall Parking Garage
Martin Luther King Jr. Blvd and E. Water Street
Dover, Delaware
Verdantas Project No. 30180

Dear Mr. Purnell:

Verdantas LLC (Verdantas) has completed the limited geotechnical evaluation for the proposed Legislative Hall Parking Garage, located at the corner of Martin Luther King Jr. Boulevard and East Water Street in Dover, Delaware. The following report pertains specifically to the supplemental field testing conducted to reevaluate the seismic site class and monitor the groundwater levels at the proposed location of the parking garage along with the proposed tunnel connecting the parking garage with an addition to Legislative Hall. These services were performed in general accordance with the scope of work provided in the proposal for Project No. 30180, dated November 1, 2024, and authorized on November 14, 2024 with State of Delaware Purchase Order No. 718952.

Verdantas referenced the following documents to aid in our evaluation:

- A report titled "Geotechnical Investigation Report, Proposed 3 Story Parking Garage for Legislative Hall Dover, Delaware," prepared by Century Engineering, dated March 21, 2024; and
- A set of drawings titled “Legislative Hall Parking Garage, 60%/99% Final Design,” prepared by StudioJAED, dated June 30, 2024.

We understand that the project consists of the construction of a three-story parking garage with a tunnel to connect the garage to a future addition to Legislative Hall. The parking garage is proposed to cover a footprint of 41,600 square feet and provide 344 parking spaces. The existing site consists of a surficial parking lot, driveways, and landscaped areas and is generally sloping towards the southeast direction with ground surface elevations ranging from +20.0 to +8.0 feet (project datum).

A previous subsurface investigation was conducted by Century Engineering that was presented in the above-mentioned report. An additional subsurface investigation was performed by Verdantas as part of limited environmental and geotechnical services to evaluate the presence of environmentally impacted media within the Legislative Hall Parking Garage and Addition project sites and to supplement the geotechnical data that is currently available. The data obtained from the geotechnical investigation for the parking garage site along with design recommendations are presented in the following sections. The results of the limited geotechnical investigation for the building addition (Verdantas Project No. 30054) and the limited environmental evaluations will be summarized in separate reports.

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1. Field and Laboratory Testing

1.1 Previous Evaluations

Century Engineering performed an evaluation to assist in the design of the three-story parking garage. The evaluation is based on a subsurface investigation conducted in December 2023. Six (6) Standard Penetration Test (SPT) borings were performed by John D. Hynes & Associates as a subcontractor to Century Engineering. Five borings extended to depths of 30 feet below the existing ground surface. A sixth boring extended to a depth of 100 feet. The geotechnical evaluation report by Century Engineering is included in **Appendix E** for reference.

According to the Century Engineering evaluation, beneath the surficial cover, which consisted of 6 to 8 inches of asphalt followed by 5 to 8 inches of subbase stone, the soil primarily consisted of sand with varying amounts of fines and interbedded with clay and silt at different locations. The sand varied in density from very loose to dense. Groundwater was observed to be at depths ranging from 6 to 13 feet, averaging 10.8 feet below the ground surface.

Century Engineering assigned a seismic site class E to the site based on the data obtained from a 100-foot deep boring.

1.2 Field Program

Between December 18 and December 21, 2024, two (2) SPT borings were performed (in general accordance with ASTM D 1586). The borings (designated TB-3 and TB-4) were located at the project site as shown in **Appendix A-2** extended to a depth of 26 feet below existing ground surface. One permanent monitoring well (MW-2) was installed at the location of TB-4. The 20 feet deep well consisted of a 2-inch diameter PVC well casing with 10 feet of PVC prepack well screen. In addition, a temporary soil vapor point was installed to a depth of 4 feet. The drilling work was completed by CGC Geoservices, LLC (CGCG), as a subcontractor to Verdantas.

Upon completion of the test borings, the boreholes were backfilled with soil cuttings and then covered with asphalt cold patch. Additional settlement and softening of the backfill materials may occur resulting in a depression or hole in the ground surface. Consequently, future maintenance and restoration of the site may be required.

As part of the subsurface investigation, three (3) Cone Penetration Tests (CPT) were performed at the project site. The tests were carried out by Stable Ground In-Situ, LLC (SGI), as a subcontractor to Verdantas, in general accordance with ASTM D3441-16/D5778. The CPT soundings extended to depths ranging from 38 feet to 50 feet. Shear wave velocity measurements were taken during SCPT-5 at approximately 3-foot (1-meter) intervals.

The test boring logs are presented in **Appendix B**, and the CPT data is included as an enclosure in **Appendix C**.

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2. Subsurface Conditions

2.1 Soil Profile

Beneath a layer of asphalt pavement that is approximately 6 inches thick, a layer of fill material consisting of a mixture of lean clay and sand with varying amounts of silt and gravel was observed. The fill layer extends to a depth that ranges from 4.5 feet to 6 feet overlying a sand layer with varying fines content. The sand layer has a thickness that ranges from approximately 2 to 10 feet, and its density ranged from very loose to medium dense. A layer of lean clay with various amounts of sand and silt was encountered below the sand layer. The clay layer has a thickness that ranges from approximately 8 to 12 feet and has a very soft to medium consistency. Beneath the clay layer, poorly graded sand was encountered at TB-04 until the termination depth of the borehole. The sand layer was loose to medium dense. A stratigraphic profile for TB-03 and TB-04 is provided in **Appendix B**.

2.2 CPT and Shear Wave Velocity Measurements

The CPT data presented in **Appendix C** indicated that the soil behavior type (SBT) observed was generally in agreement with the data obtained in the adjacent SPT boring locations. Shear wave velocity measurements obtained at SCPT-5 (labeled as CPT-5 in **Appendix C**), indicated an increasing trend in the shear wave velocity with depth. The results appeared similar to the shear wave velocity estimated by correlations from the CPT data measurement. Based on the results of the shear wave velocity tests performed, the average shear wave velocity measurement for the V_s100 was calculated as 926 feet/sec.

2.3 Groundwater

During the performance of the field program, indications of groundwater and/or perched water conditions were observed at approximate depths ranging from 13.6 to 14.0 feet below grade. The Delaware Geological Survey (DGS) Data viewer indicates that groundwater depths at the site during “normal” and “wet” conditions vary from approximately 0 to 16 feet and 0 to 9 feet, respectively. Due to seasonal and annual variations in precipitation, groundwater fluctuations of several feet should be anticipated.

To estimate the variations in the groundwater levels, measurements of the depth to water are currently being collected twice a month at the onsite monitoring well (MW-2). The results that have been collected at the time of this report are presented in **Appendix B**. The most recent measurement at MW-2 indicated a groundwater level at a depth of approximately 6.1 feet, corresponding to approximate 3.86 feet elevation.

As part of the field program for the building addition site, a monitoring well (MW-1) was installed and measurements are being obtained. The most recent measurement at MW-1 indicated a groundwater level at a depth of approximately 15.3 feet, corresponding to approximate 5.47 feet elevation. The results of the groundwater monitoring for the building addition will be summarized in a separate report. The results from MW-1 and MW-2 will be provided periodically along with the results of groundwater measurements performed during the installation of additional monitoring wells as part of a supplemental environmental field program.

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3. Conclusion and Recommendations

The data provided in this report supplements the data presented by Century Engineering for the construction of the Legislative Hall parking garage. Two additional SPT borings were drilled at the site and a permanent monitoring well was installed. In addition, three CPT soundings were performed across the site with shear wave velocity measurements collected at one location. No recommended changes in the geotechnical design and construction recommendations provided by Century Engineering are provided in this letter report with the exception of the recommended change in the seismic site class and its corresponding seismic design parameters as discussed below.

3.1 Seismic Design Parameters

According to the American Society of Civil Engineers Minimum Design Loads for Buildings and Other Structures (ASCE/SEI 7-16), a seismic site class type is assigned to a project site based on three different parameters: the average shear wave velocity, V_s, the average field standard penetration resistance, N, or the average undrained shear strength S_u. The average values are taken in the top 100 feet, with the shear wave velocity taking precedence over the standard penetration resistance, since the shear wave velocity is a direct measure to the soil's small strain shear strength and the standard penetration resistance is typically more variable.

According to the Century Engineering evaluation report, the site was assigned a seismic site class E. This classification is based on the average field penetration resistance obtained from a 100 foot deep borehole drilled within the vicinity of the project site. The seismic site class impacts the structural design based on the proposed seismic design parameters as well as the soil susceptibility to liquefaction. As such, additional CPT testing and shear wave velocity measurements were conducted to evaluate the site class that was previously assigned.

Based on an average shear wave velocity of 926 feet/sec calculated at the project location, a seismic site class D is recommended for the analysis of the seismic conditions as defined by 1613.3.2 of the 2018 International Building Code and Chapter 20 of the ASCE/SEI 7-16. The recommended design parameters for the site location, assuming Risk Category II as obtained from ASCE Hazard Tool, are presented in **Appendix D**.

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4. Qualifications

These recommendations have been prepared according to generally accepted soil and engineering practices and are based on the conditions encountered by the test boring and cone penetration tests performed at the site. It is noted that, although soil quality has been inferred from the interpolation of the sampling data, subsurface conditions between sampling locations are, in fact, unknown. As a result, these recommendations may require modifications based on the conditions encountered and exposed during construction excavation. Should any conditions encountered during construction differ from those described in this report, this office should be notified immediately in order to review, and possibly modify these recommendations. This report applies solely to the size, type, and location of the structure described herein. In the event that changes are proposed, this report will not be considered valid unless the changes have been reviewed and the recommendations of this report modified and reapproved in writing by Verdantas LLC.

We appreciate this opportunity to be of service to you. If you have any questions or require further information, please do not hesitate to contact us.

Sincerely,

VERDANTAS LLC

JOSEPH JAKUBOWSKI LICENSE No. 15181 3-19-2025 DELAWARE PROFESSIONAL ENGINEER

Mohamed ElGhoraiby, EIT, PhD
Staff Engineer III

Joseph Jakubowski, P.E., LEED AP
AVP, Geotechnical Group Leader
Delaware PE License No. 15181

Enclosures: Appendix A – Site Layout and Test Borings Location Sketch
Appendix B – Test Boring Logs and Monitoring Well Observation Summary
Appendix C – CPT Data
Appendix D – ASCE Design Hazards Report
Appendix E – 2024 Century Engineering Evaluation Report

MAE/WT/JJ:acj
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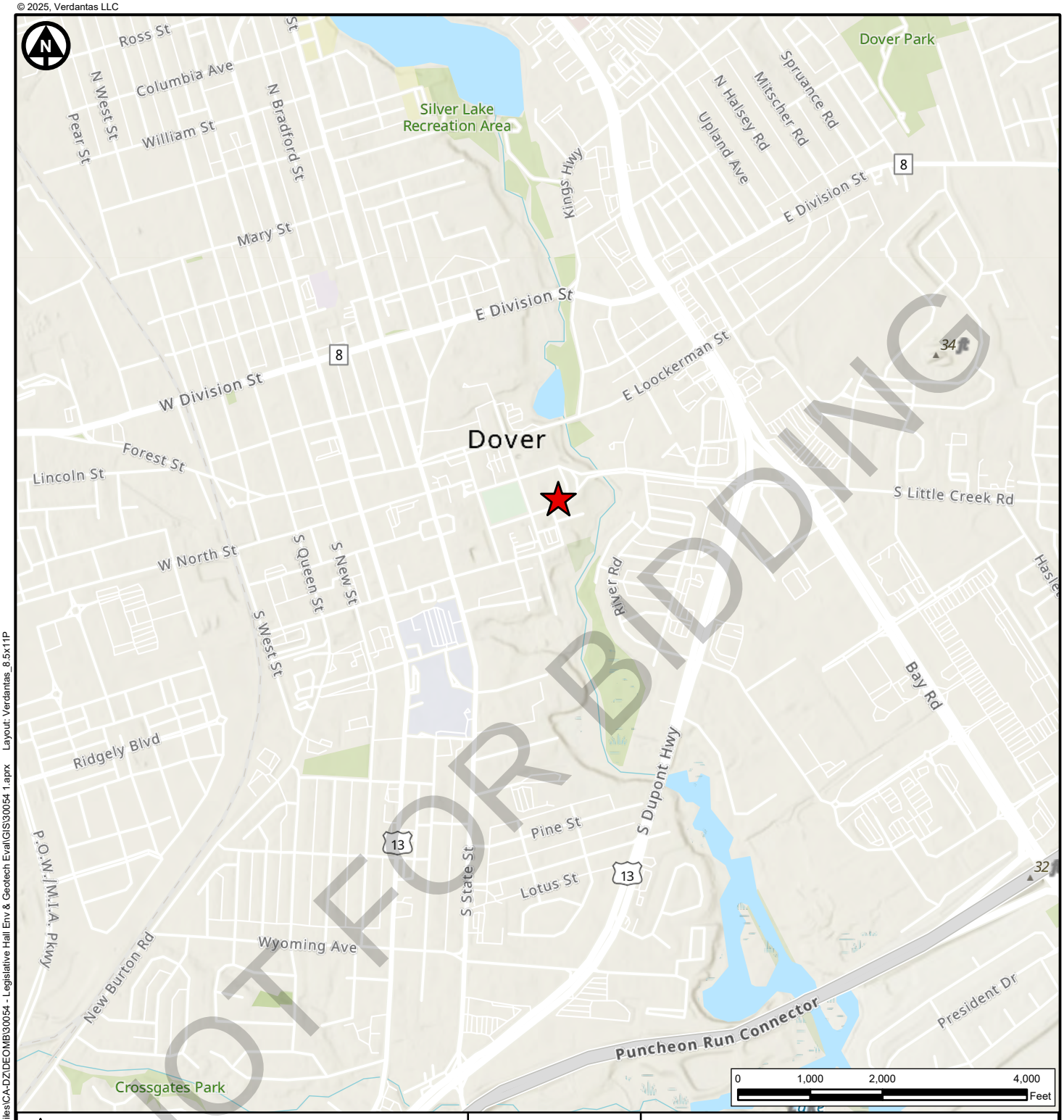
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Appendix A

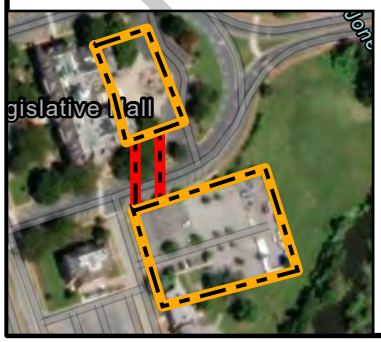
SITE LAYOUT AND TEST BORINGS LOCATION SKETCH

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Subject Property Location



Note: The aerial photo was acquired through the Esri Imagery Web Service. Aerial photography dated 2021.

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150 East Water Street
Dover, Kent County, Delaware

Subject Property Location Map

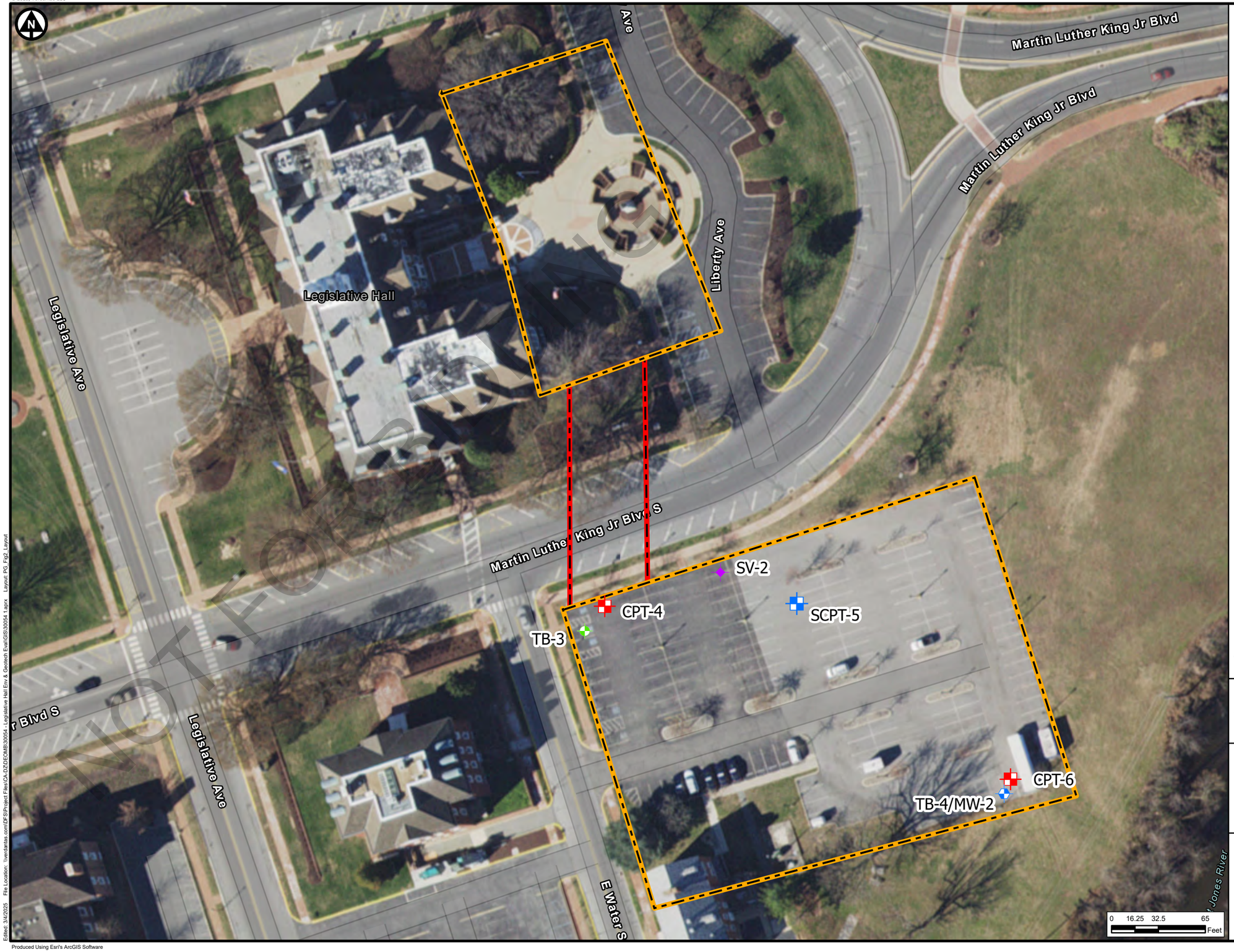
Limited Environmental Evaluation
Legislative Hall Parking Garage

Project Number	30180
Date	01/2025
Author	wharness
Scale	1 in = 1,926 ft
Figure	1

Edited: 1/24/2025 File Location: \\verdantas.com\DFS\Project Files\CA-DZ\DEOMB\30054 - Legislative Hall Env & Geotech Eval\GIS\30054 1.aprx Layout: Verdantas_8.5x11P

Produced Using Esri's ArcGIS Software

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- Soil-Vapor Point Location
- Soil Boring/Monitoring Well Location
- Soil Boring Location
- Seismic Cone Penetration Test Location
- Cone Penetration Test Location
- Approximate Proposed Redevelopment Area
- Approximate Tunnel Location

Note: The aerial photo was acquired through the Esri Imagery Web Service. Aerial photography dated 2021.

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Limited Environmental and Geotechnical Evaluation
Legislative Hall Addition

Drilling and Sampling Locations

150 E Water St, Dover, DE

Project Number	30180
Date	03/2025
Author	wharness
Scale	1 in = 65 ft
Figure	2

Edited: 3/4/2025 File Location: \\verdantas.com\DFS\Project Files\CA-D2\DEOMB\30054 - Legislative Hall Env & Geotech Eval\GIS\30054 1.aprx Layout: PG_Fig2_Layout

Produced Using Esri's ArcGIS Software

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Appendix B

TEST BORING LOGS AND MONITORING WELL OBSERVATION SUMMARY

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GENERAL NOTES

VERDANTAS LLC uses the following definitions and terminology to classify and correlate the field and laboratory samples.

VISUAL UNIFIED CLASSIFICATIONS: The soil samples are described by color, major constituent, modifiers (by percentage), and density (or consistency). Coarse Grained or Granular Soils have more than 50% of their dry weight retained on a No. 200 sieve; they are described as: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a No. 200 sieve; they are described as: clays or clayey silts if they are cohesive and silts if they are noncohesive. In addition to gradation, granular soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their strength or consistency and their plasticity. The Unified Soil Classification symbols are:

COARSE GRAINED SOILS

GW - Well graded gravels
GP - Poorly graded gravels
GM - Silty gravels
GC - Clayey gravels
SW - Well graded sands
SP - Poorly graded sands
SM - Silty sands
SC - Clayey sands

FINE GRAINED SOILS

ML - Silts of low plasticity
CL - Clays of low to medium plasticity
OL - Organic silt clays of low plasticity
MH - Silts of high plasticity
CH - Clays of high plasticity
OH - Organic silt clays of high plasticity
PT - Peat and highly organic

SIZE DESCRIPTION

F - Fine
M - Medium
C - Coarse
G - Gravel

MODIFIERS (PERCENTAGE)

Tr - Trace 1 - 10
Ltl - Little 11 - 20
Sm - Some 21 - 35
& - And 36 - 50%

COLOR

Or - Orange
Yel - Yellow
Br - Brown
Blk - Black
Gr – Gray
R - Red
Vc - Varicolored
Dk - Dark
Lt - Light

DENSITY: COARSE GRAINED SOILS

Very loose	4 blows/ft or less
Loose	5 to 10 blows/ft
Medium	11 to 30 blows/ft
Dense	31 to 50 blows/ft
Very Dense	51 blows/ft or more

WH/WOH Weight of hammer advanced sampler
WR/WOR Weight of drilling rods advanced sampler

CONSISTENCY: FINE GRAINED SOILS

Very soft	2 blows/ft or less
Soft	3 to 4 blows/ft
Medium	5 to 8 blows/ft
Stiff	9 to 15 blows/ft
Very stiff	16 to 30 blows/ft
Hard	31 blows/ft or more

NOTE: The Standard Penetration Test "N" value is the number of blows per foot of a 140-pound hammer falling 30 inches to advance a 2 inch outside-diameter split spoon sampler between the 6 and 18 inch penetration interval with no corrections applied, except where otherwise noted.

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TEST BORING TB-03

Legislative Hall Parking Garage
Martin Luther King Jr. Blvd and E. Water Street
Dover, Delaware
Verdantas Project No. 30180

Date Started	: December 18, 2024	Drilling Equipment	: Geoprobe
Date Completed	: December 18, 2024	Drilling Methods	: 3.25" ID HSA
Logged/Chk'd	: WH/MAE	Surface Elevation (ft)	: 20.0
Weather	: 55 F Sunny	Northing (ft)	: 421,276.6
Driller/Agency	: MN/CGC Geoservices	Easting (ft)	: 627,094.2

Sample Condition: ⊠ Remolded
Water Levels: ▽ At Completion

Depth (ft)	Elevation (ft)	USCS	DESCRIPTION	Sample Number	Blows per 6 inches	Recovery (ft)
0	20		ASPHALT (± 6 inches)			
			Fill - Lean Clay (CL): soft, dark brown, dry clay with trace sand	S-1	1-2-1	1.3
			Fill - Lean Clay and Silt (CL/ML): soft, light brown, dry clay and silt	S-2	2-1-2-3	1.5
			same as above - depth 4.5 feet	S-3A S-3B		
5	15		Poorly Graded Sand (SP): very loose, light brown, dry medium to fine sand		2-2-2-3	2.0
			Poorly Graded Sand (SP): medium dense, tan/orange, dry, medium sand with trace gravel	S-4	7-11-16-19	1.3
		SP	Poorly Graded Sand (SP): medium dense, tan/orange, dry, medium to coarse sand with a 6 inch dark brown silty and lean clay lense	S-5	8-7-9-7	2.0
10	10		Poorly Graded Sand (SP): loose, tan, moist, medium to coarse sand	S-6	6-5-4-3	1.8
			same as above, except with trace gravel	S-7	2-2-2-1	1.3
			same as above - depth 14.5 feet			
15	5		Lean Clay (CL): soft, gray, wet lean clay, with trace of coarse sand	S-8	1-1-1-1	1.5
			Lean Clay (CL): soft, tan/gray, wet lean clay with trace fine sand and a 6 inch coarse sand lense	S-9	2-3-4-2	2.0
			Lean Clay (CL): very soft, orange, wet lean clay with trace corase sand	S-10	1/12"-1-1	2.0
20	0	CL	Lean Clay and Silt (CL/ML): very soft, orange, wet lean clay and silt with trace coarse sand	S-11		2.0
			Same as above	S-12	1/12"-1-1	2.0
25	-5		Lean Clay (CL): very soft, dark gray/black and orange, wet lean clay with trace fine to medium sand	S-13	1-1-1-10	2.0
30	-10					

Moisture Content (%)	% Passing 200 Sieve	Liquid Limit (%)	Plasticity Index (%)

NOT FOR BIDDING

NOTES:
1. Test boring terminated at ± 26.0 feet below existing ground surface (B.E.G.S.).
2. Latitude and longitude estimated in field. Elevation based on Google Earth Pro.
3. Split spoon sampling performed in general accordance with ASTM D1586 with automatic hammer.
4. Water level through augers at ± 14.0 feet B.E.G.S. at completion of drilling.
5. Borehole backfilled with soil cuttings upon completion.

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TEST BORING TB-04

Legislative Hall Parking Garage
Martin Luther King Jr. Blvd and E. Water Street
Dover, Delaware
Verdantas Project No. 30180

Date Started	: December 19, 2024	Drilling Equipment	: CME
Date Completed	: December 19, 2024	Drilling Methods	: 3.25" ID HSA
Logged/Chk'd	: WH/MAE	Surface Elevation (ft)	: 10.2
Weather	: 41 F Sunny	Northing (ft)	: 421,157.5
Driller/Agency	: MN/CGC Geoservices	Easting (ft)	: 627,363.2

Sample Condition: ⊠ Remolded
Water Levels: ▽ At Completion

Depth (ft)	Elevation (ft)	USCS	DESCRIPTION	Sample Number	Blows per 6 inches	Recovery (ft)	Moisture Content (%)	% Passing 200 Sieve	Liquid Limit (%)	Plasticity Index (%)
0	10		ASPHALT (± 6 inches)							
			Poorly Graded Sand and Gravel (SP/GP): medium dense, gray, moist gravel and medium sand	1	7-6-6	1.3				
			Poorly Graded SAND (SP): loose, gray, moist, medium sand	2	6-5-4-4	1.0				
5	5		same as above expect with trace clay	3	2-2-2-4	1.0				
		SP	Poorly Graded Sand (SP): medium dense, brown/orange, moist coarse sand with trace clay and trace gravel	4	6-11-3-2	1.0				
			Lean Clay (CL): soft, moist, gray lean clay	5	2-1-2-3	2.0				
10	0		same as above except with little sand	6	2-1-1-2	2.0				
		CL	same as above except medium stiff with some fine sand	7	3-2-3-2	1.8				
	▽									
15	-5		same as above except wet and stiff	8	3-4-5-5	0.3				
			Poorly Graded SAND (SP): loose, gray, medium sand with trace clay	9	6-3-4-4	2.0				
			same as above except some clay	10	2-4-4-10	2.0				
20	-10	SP	same as above except medium dense	11	4-2-10-12	2.0				
			same as above	12	4-6-9-11	2.0				
25	-15		same as above	13	7-8-10-10	1.3				
30										

NOT FOR BIDDING

NOTES:
1. Test boring terminated at ± 26.0 feet below existing ground surface (B.E.G.S.).
2. Latitude and longitude estimated in field. Elevation based on Google Earth Pro.
3. Split spoon sampling performed in general accordance with ASTM D1586 with automatic hammer.
4. Water level through augers at ± 13.6 feet B.E.G.S. at completion of drilling.
5. Borehole backfilled with soil cuttings upon completion.

NOT FOR BIDDING

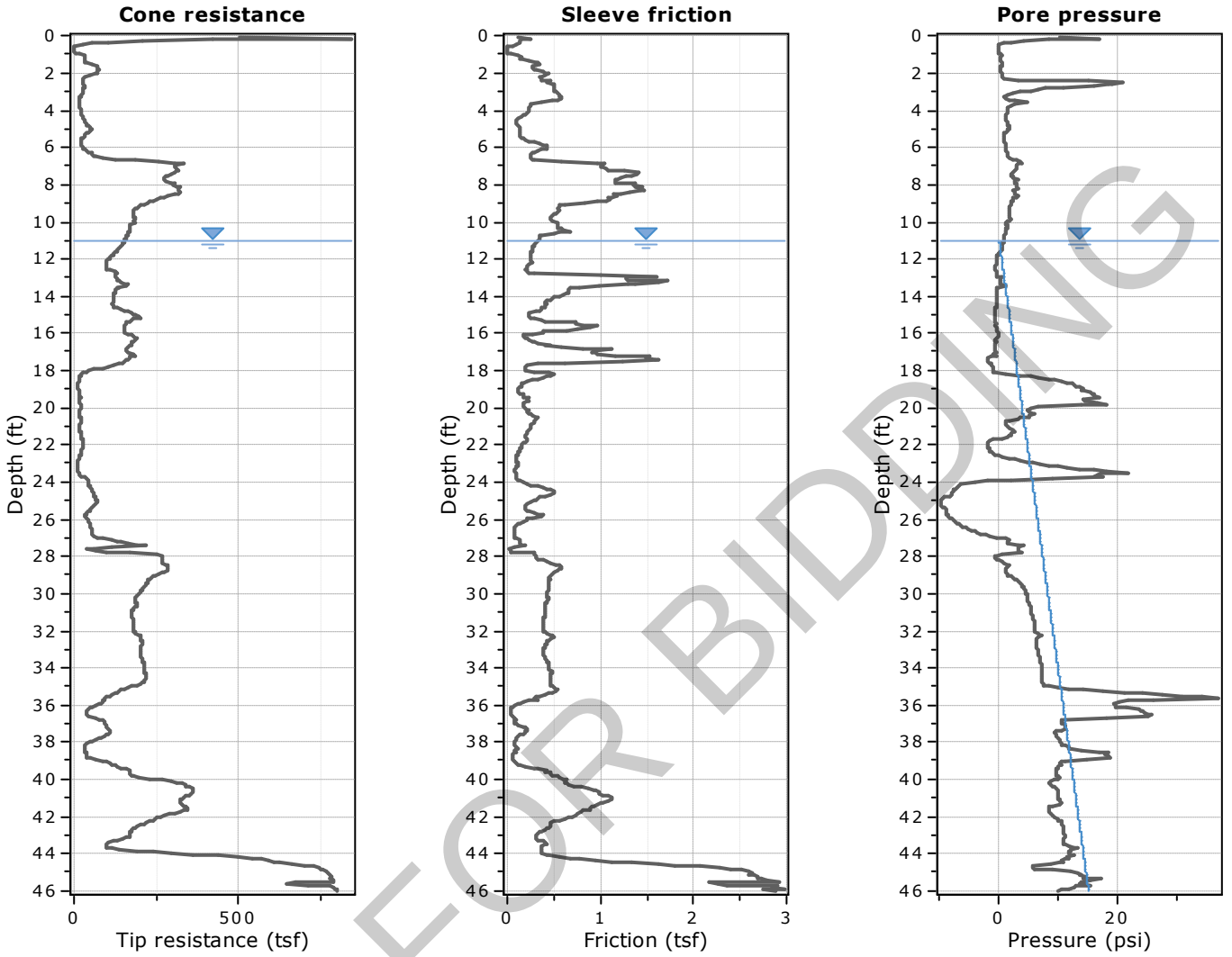
Appendix C

CPT DATA

Stable Ground In-Situ, LLC.
ENGINEERING INVESTIGATIONS & CONSULTING
BUILD CONFIDENTLY
http://www.sgi-insitu.com

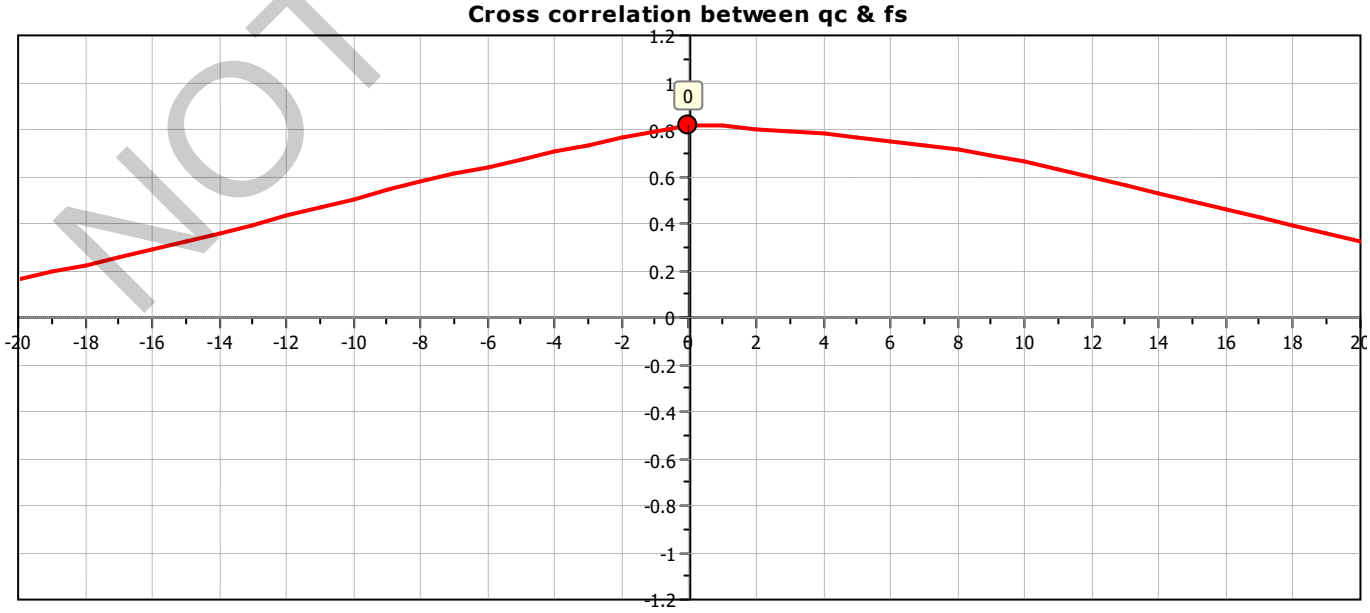
CPT: CPT-4
Total depth: 46.00 ft, Date: 12/24/2024
Surface Elevation: 20.00 ft
Coords: N 0.0, E 0.0
Cone Type: NOVA U2
Cone Operator: R. Ward, P.E., F.Garcia, P.E., D.GE.

Project: - Leg Hall Project
Location: Dover, Delaware

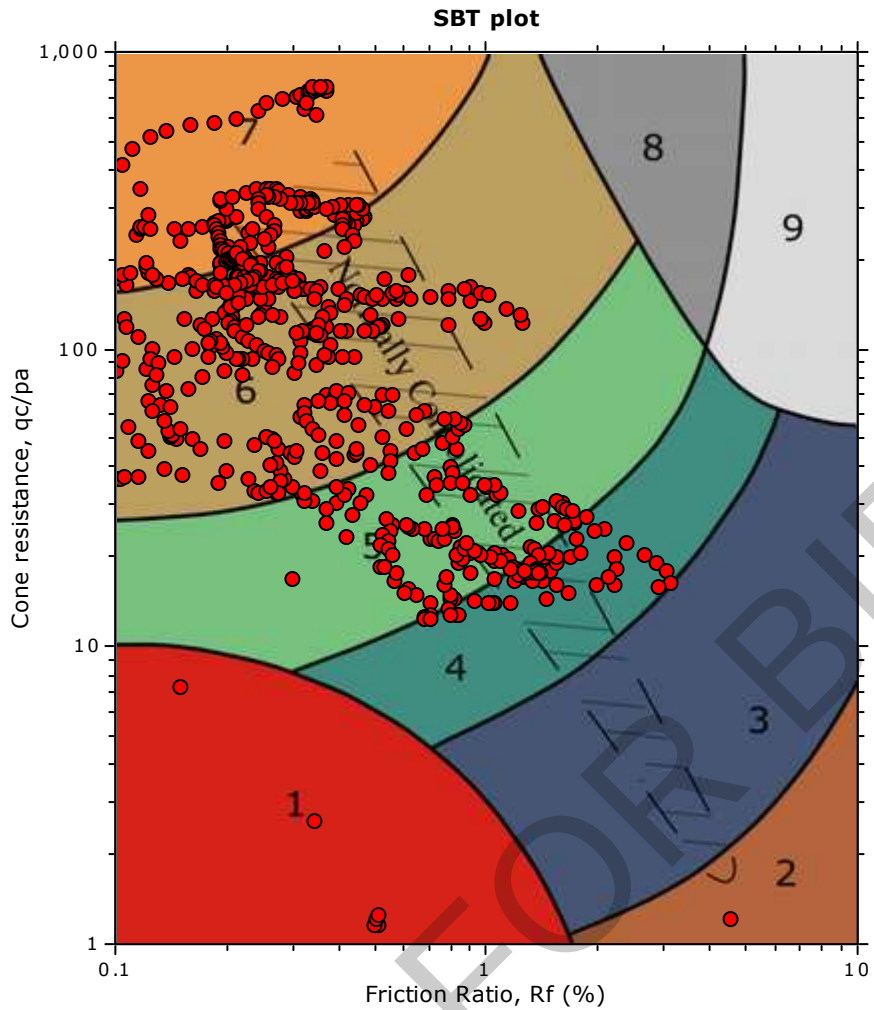


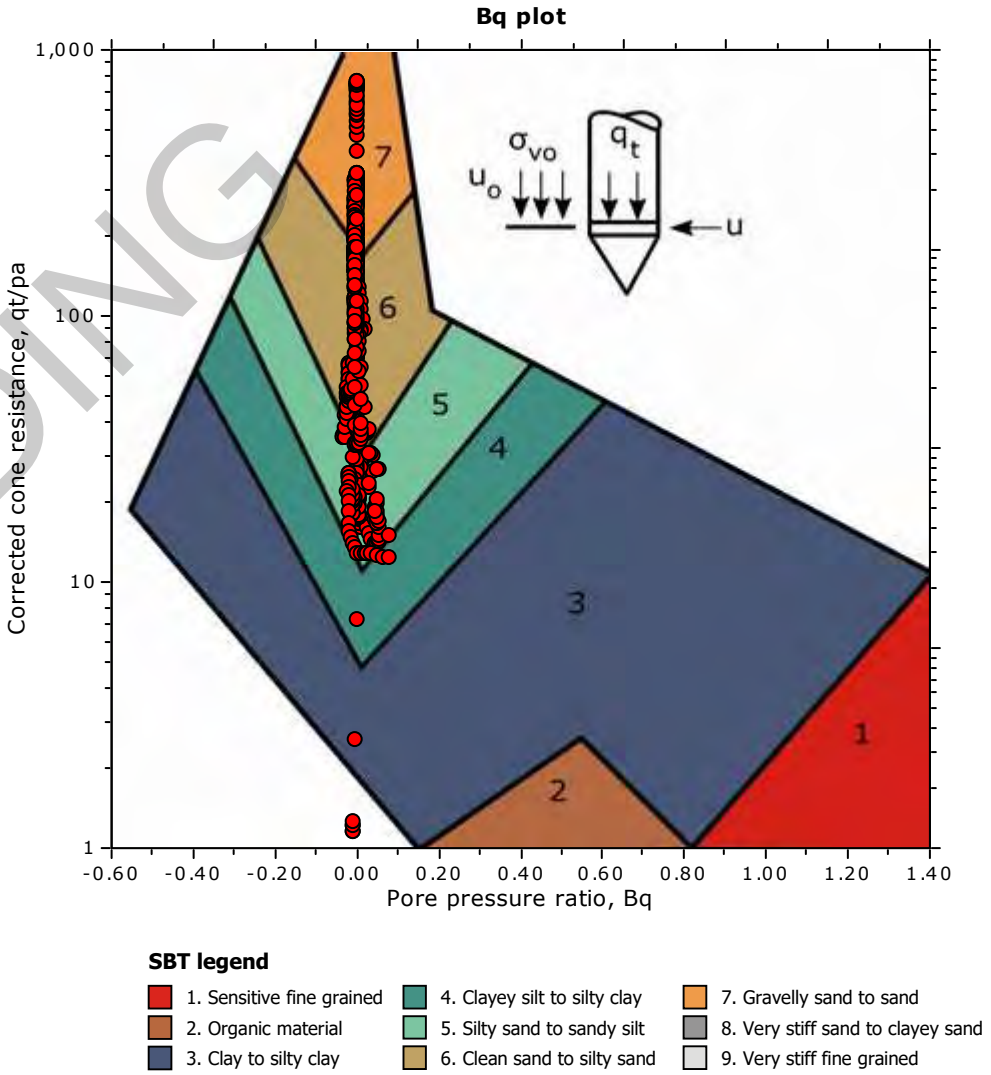
NOT FOR BIDDING

The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).



SBT - Bq plots



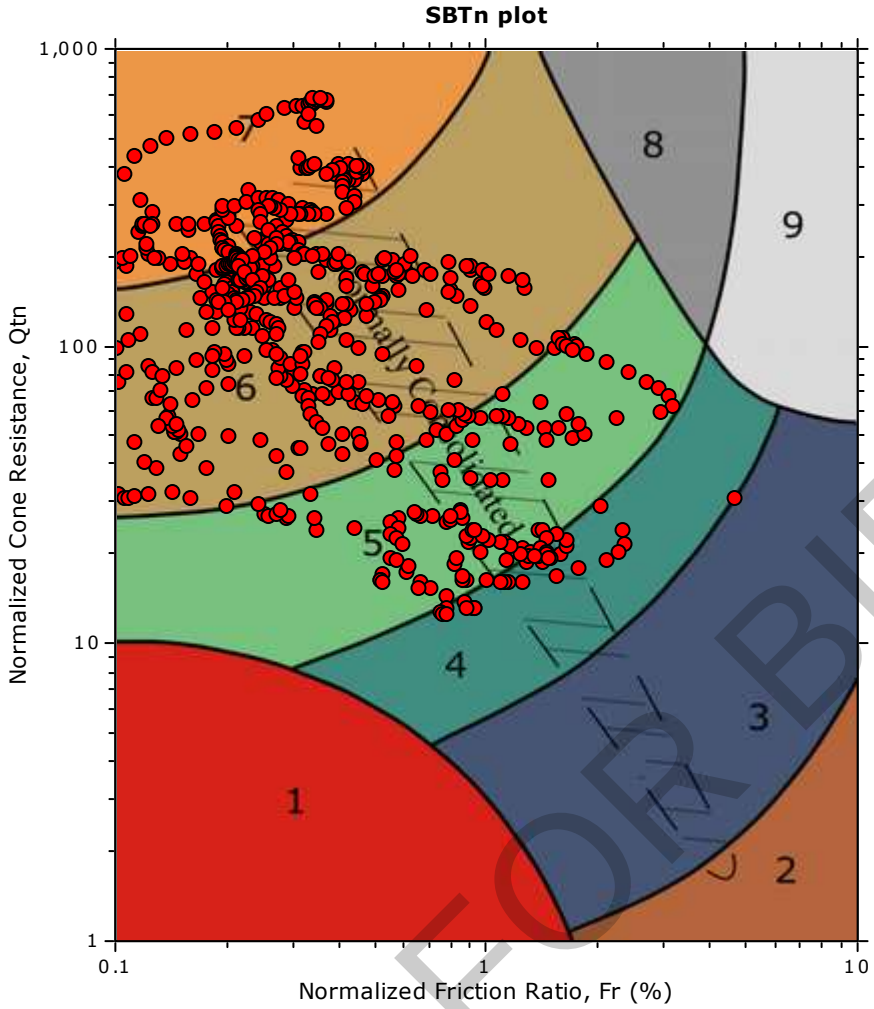


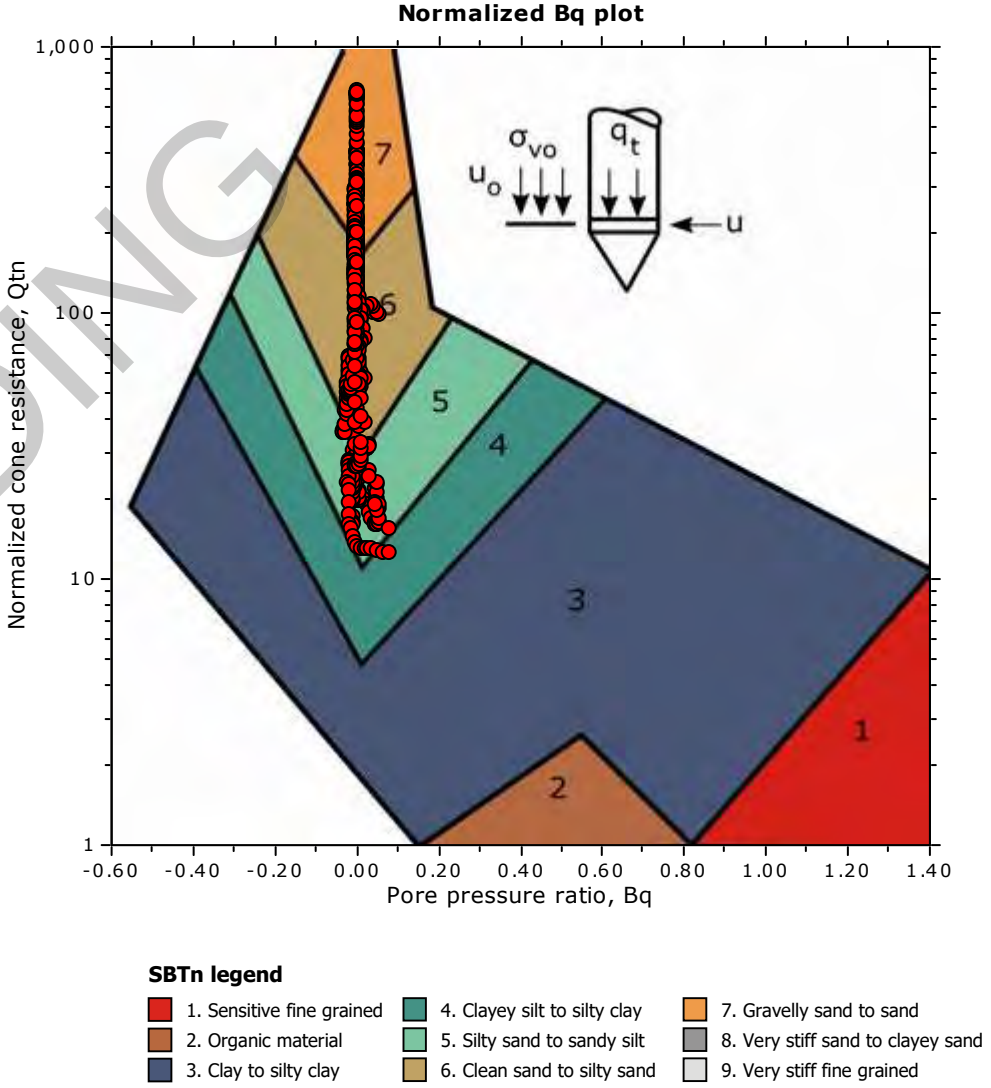
SBT legend

1. Sensitive fine grained	4. Clayey silt to silty clay	7. Gravelly sand to sand
2. Organic material	5. Silty sand to sandy silt	8. Very stiff sand to clayey sand
3. Clay to silty clay	6. Clean sand to silty sand	9. Very stiff fine grained

NOT FOR BIDDING

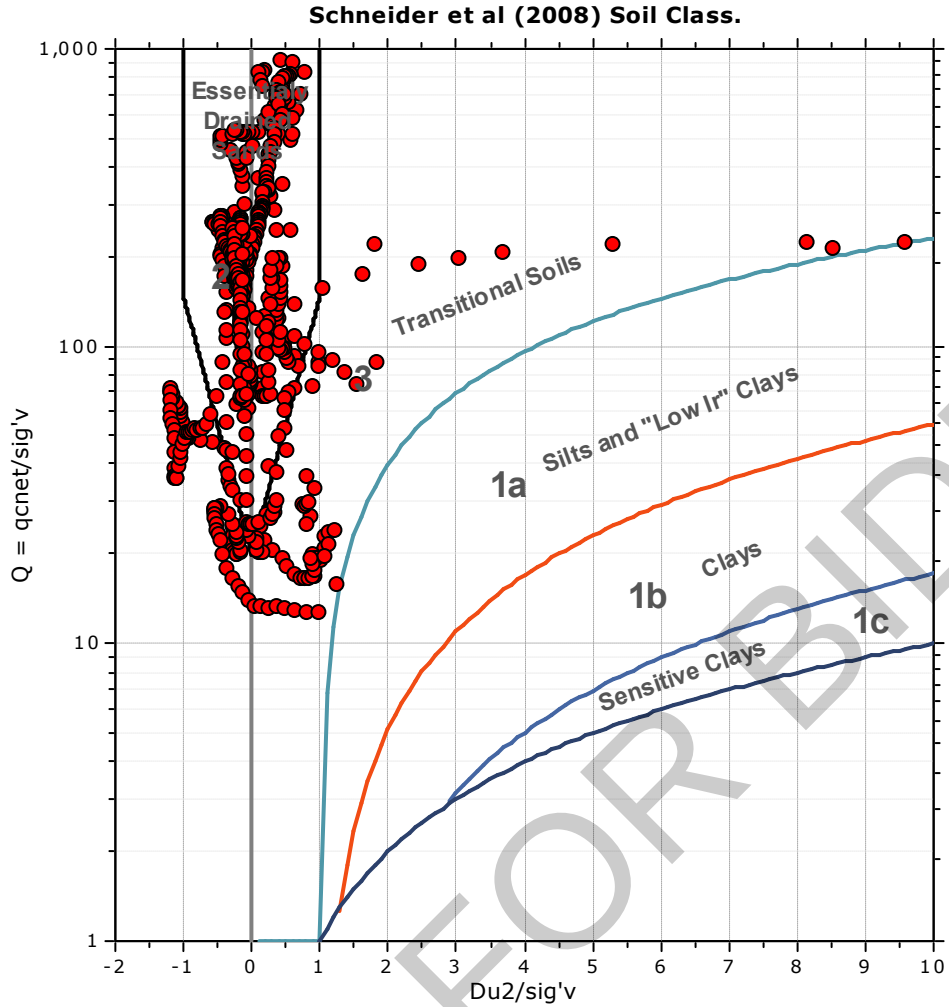
SBT - Bq plots (normalized)

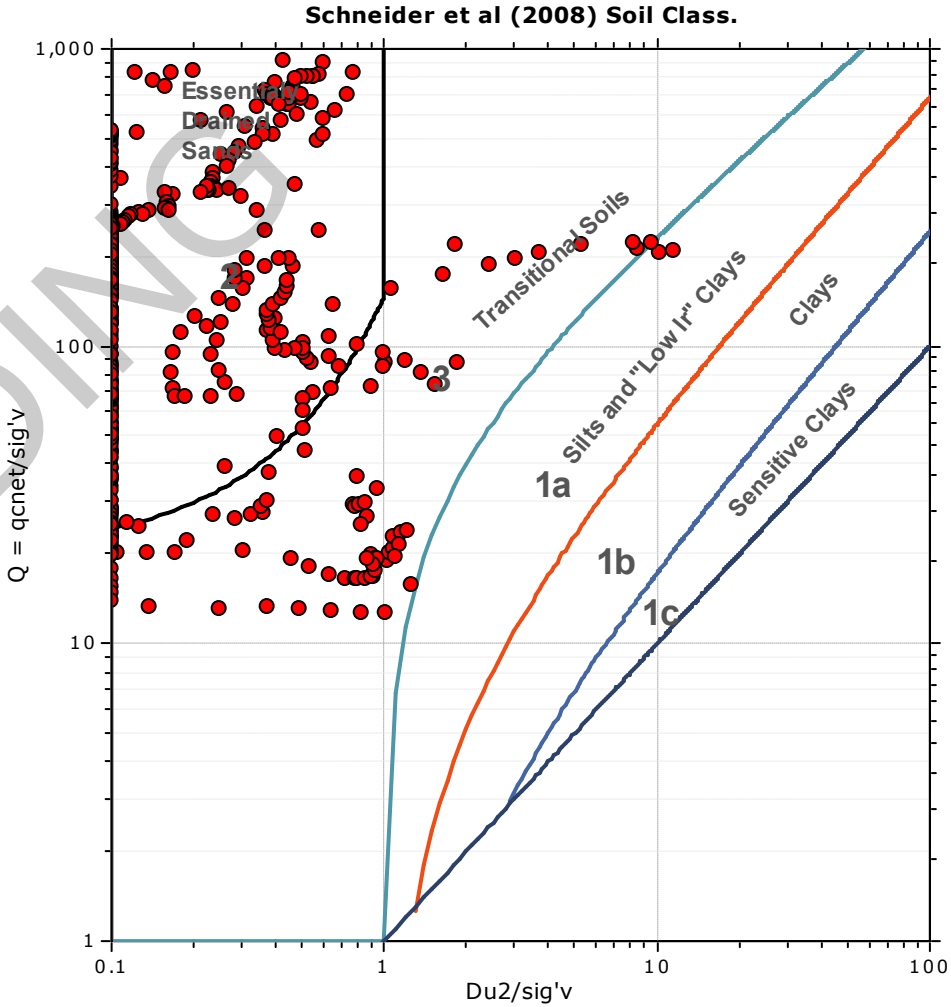




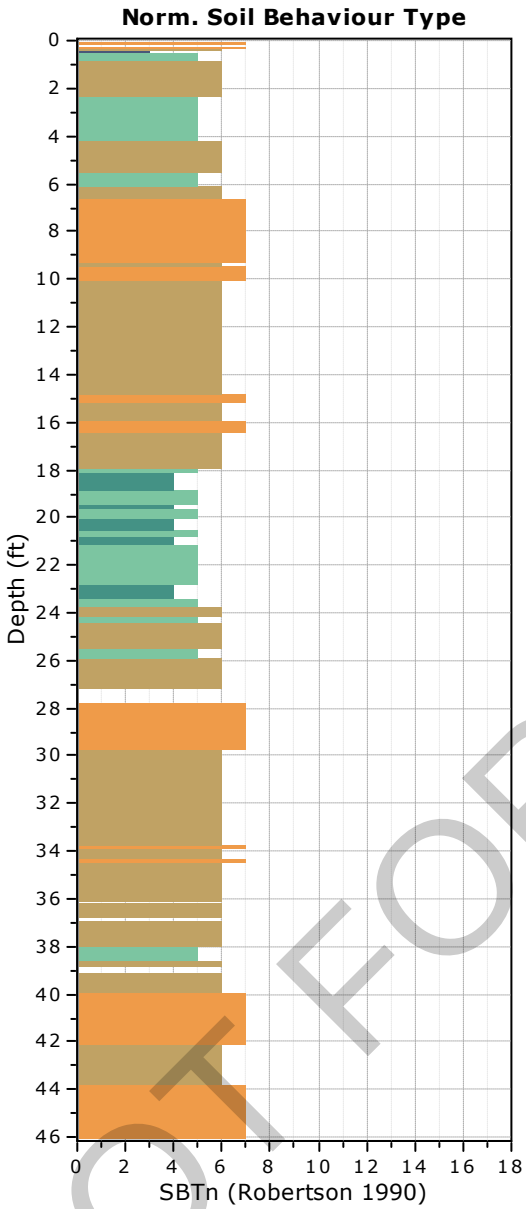
NOT FOR BIDDING

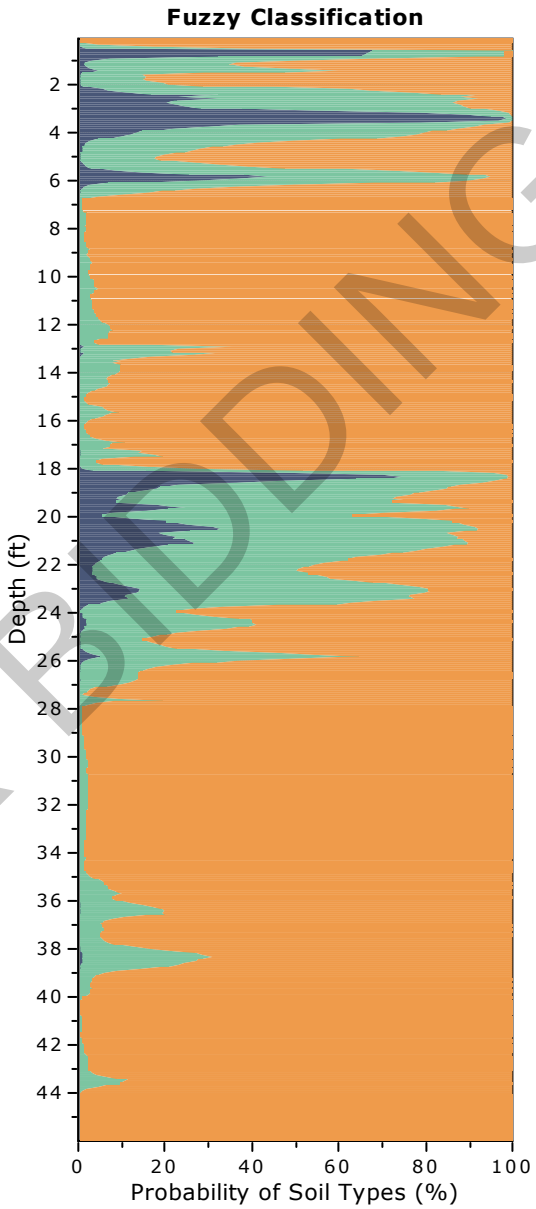
Bq plots (Schneider)





NOT FOR BIDDING





Fuzzy classifiaction legend

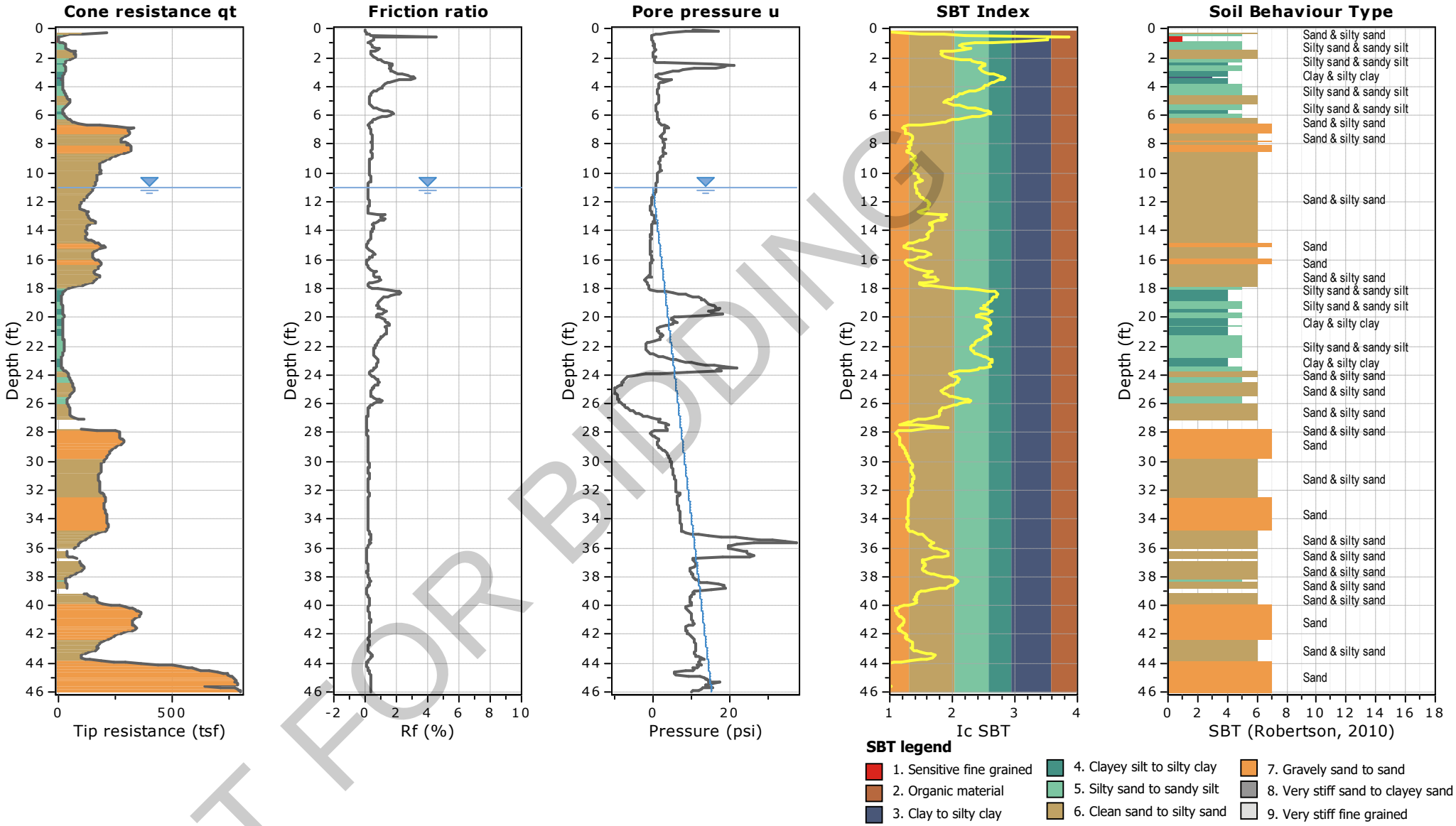
- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

NOT FOR BIDDING

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Project: - Leg Hall Project
Location: Dover, Delaware

CPT: CPT-4
Total depth: 46.00 ft, Date: 12/24/2024
Surface Elevation: 20.00 ft
Coords: N 0.0, E 0.0
Cone Type: NOVA U2
Cone Operator: R. Ward, P.E., F.Garcia, P.E., D.GE.

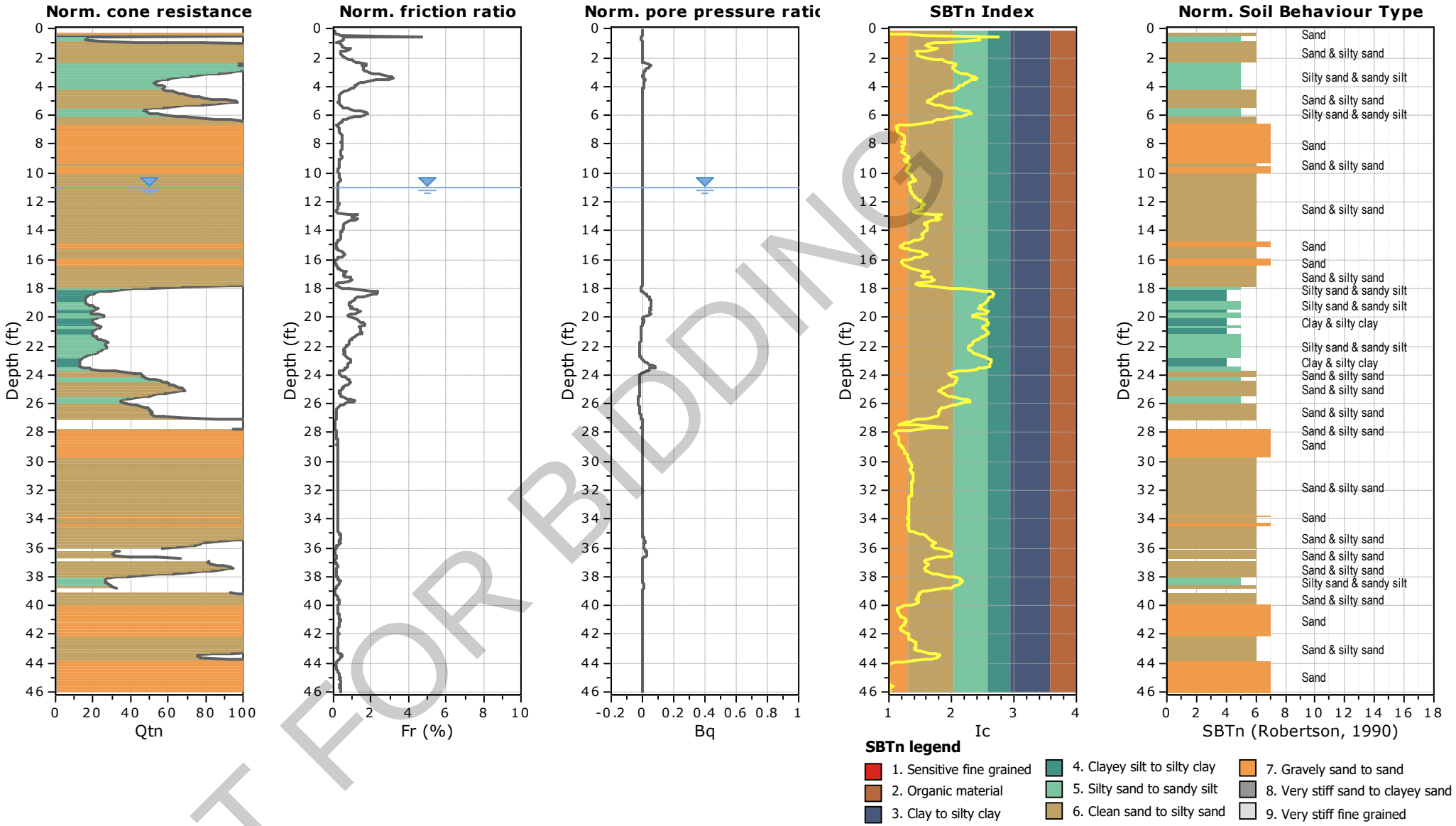


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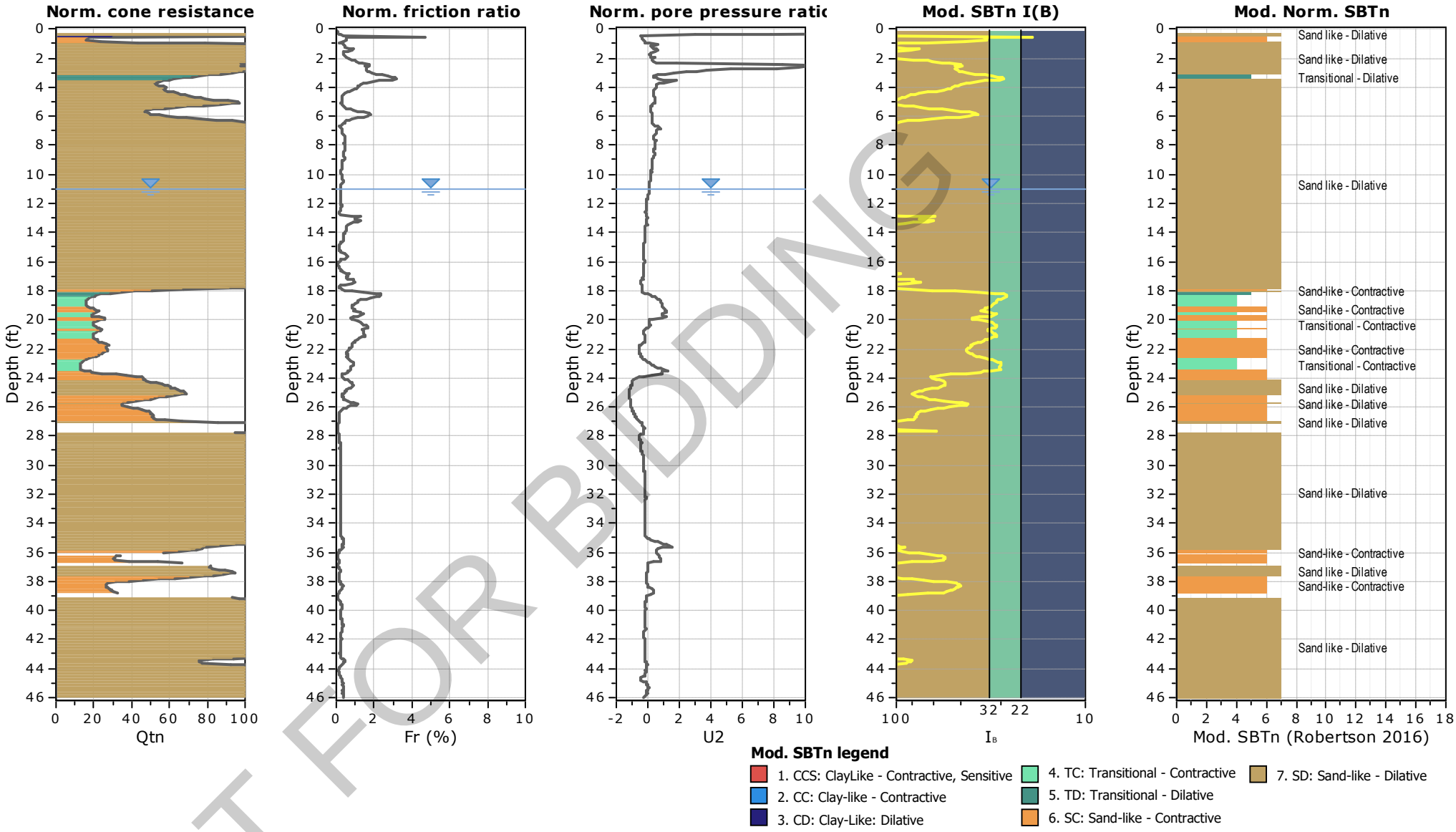


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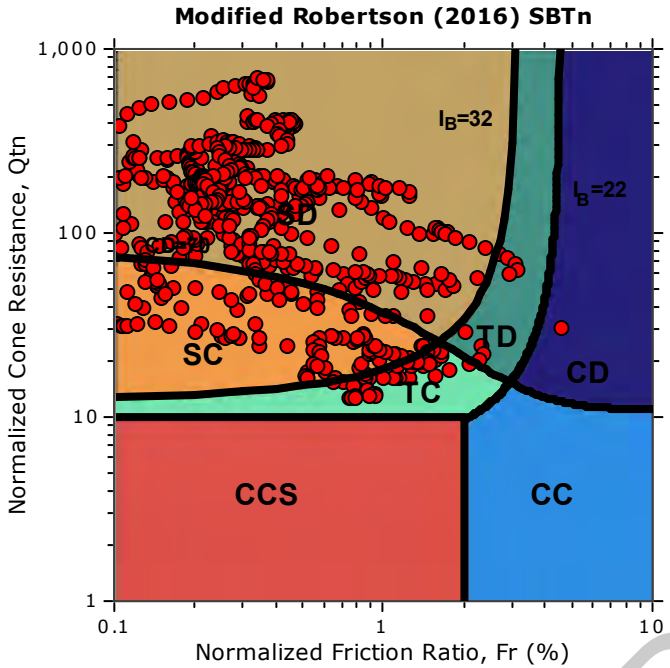
Project: - Leg Hall Project
Location: Dover, Delaware

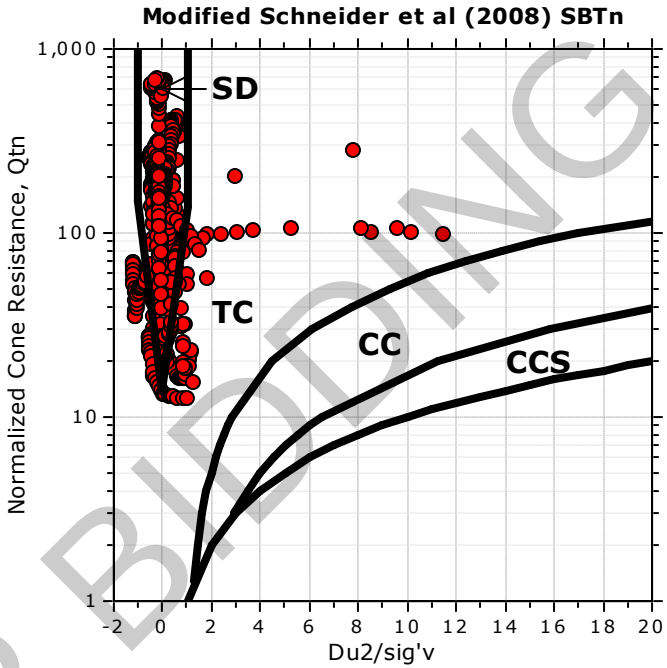
CPT: CPT-4
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Coords: N 0.0, E 0.0
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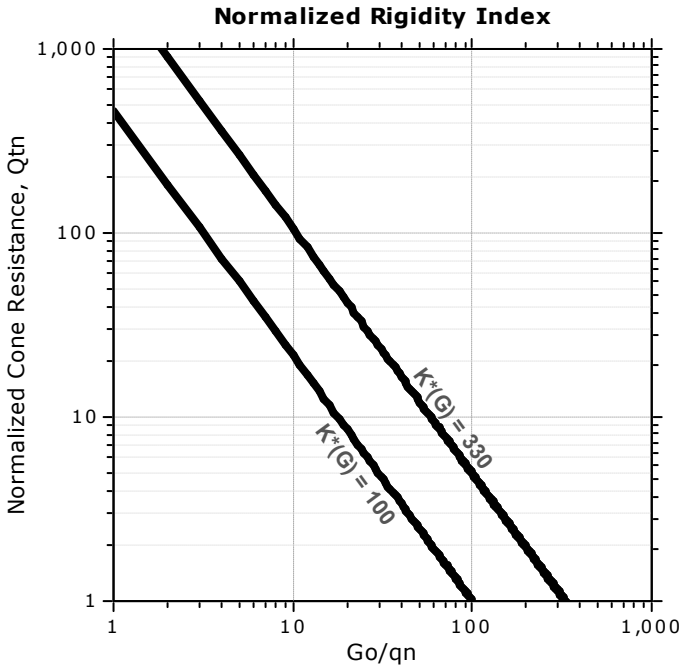


NOT FOR BIDDING

Updated SBTn plots







CCS: Clay-like - Contractive - Sensitive
CC: Clay-like - Contractive
CD: Clay-like - Dilative
TC: Transitional - Contractive
TD: Transitional - Dilative
SC: Sand-like - Contractive
SD: Sand-like - Dilative

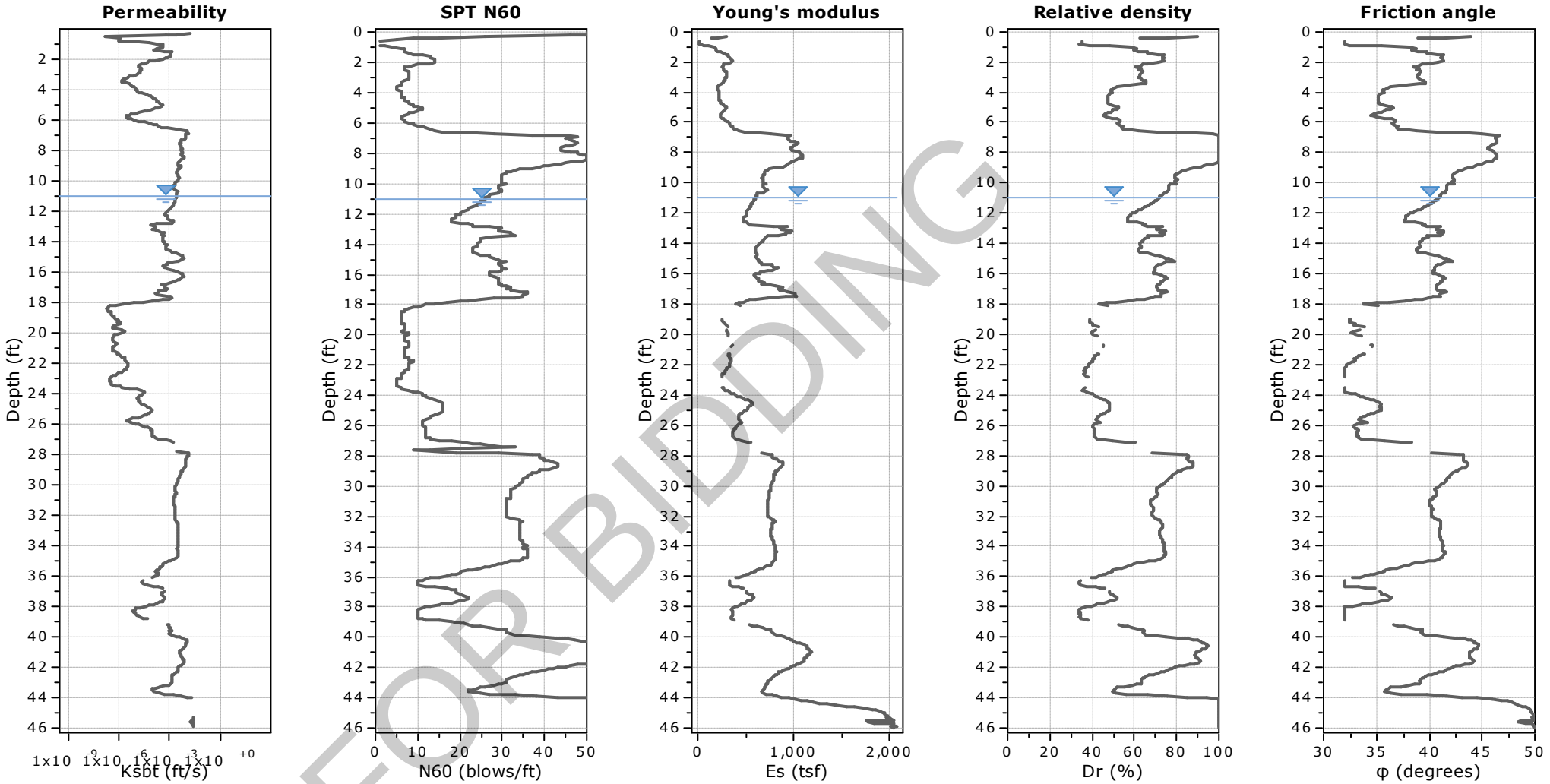
K(G) > 330: Soils with significant microstructure (e.g. age/cementation)

NOT FOR BIDDING

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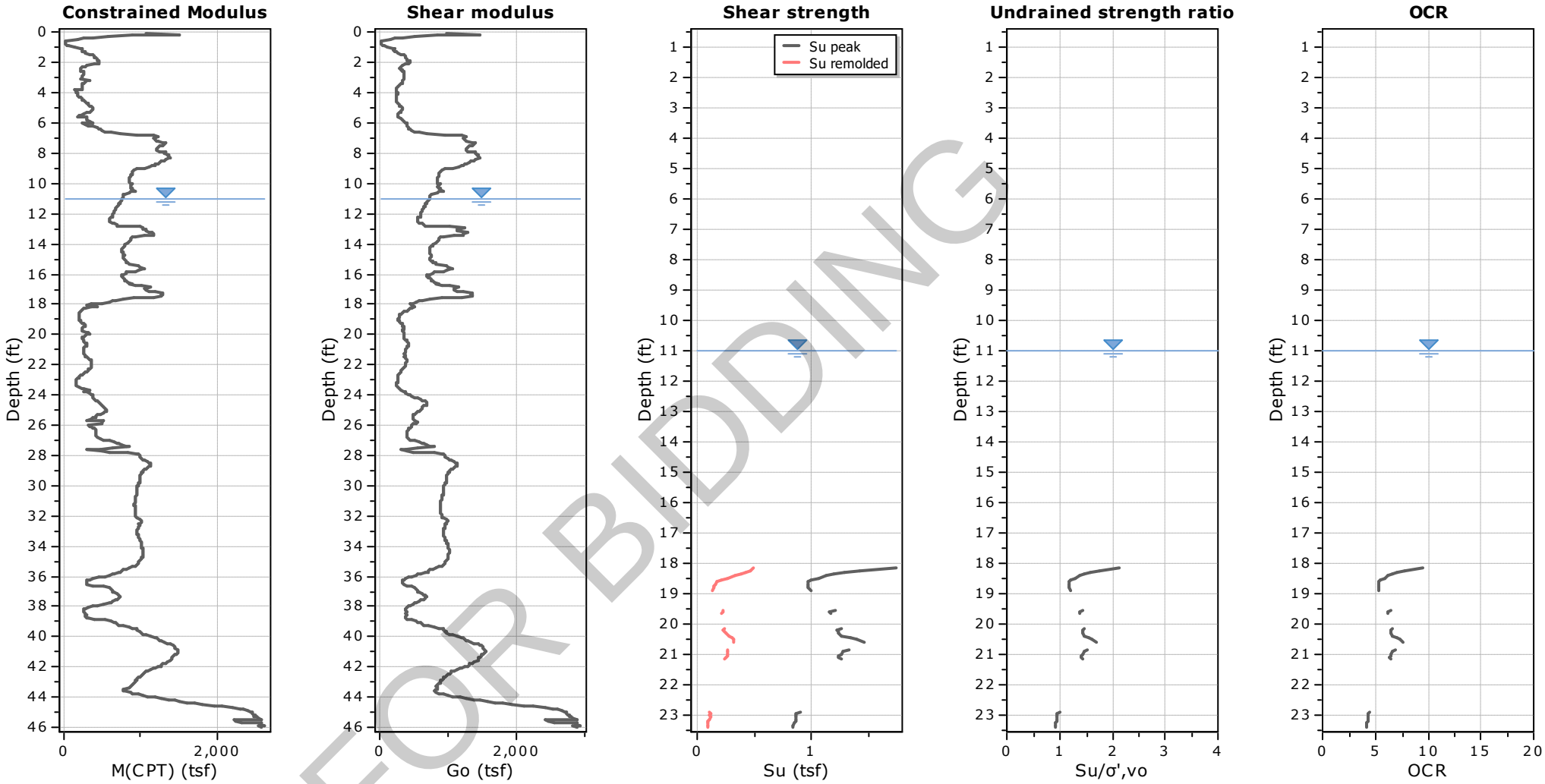
NOT FOR BIDDING

Calculation parameters
Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

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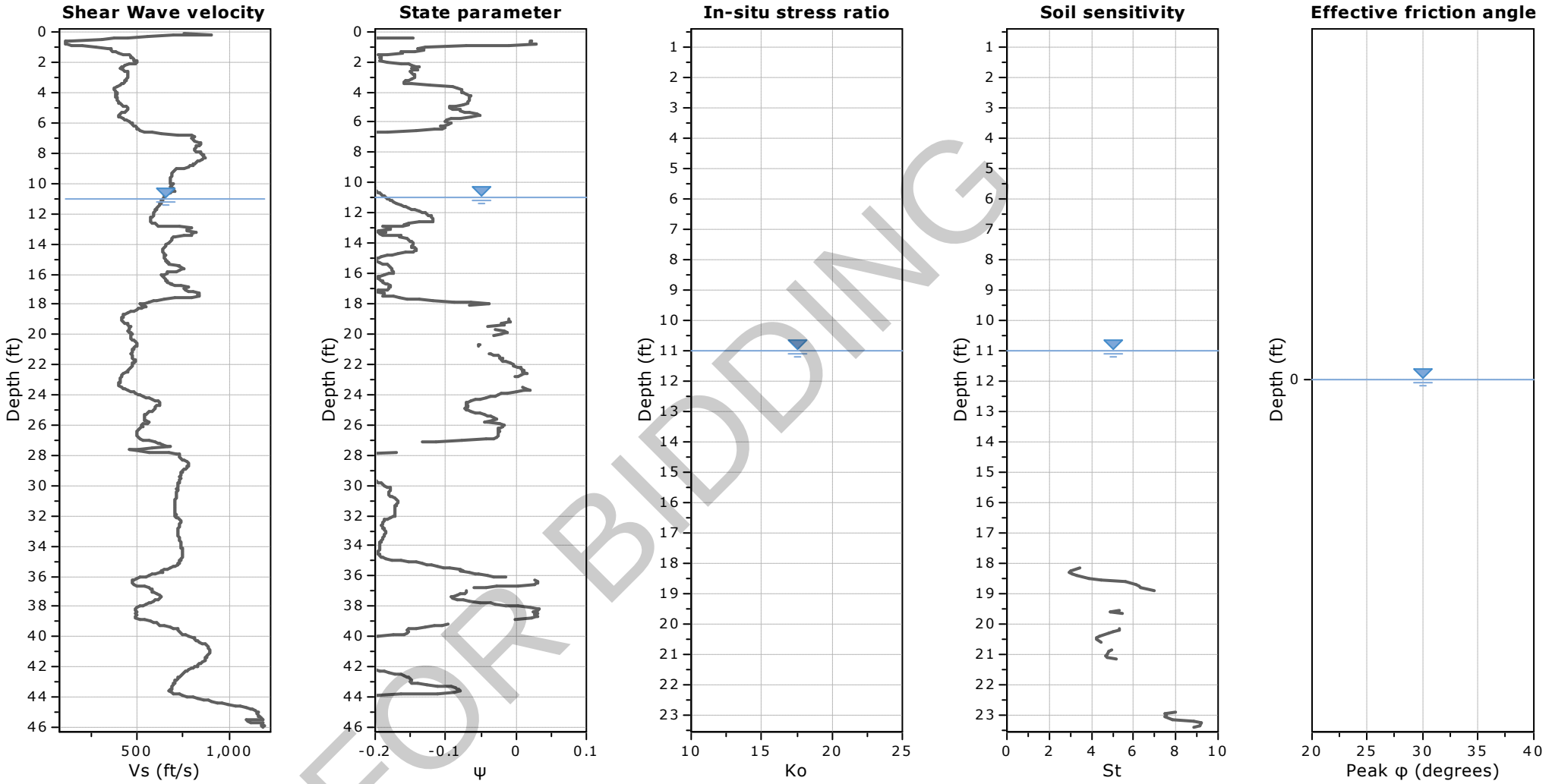


NOT FOR BIDDING

Calculation parameters
Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Project: - Leg Hall Project
Location: Dover, Delaware

CPT: CPT-4
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Coords: N 0.0, E 0.0
Cone Type: NOVA U2
Cone Operator: R. Ward, P.E., F.Garcia, P.E., D.GE.



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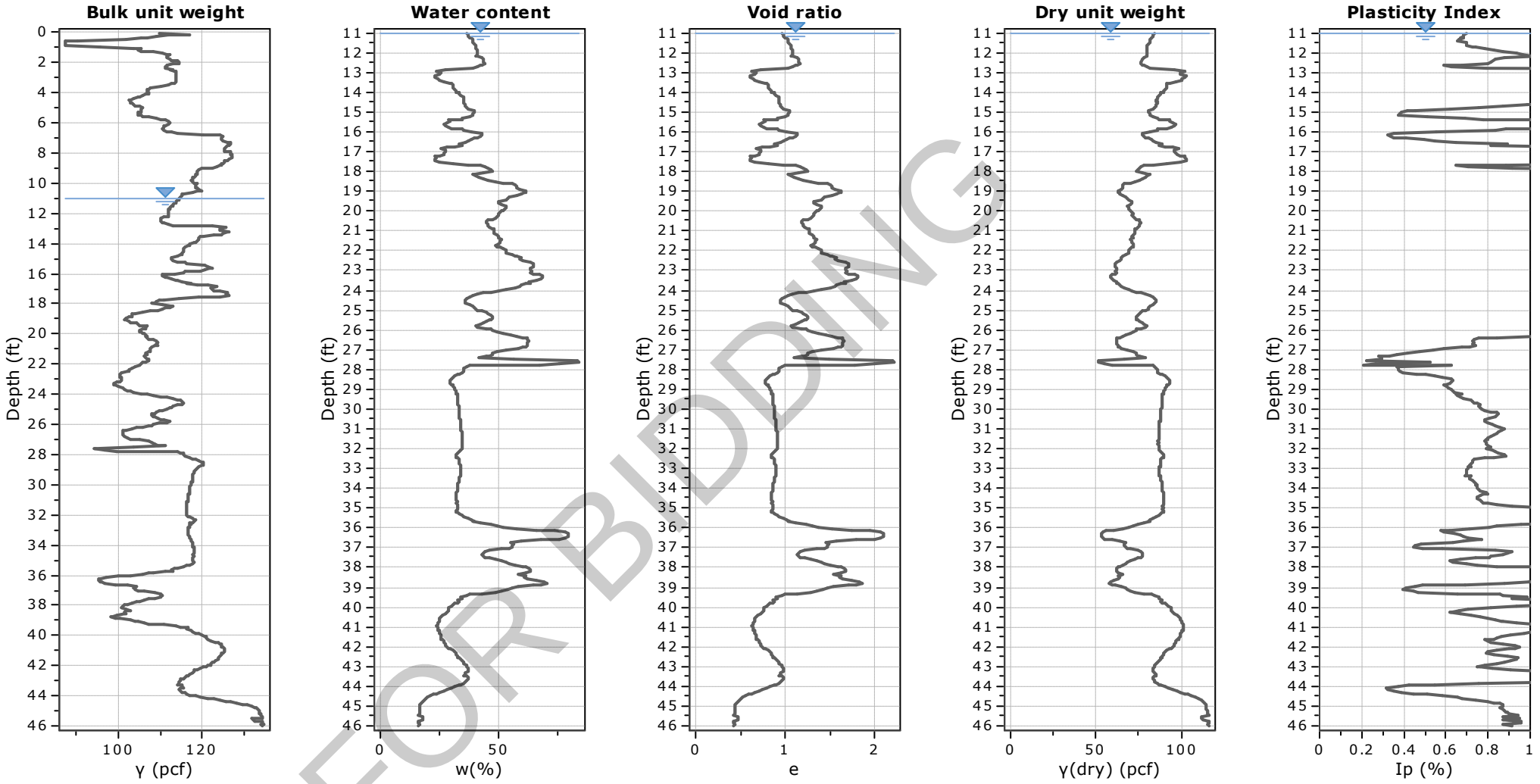
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

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Project: **- Leg Hall Project**
Location: **Dover, Delaware**

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Surface Elevation: 20.00 ft
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Cone Type: NOVA U2
Cone Operator: R. Ward, P.E., F.Garcia, P.E., D.GE.

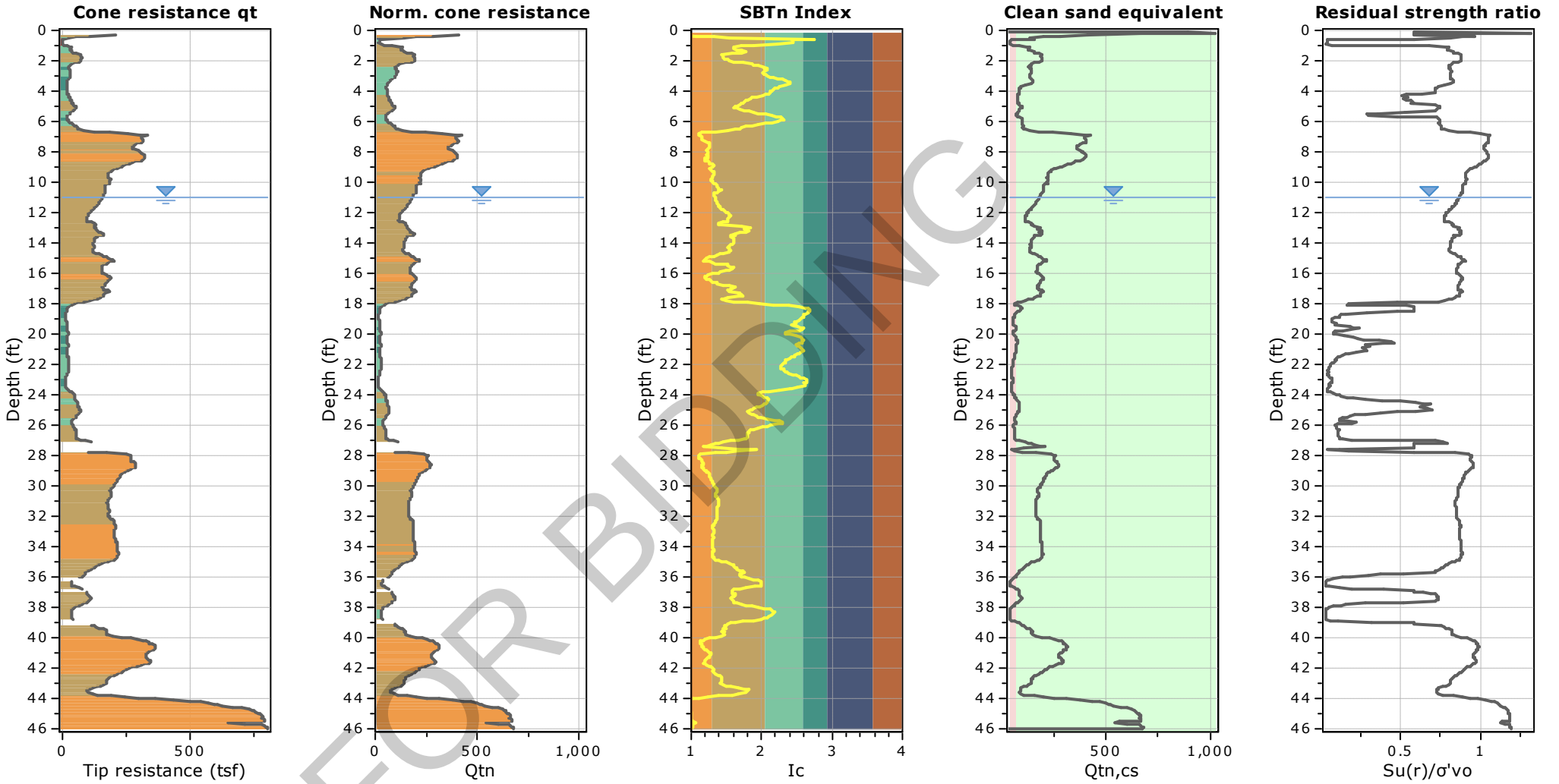


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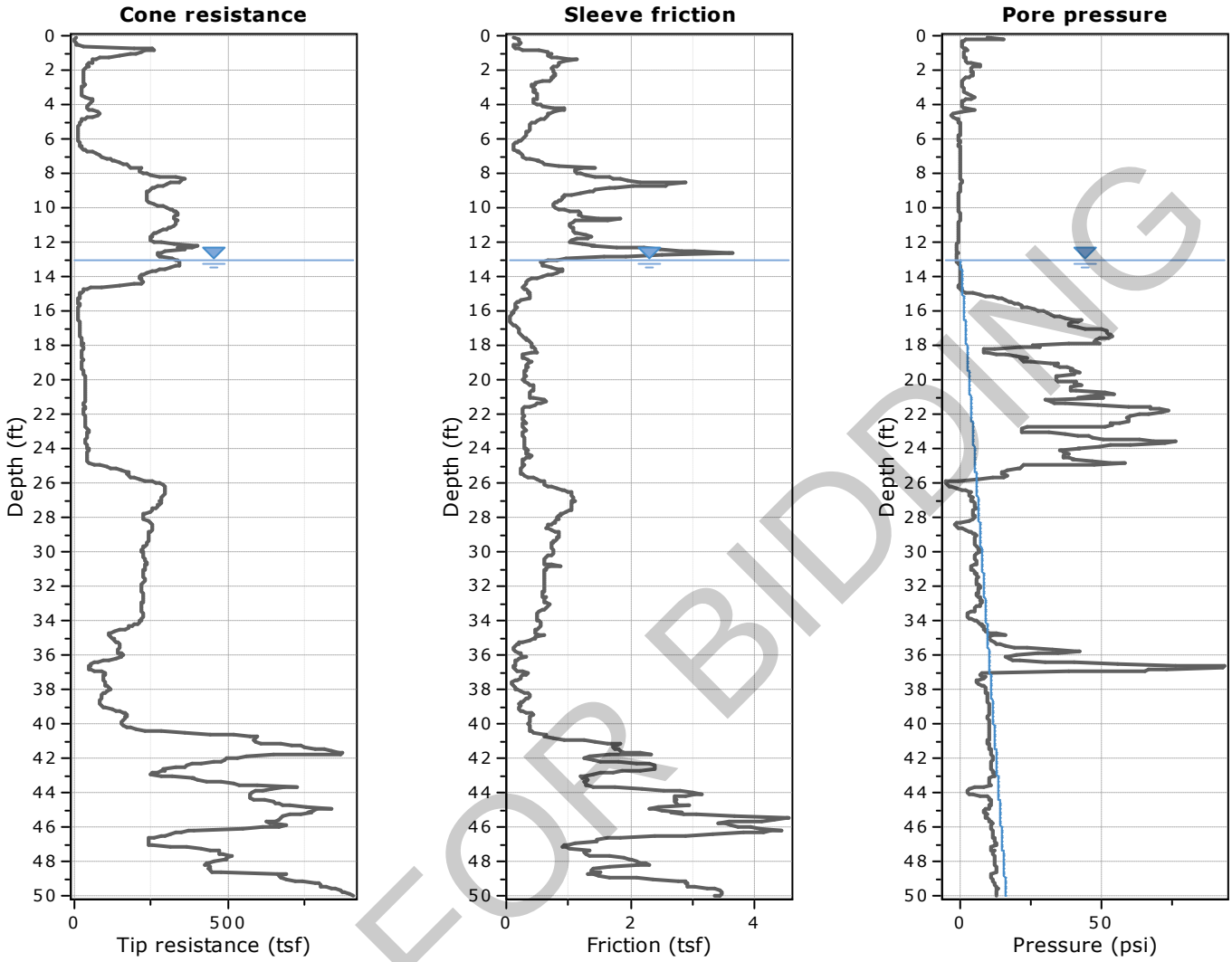


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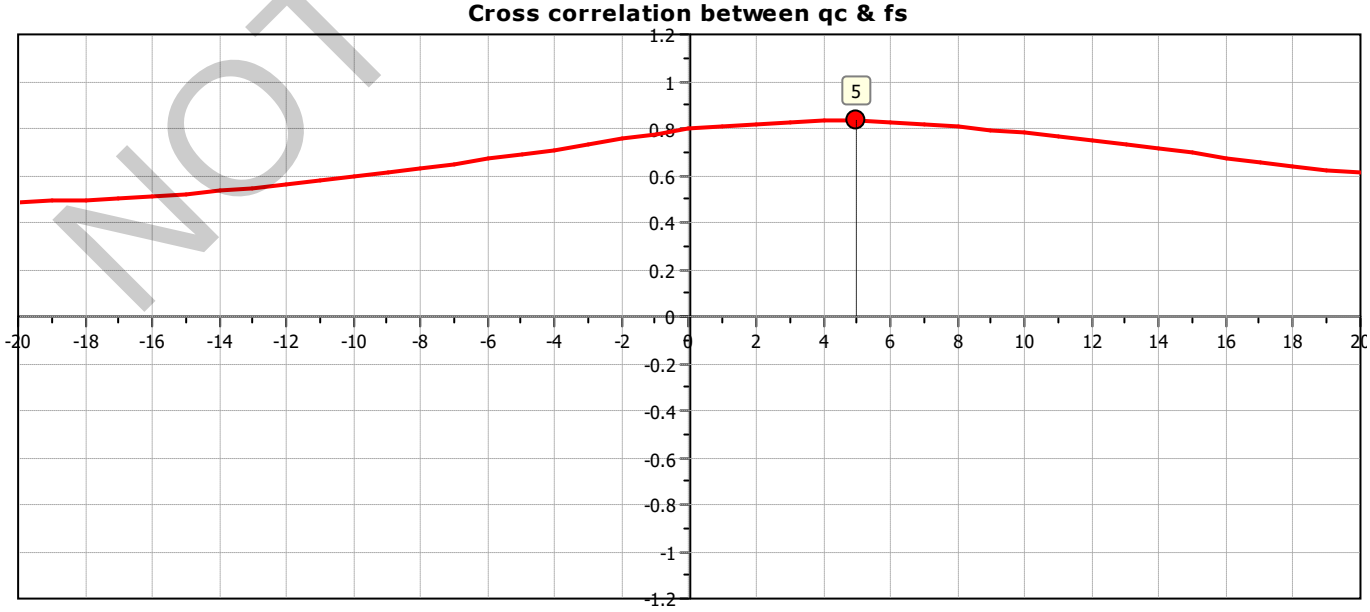
CPT: CPT-5
Total depth: 50.04 ft, Date: 12/24/2024
Surface Elevation: 17.00 ft
Coords: N 0.0, E 0.0
Cone Type: NOVA U2
Cone Operator: R. Ward, P.E., F.Garcia, P.E., D.GE.

Project: - Leg Hall Project
Location: Dover, Delaware

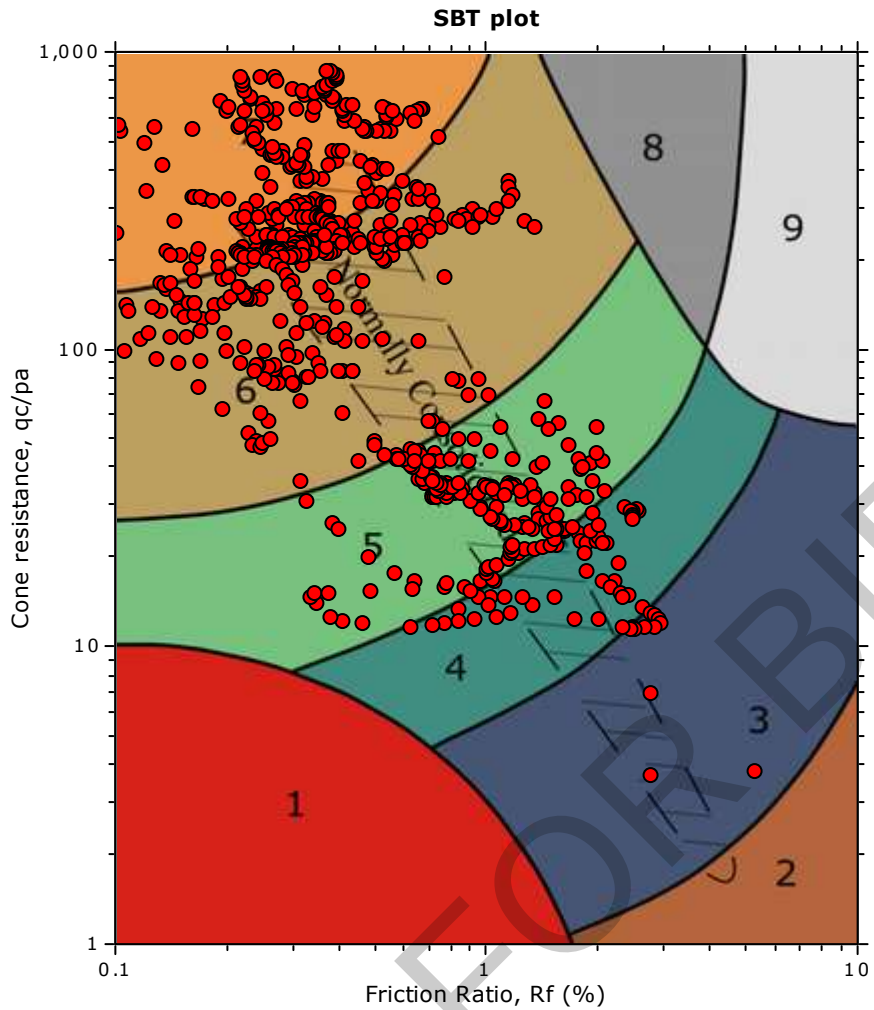


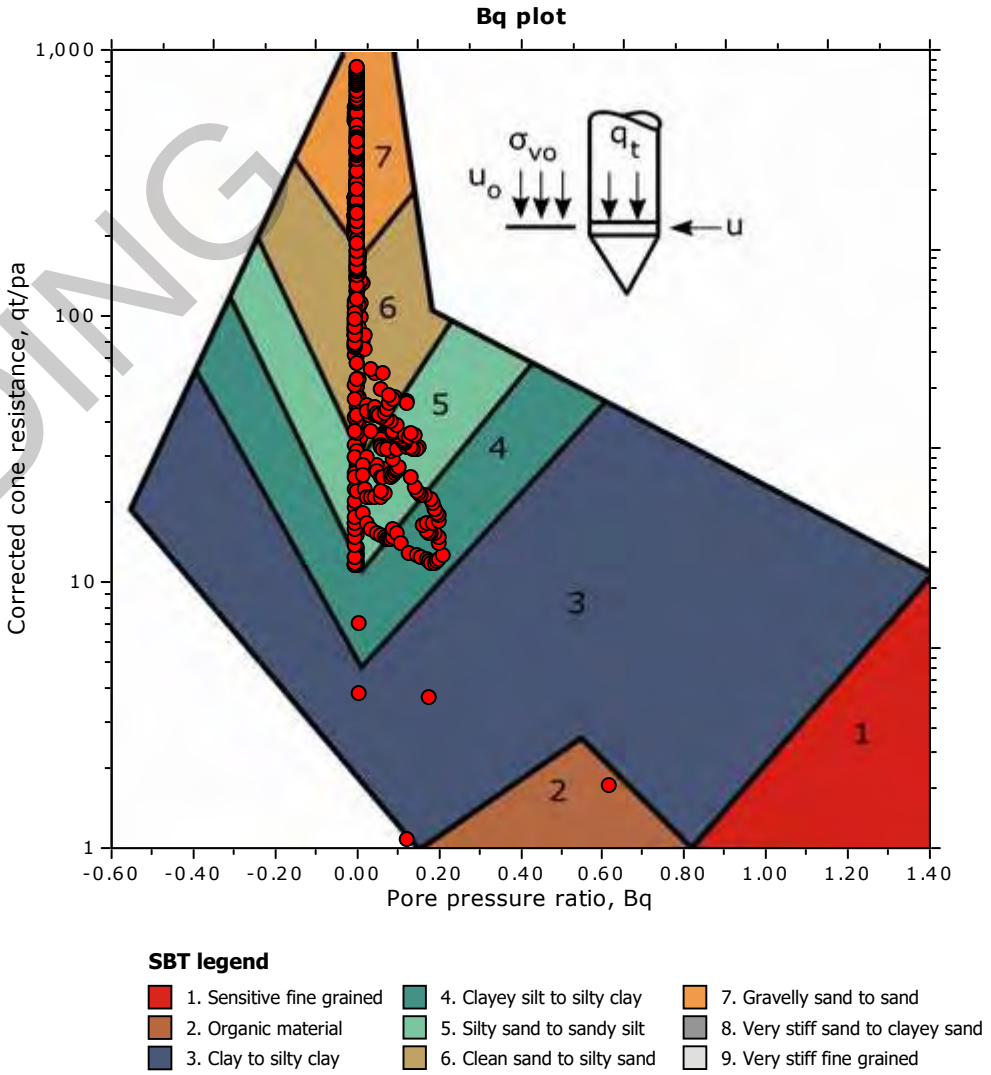
NOT FOR BIDDING

The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).



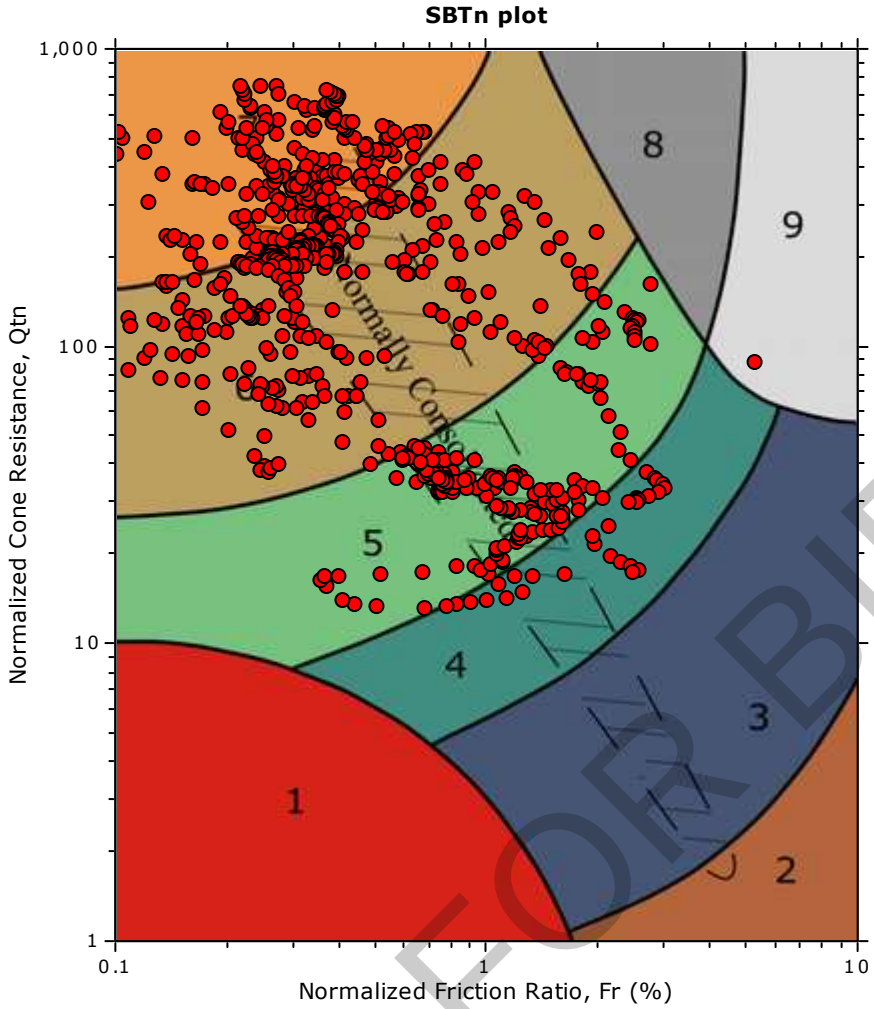
SBT - Bq plots

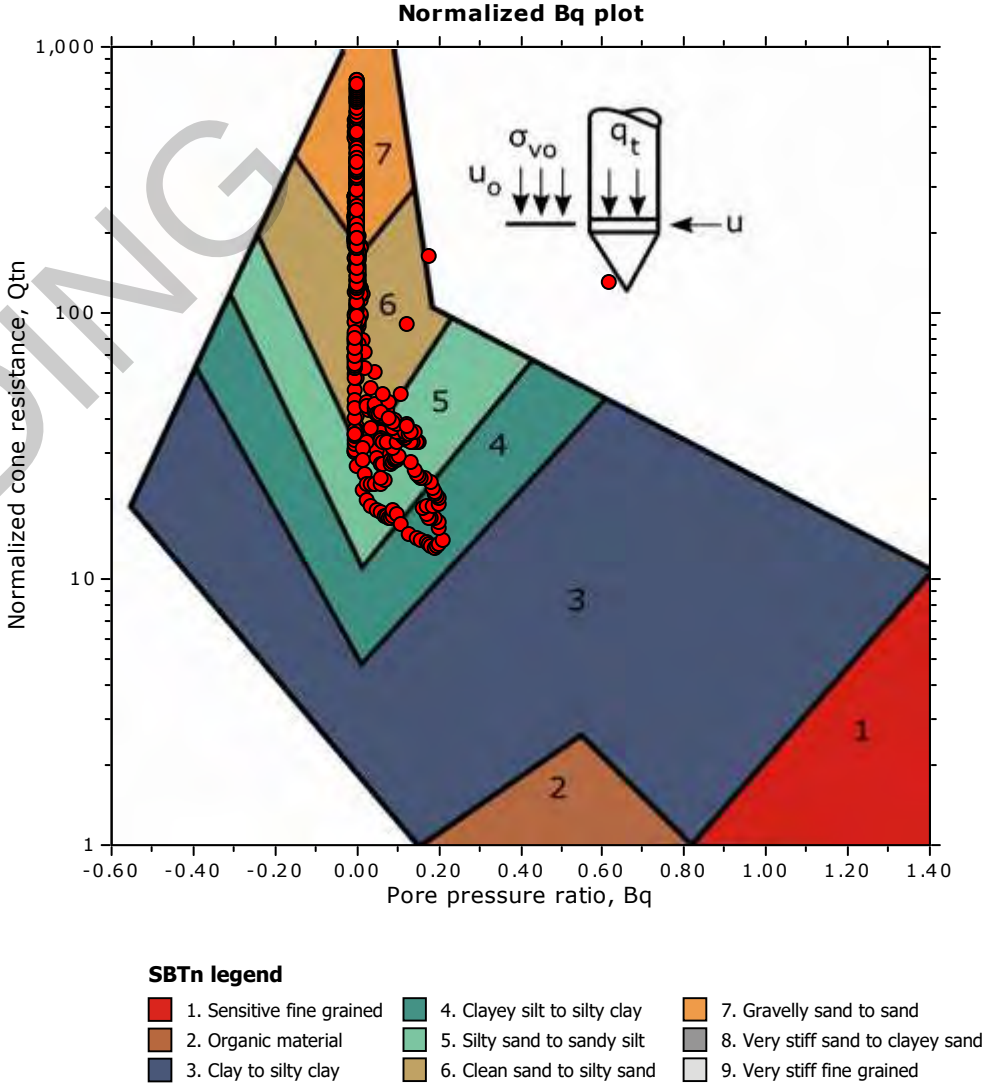




NOT FOR BIDDING

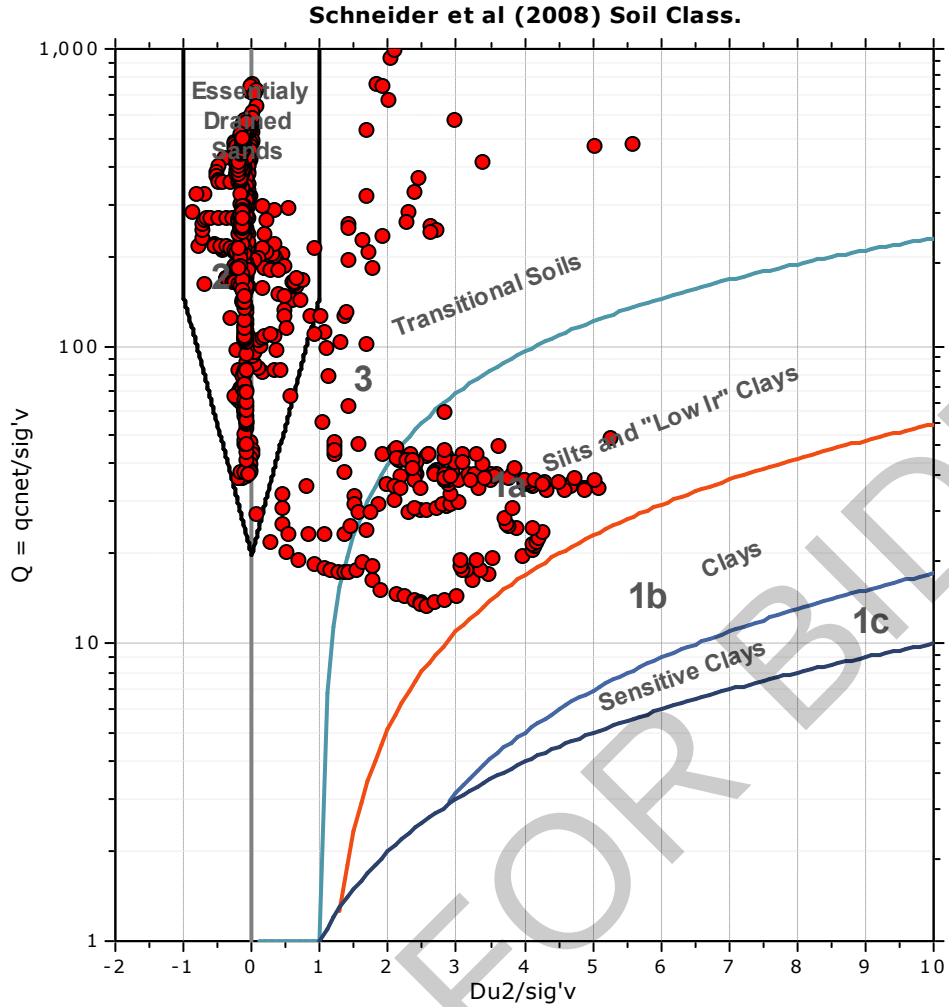
SBT - Bq plots (normalized)

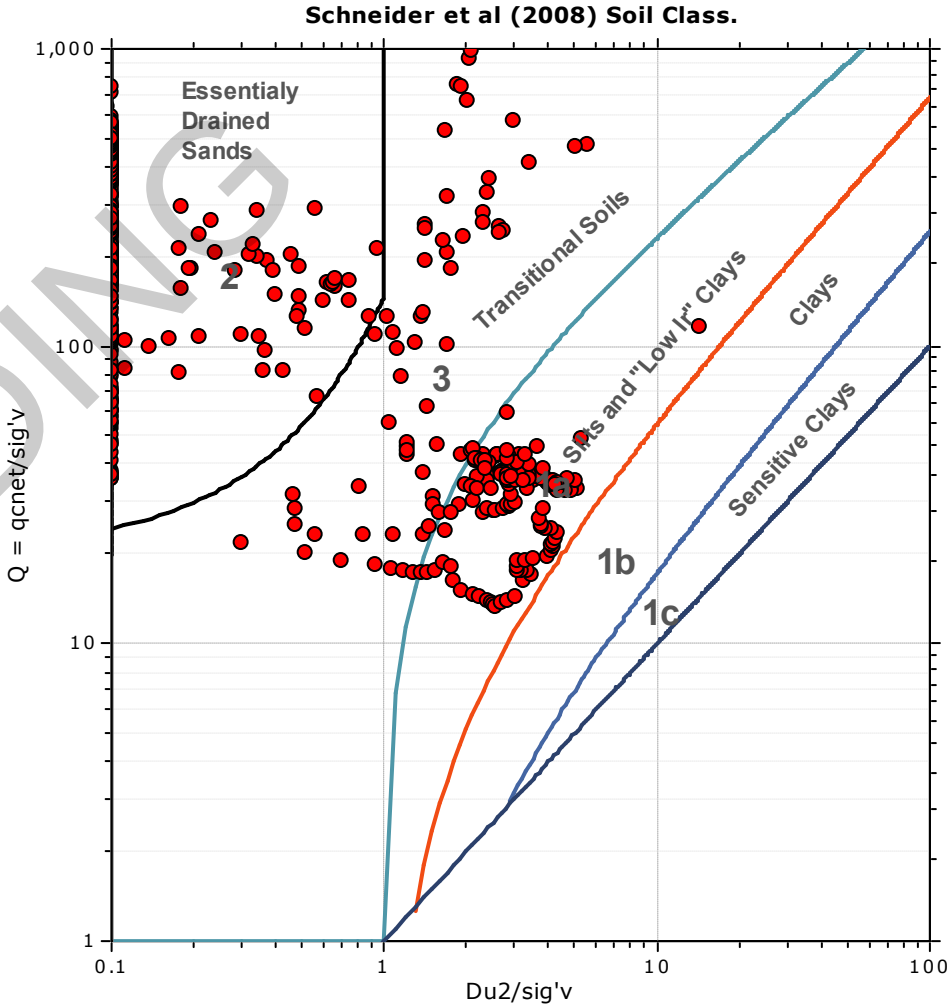




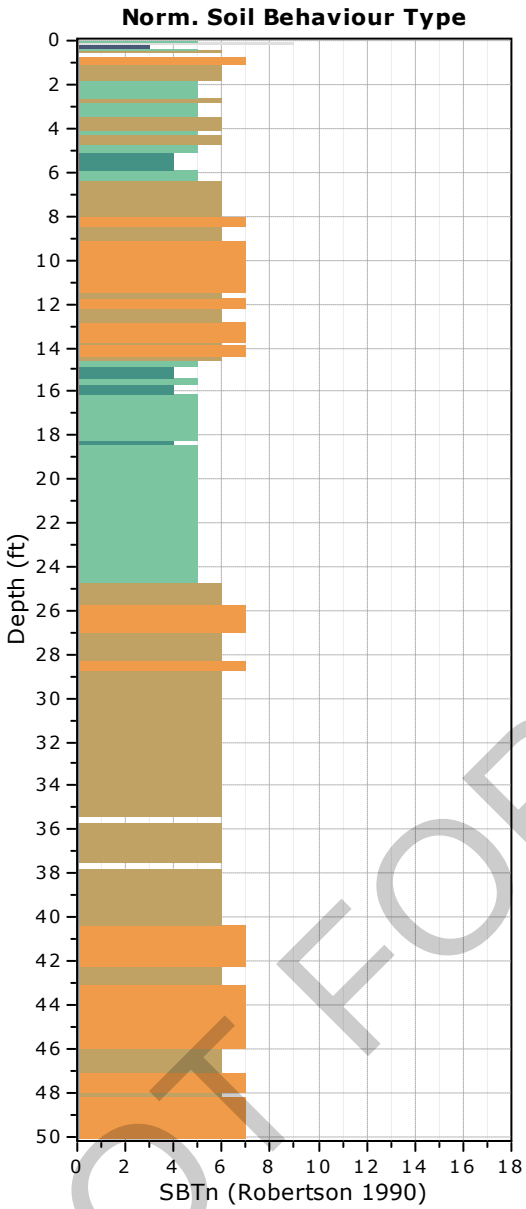
NOT FOR BIDDING

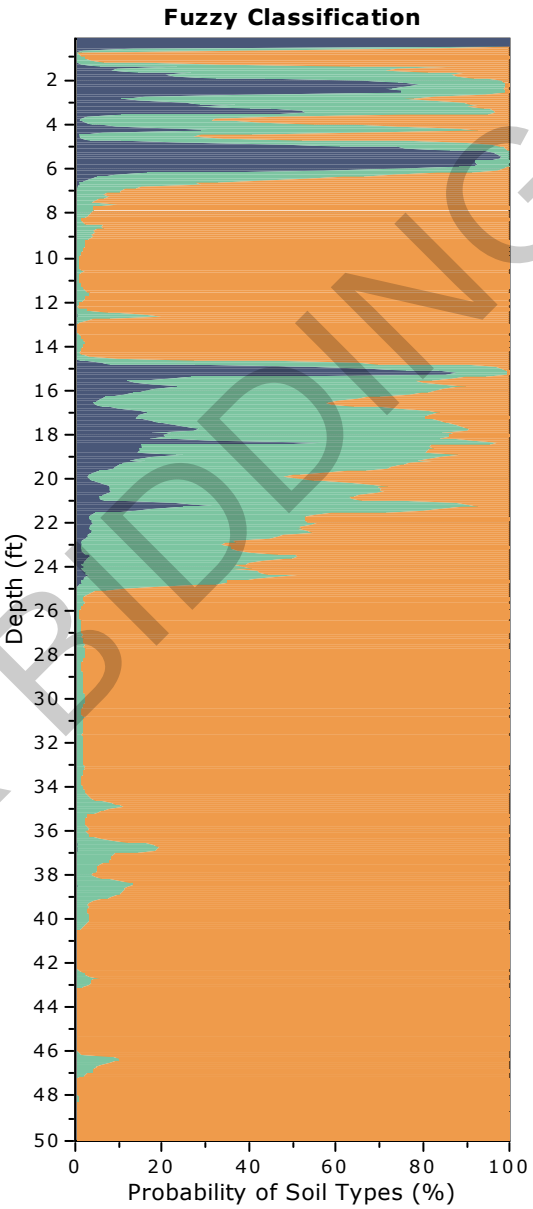
Bq plots (Schneider)





NOT FOR BIDDING





Fuzzy classifiaction legend

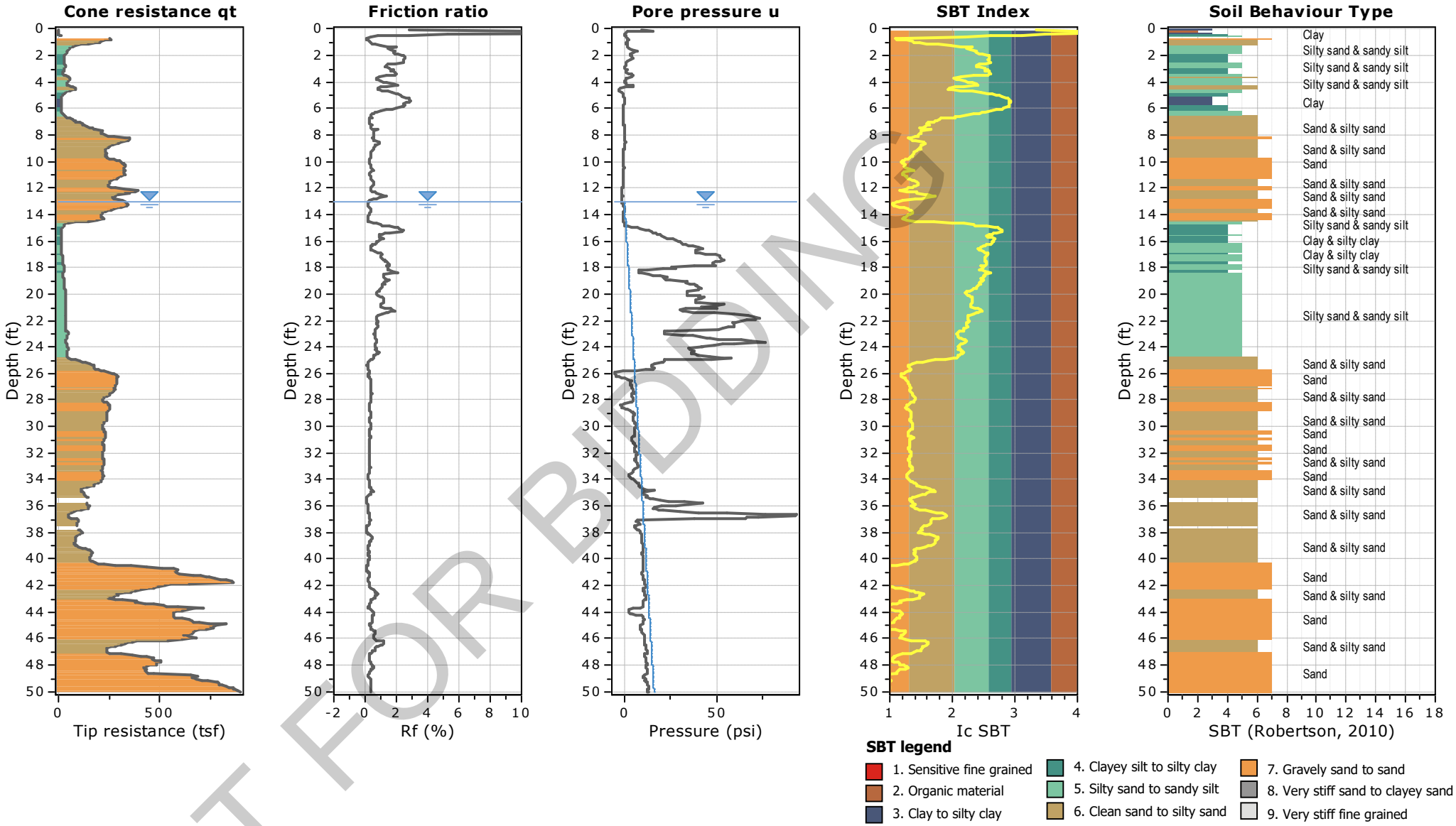
- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

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Project: - Leg Hall Project
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CPT: CPT-5
Total depth: 50.04 ft, Date: 12/24/2024
Surface Elevation: 17.00 ft
Coords: N 0.0, E 0.0
Cone Type: NOVA U2
Cone Operator: R. Ward, P.E., F.Garcia, P.E., D.GE.

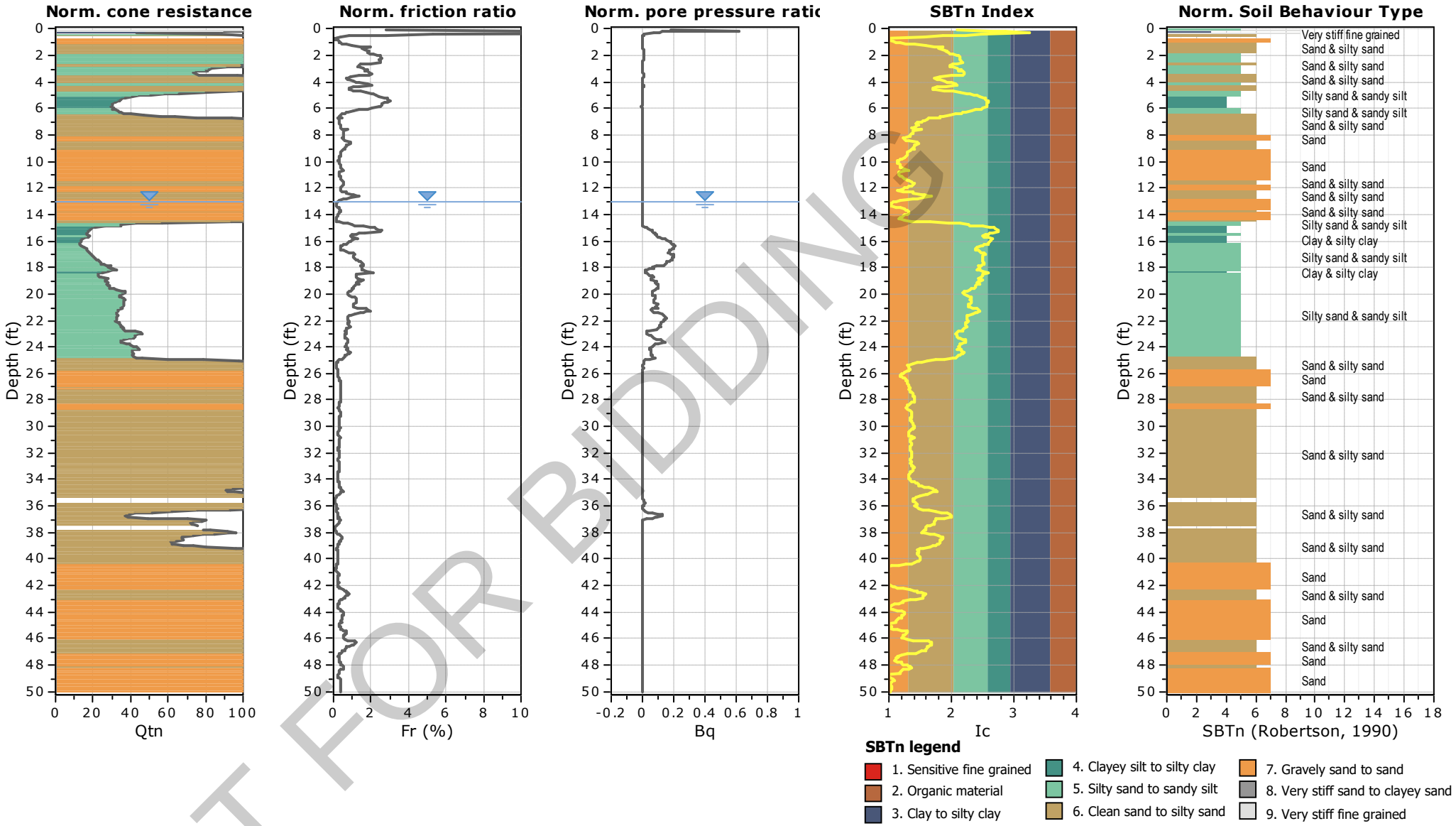


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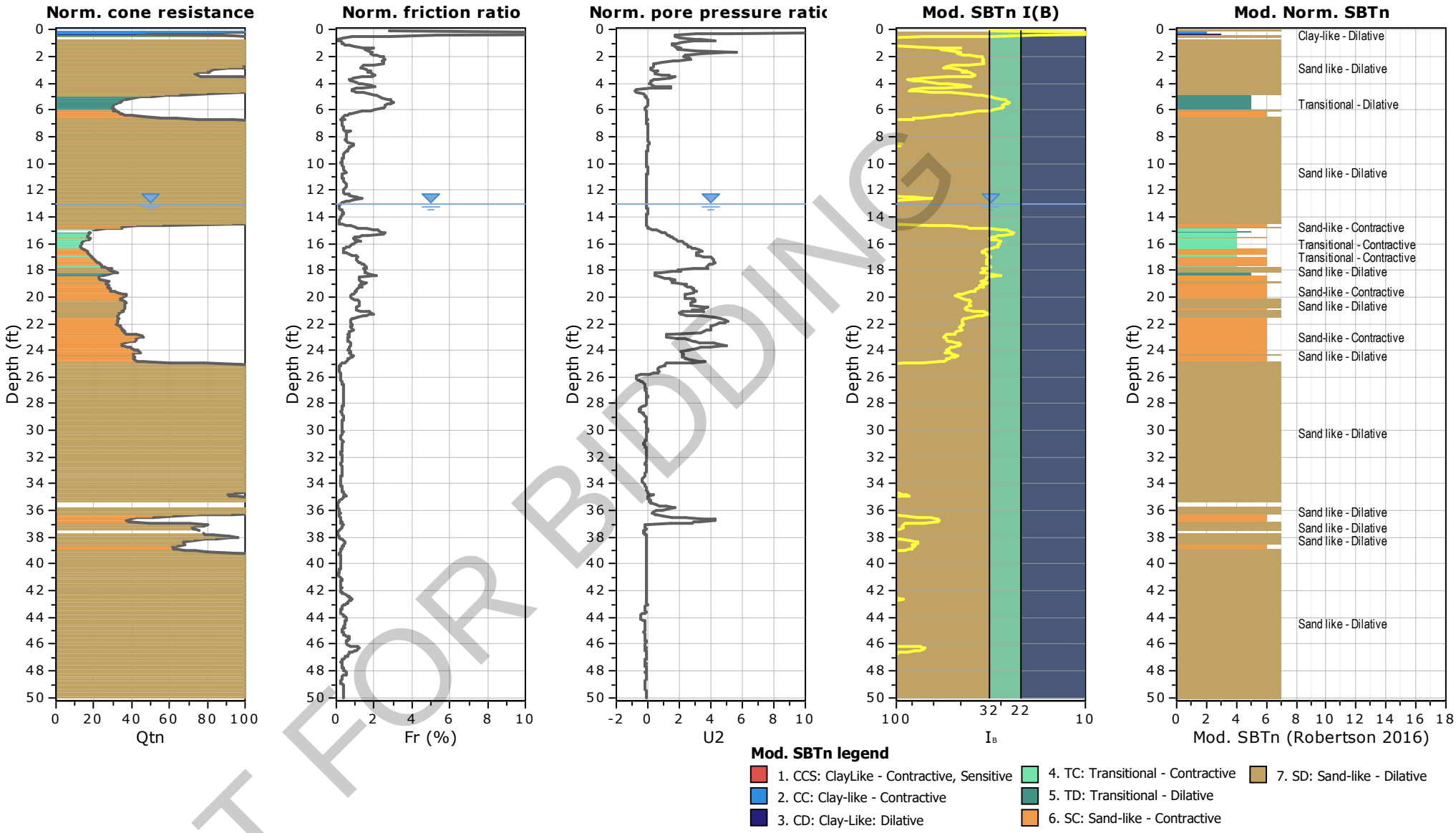


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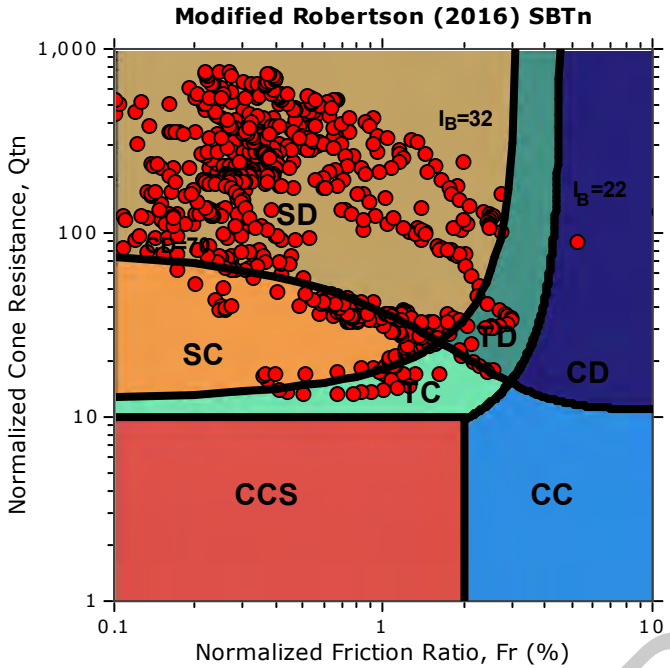
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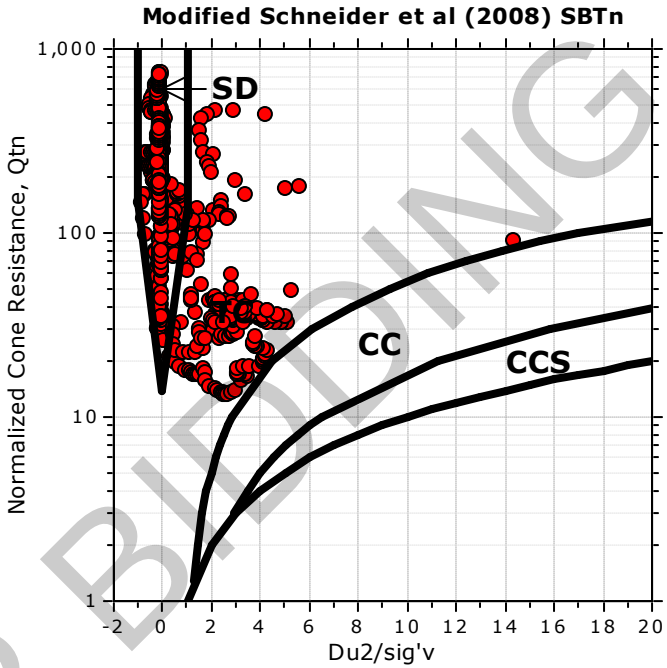
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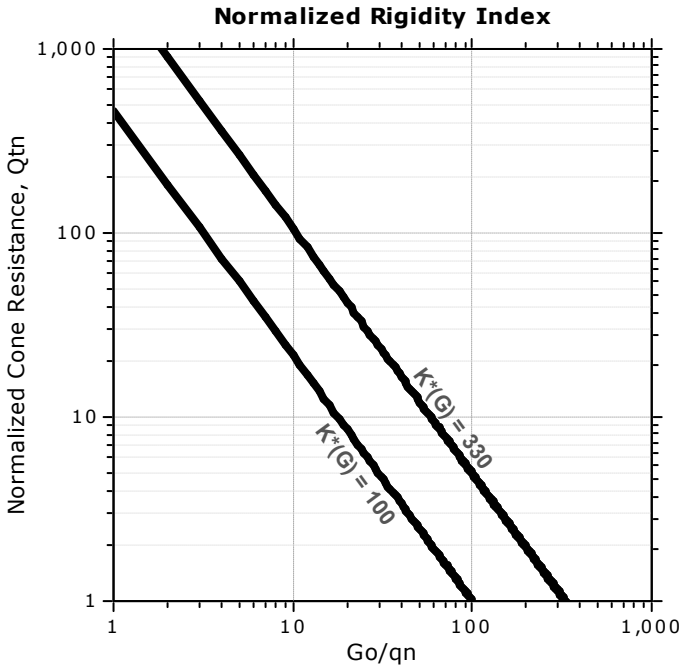


NOT FOR BIDDING

Updated SBTn plots







CCS: Clay-like - Contractive - Sensitive
CC: Clay-like - Contractive
CD: Clay-like - Dilative
TC: Transitional - Contractive
TD: Transitional - Dilative
SC: Sand-like - Contractive
SD: Sand-like - Dilative

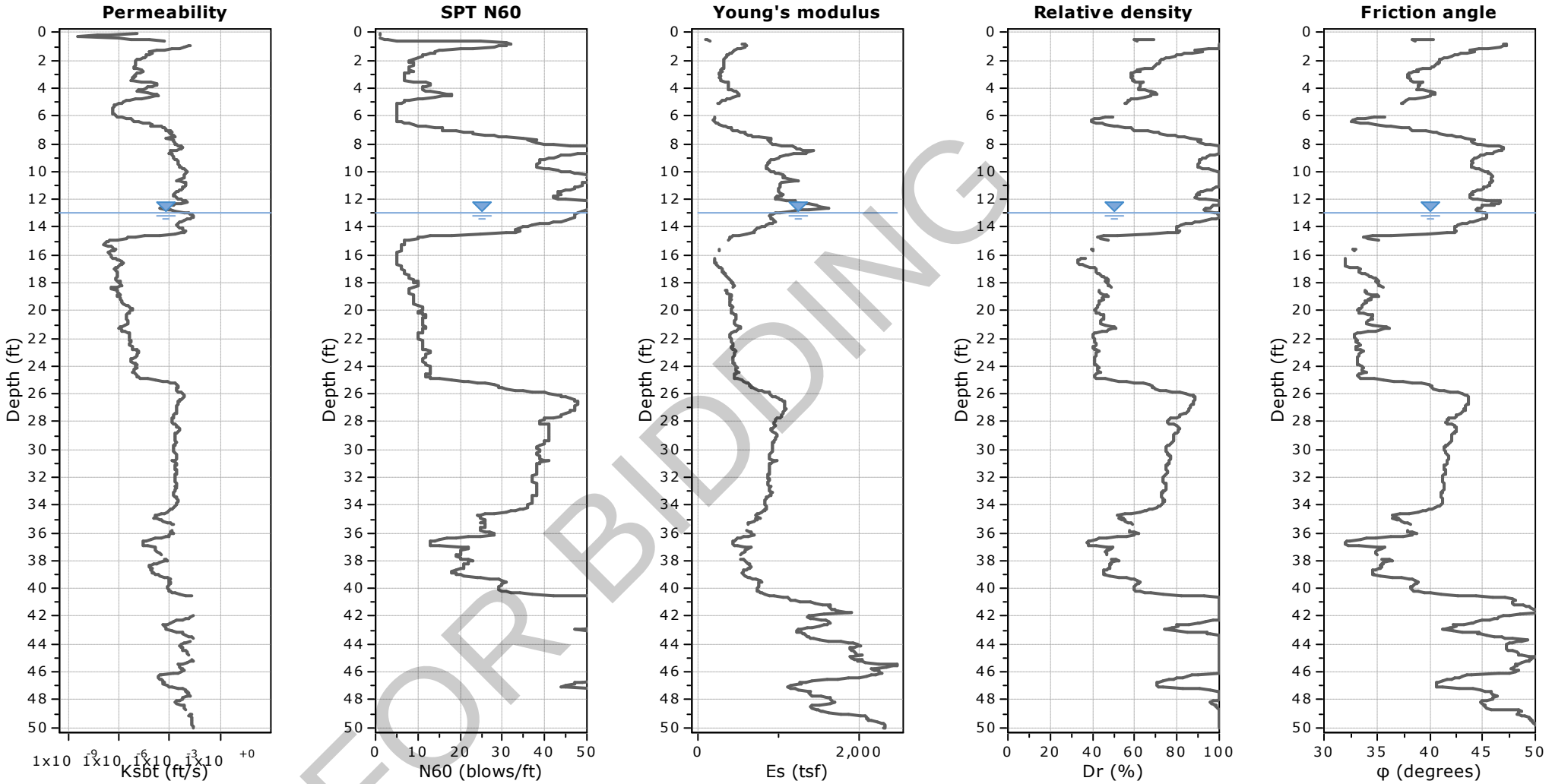
K(G) > 330: Soils with significant microstructure (e.g. age/cementation)

NOT FOR BIDDING

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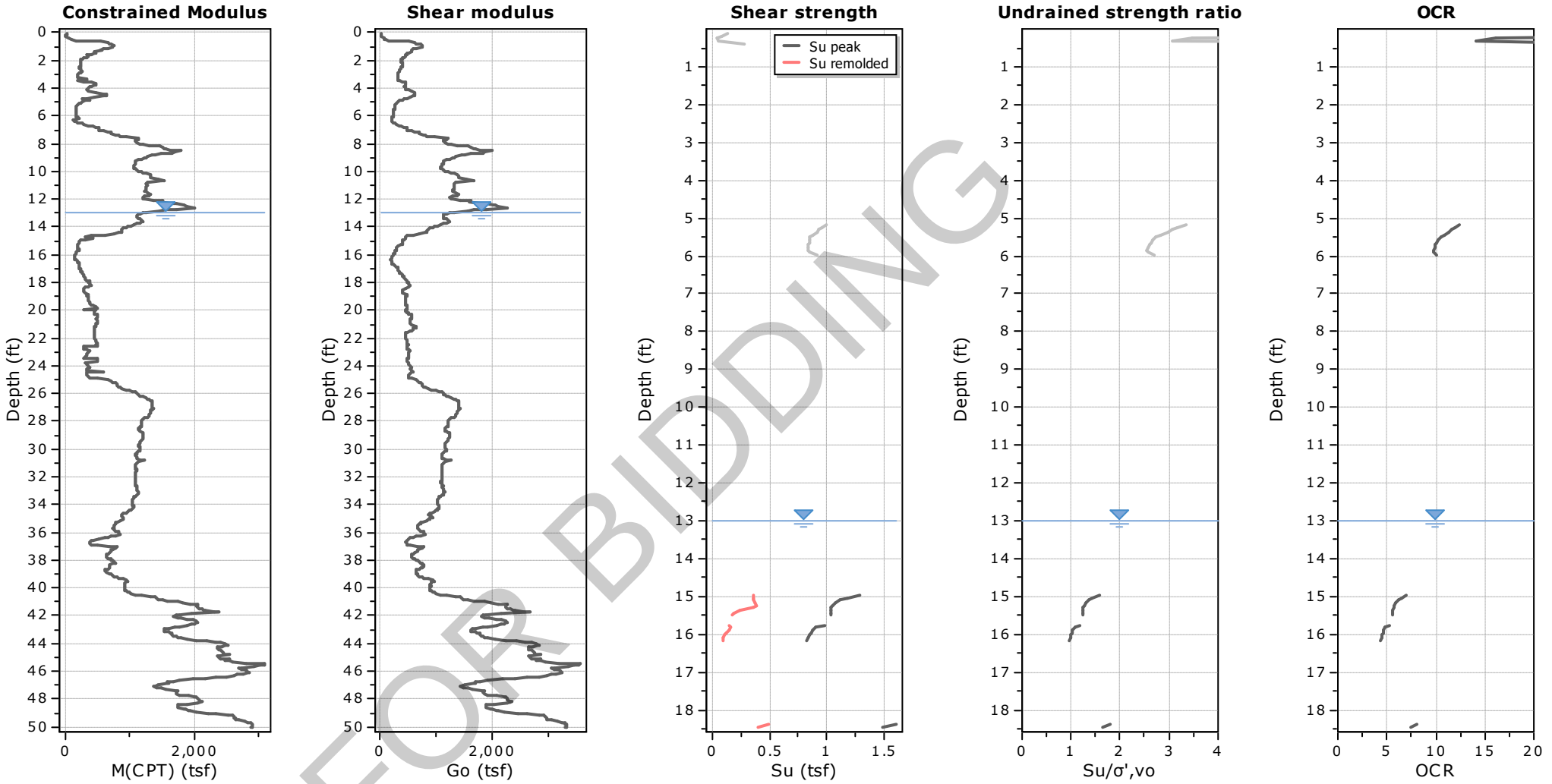
NOT FOR BIDDING

Calculation parameters
Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

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Project: - Leg Hall Project
Location: Dover, Delaware

CPT: CPT-5
Total depth: 50.04 ft, Date: 12/24/2024
Surface Elevation: 17.00 ft
Coords: N 0.0, E 0.0
Cone Type: NOVA U2
Cone Operator: R. Ward, P.E., F.Garcia, P.E., D.GE.



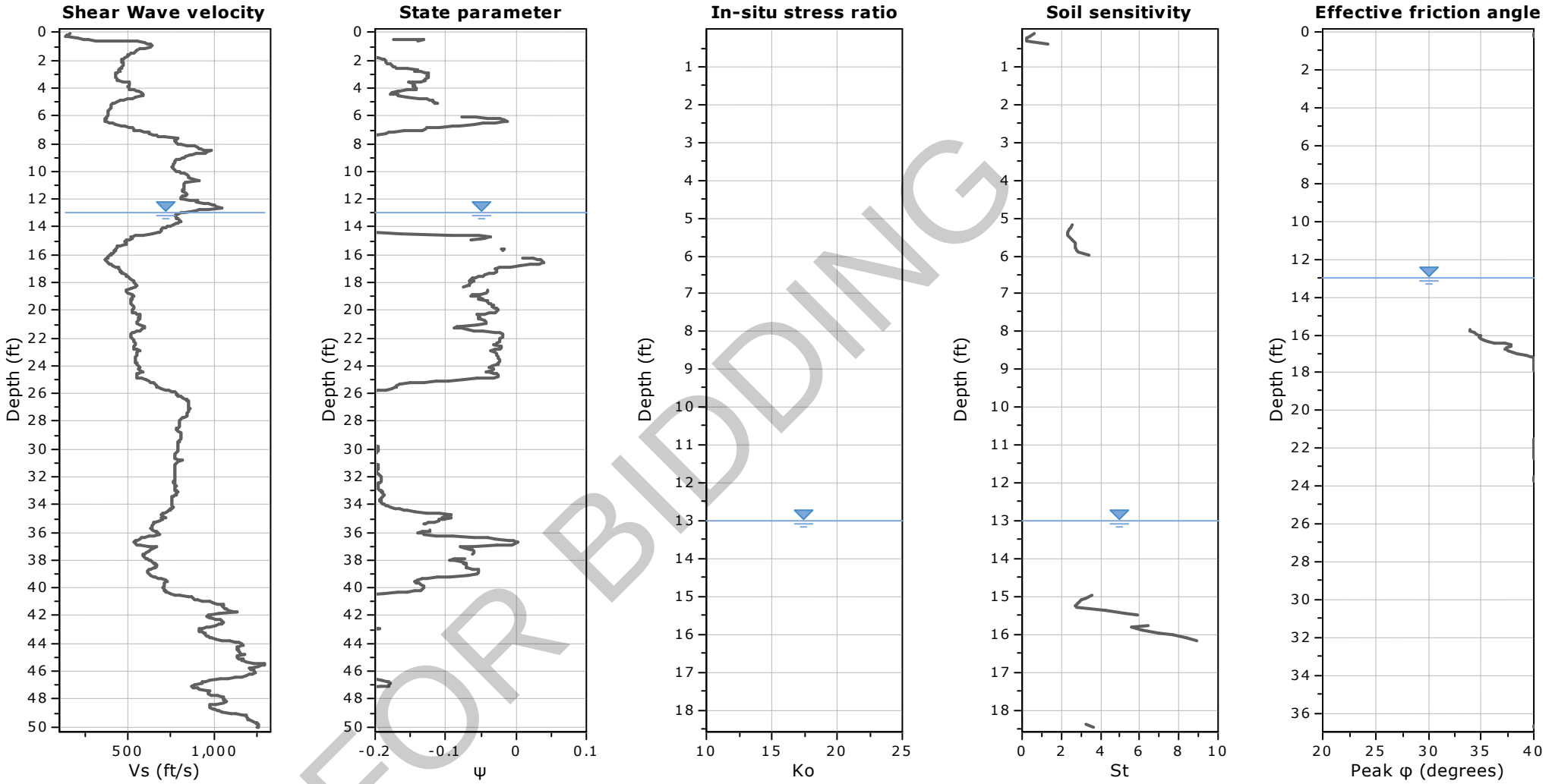
NOT FOR BIDDING

Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

Project: - Leg Hall Project
Location: Dover, Delaware

CPT: CPT-5
Total depth: 50.04 ft, Date: 12/24/2024
Surface Elevation: 17.00 ft
Coords: N 0.0, E 0.0
Cone Type: NOVA U2
Cone Operator: R. Ward, P.E., F.Garcia, P.E., D.GE.



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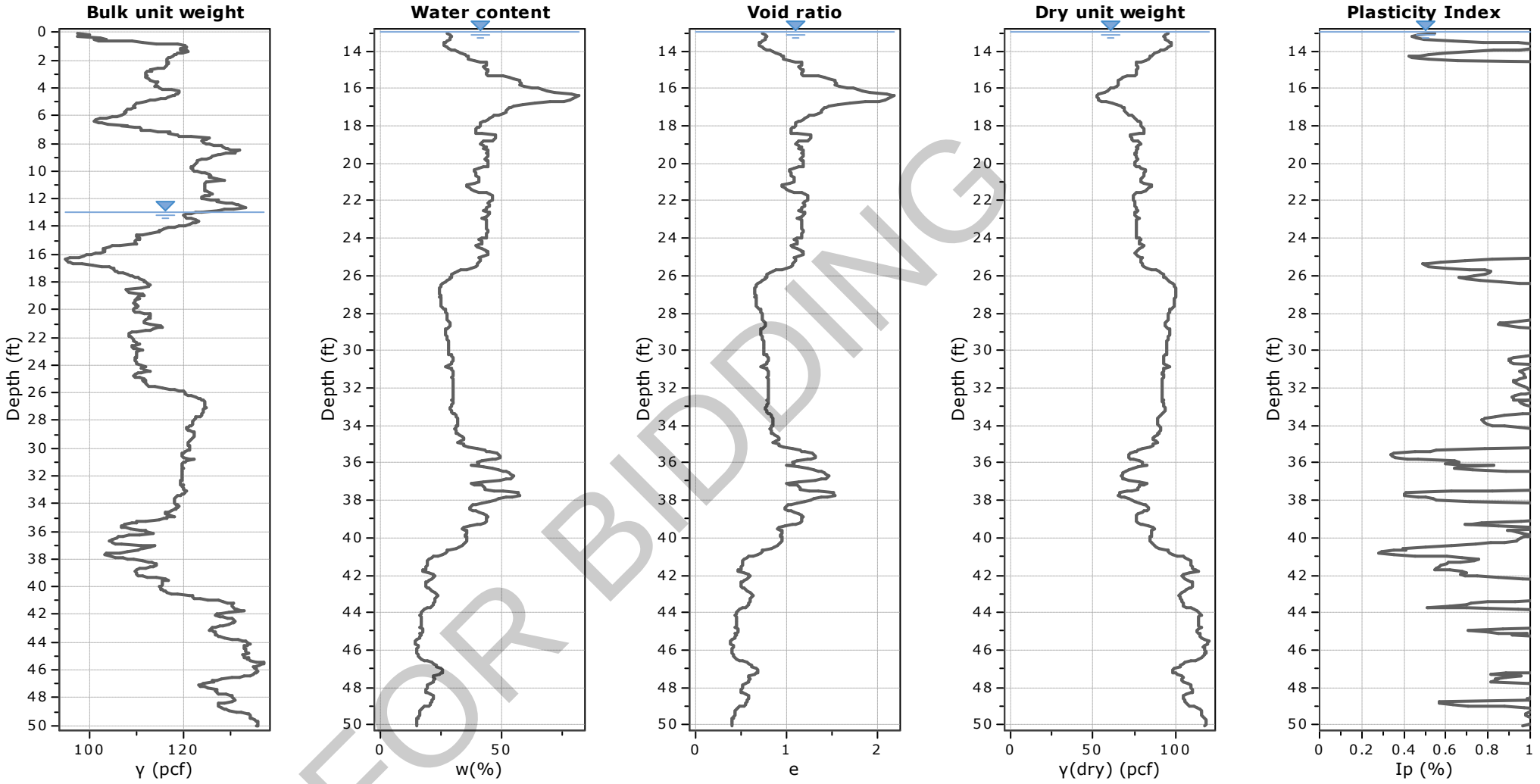
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

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Surface Elevation: 17.00 ft
Coords: N 0.0, E 0.0
Cone Type: NOVA U2
Cone Operator: R. Ward, P.E., F.Garcia, P.E., D.GE.

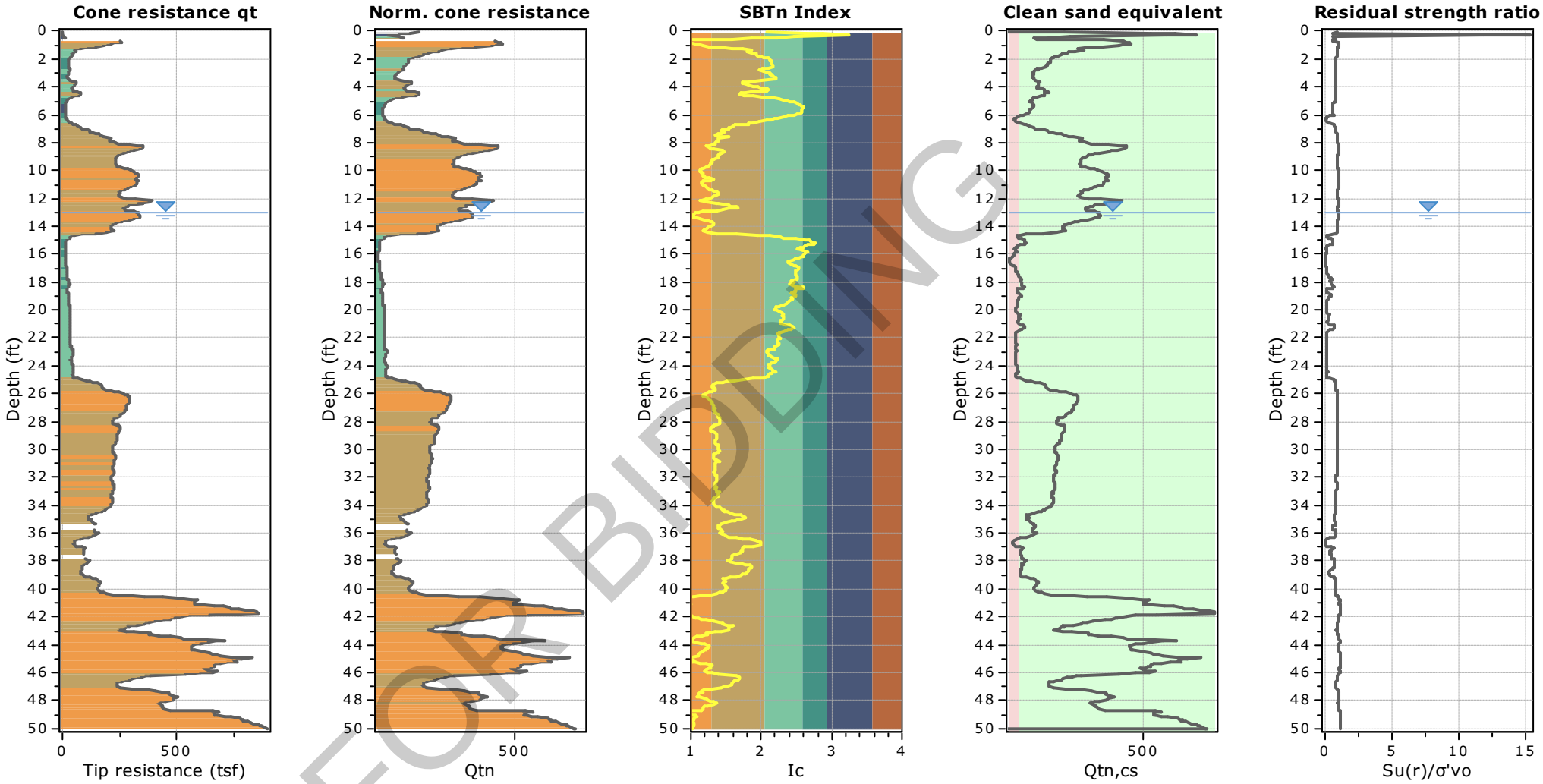


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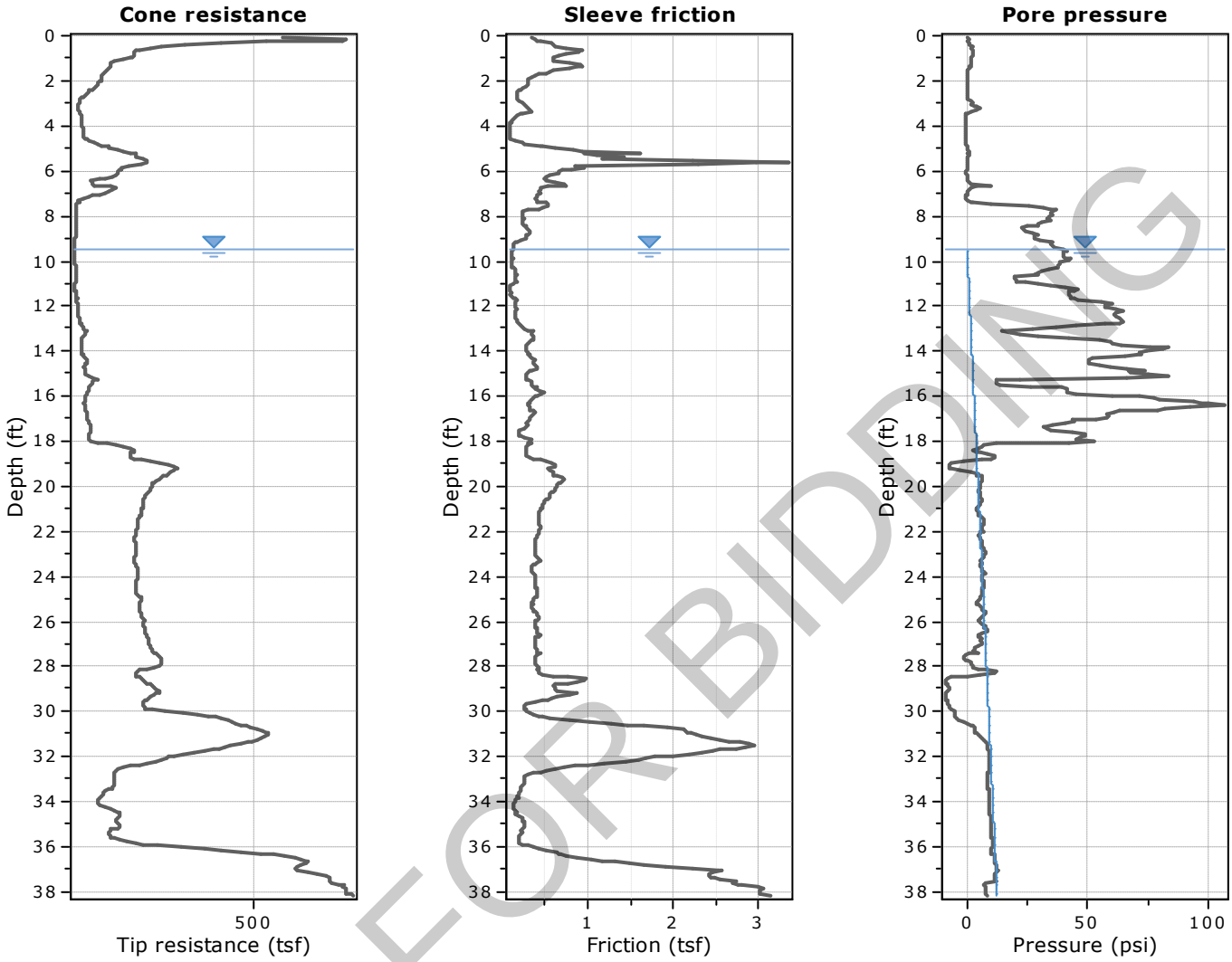


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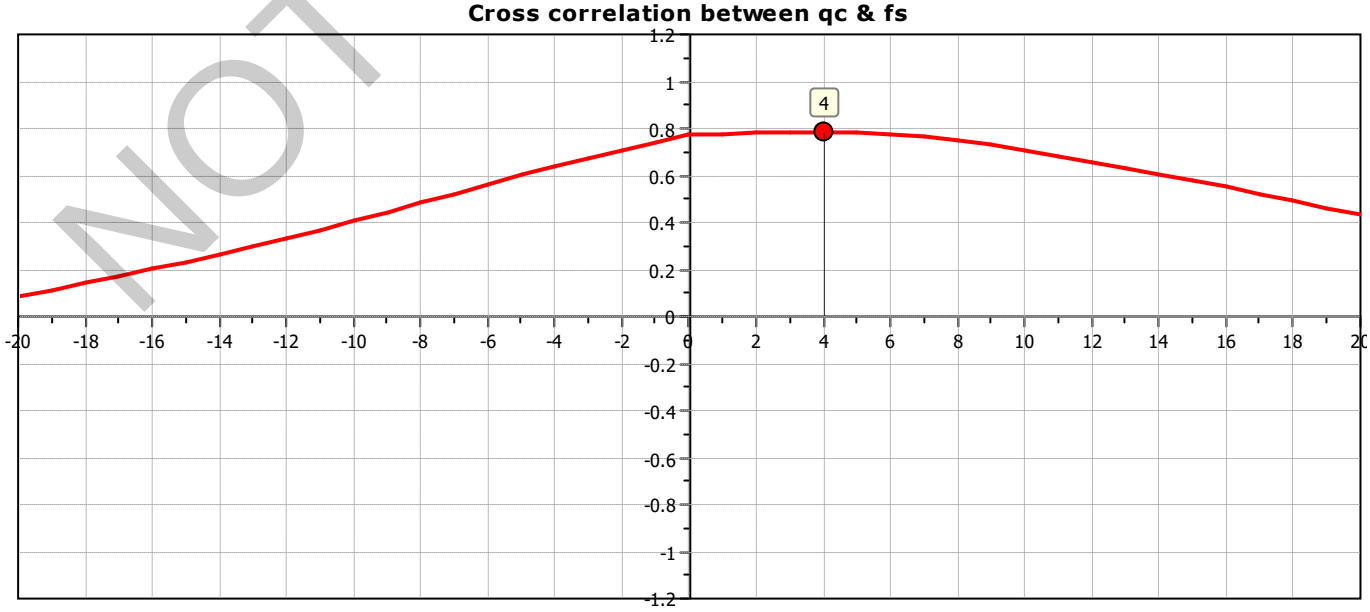
CPT: CPT-6
Total depth: 38.17 ft, Date: 12/24/2024
Surface Elevation: 11.00 ft
Coords: N 0.0, E 0.0
Cone Type: NOVA U2
Cone Operator: R. Ward, P.E., F.Garcia, P.E., D.GE.

Project: - Leg Hall Project
Location: Dover, Delaware

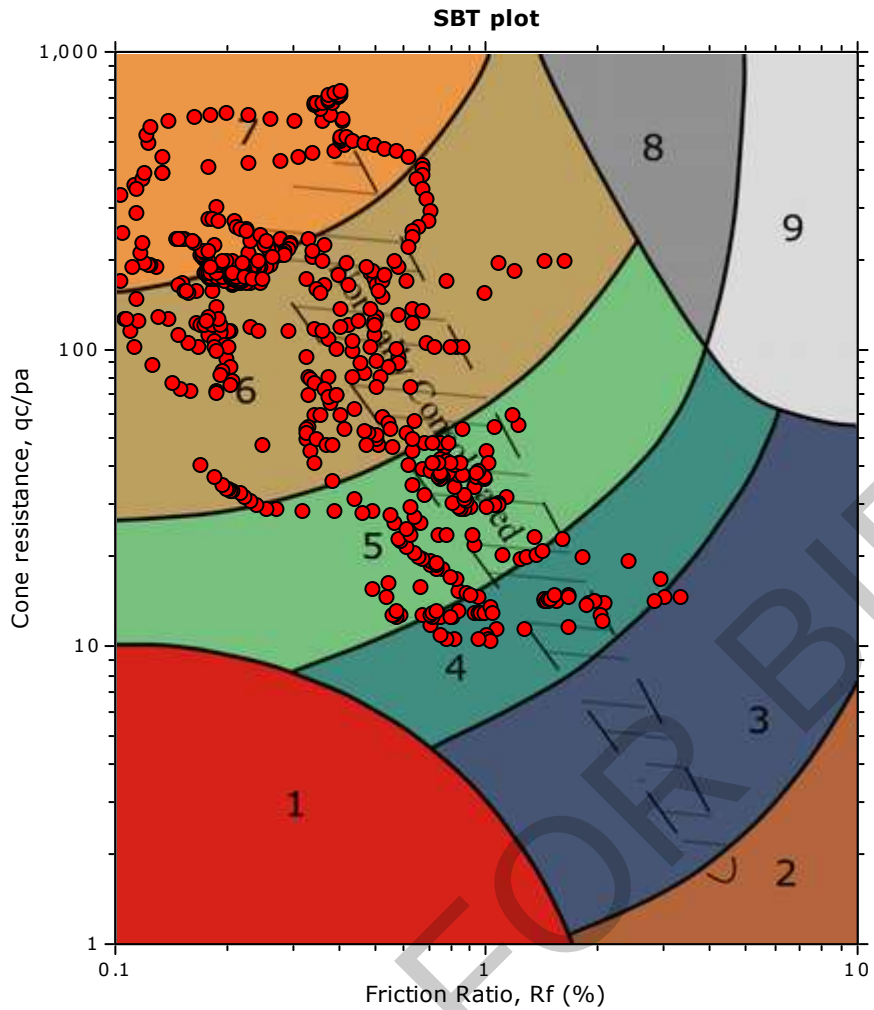


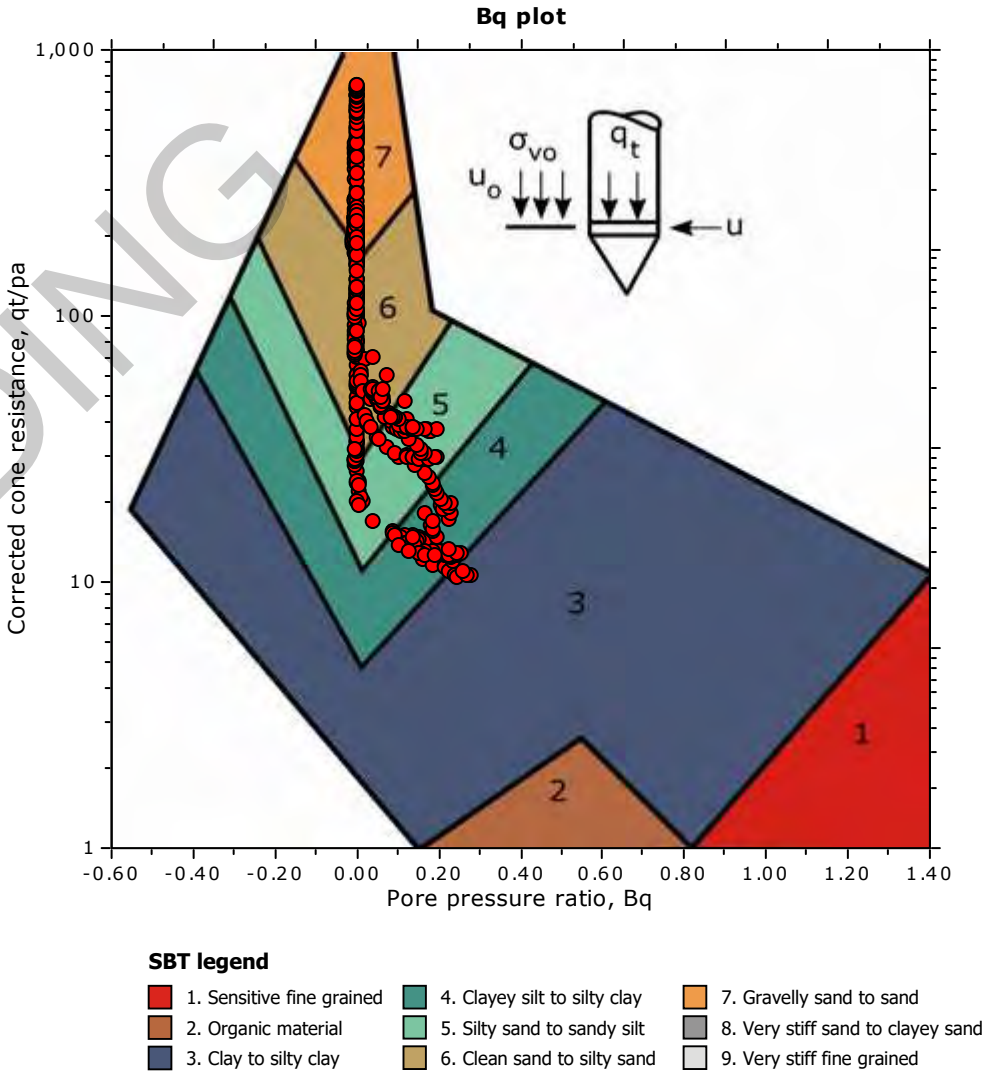
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The plot below presents the cross correlation coeficient between the raw qc and fs values (as measured on the field). X axes presents the lag distance (one lag is the distance between two sucessive CPT measurements).



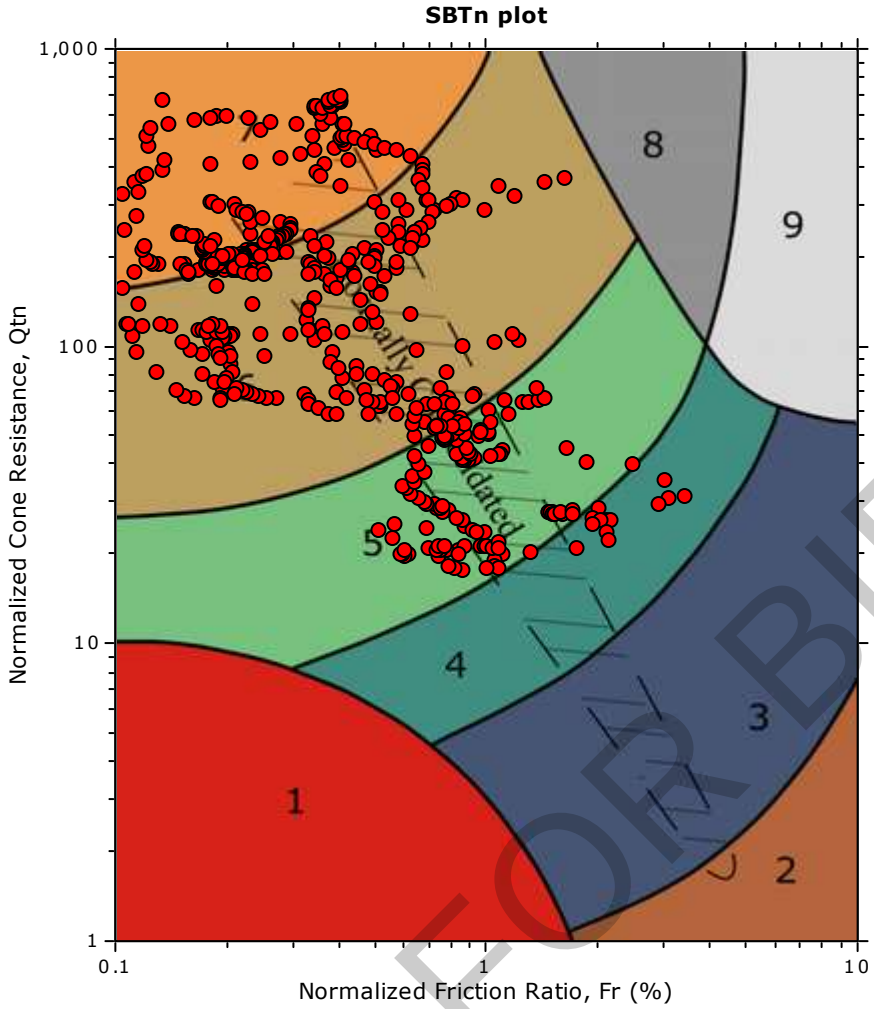
SBT - Bq plots

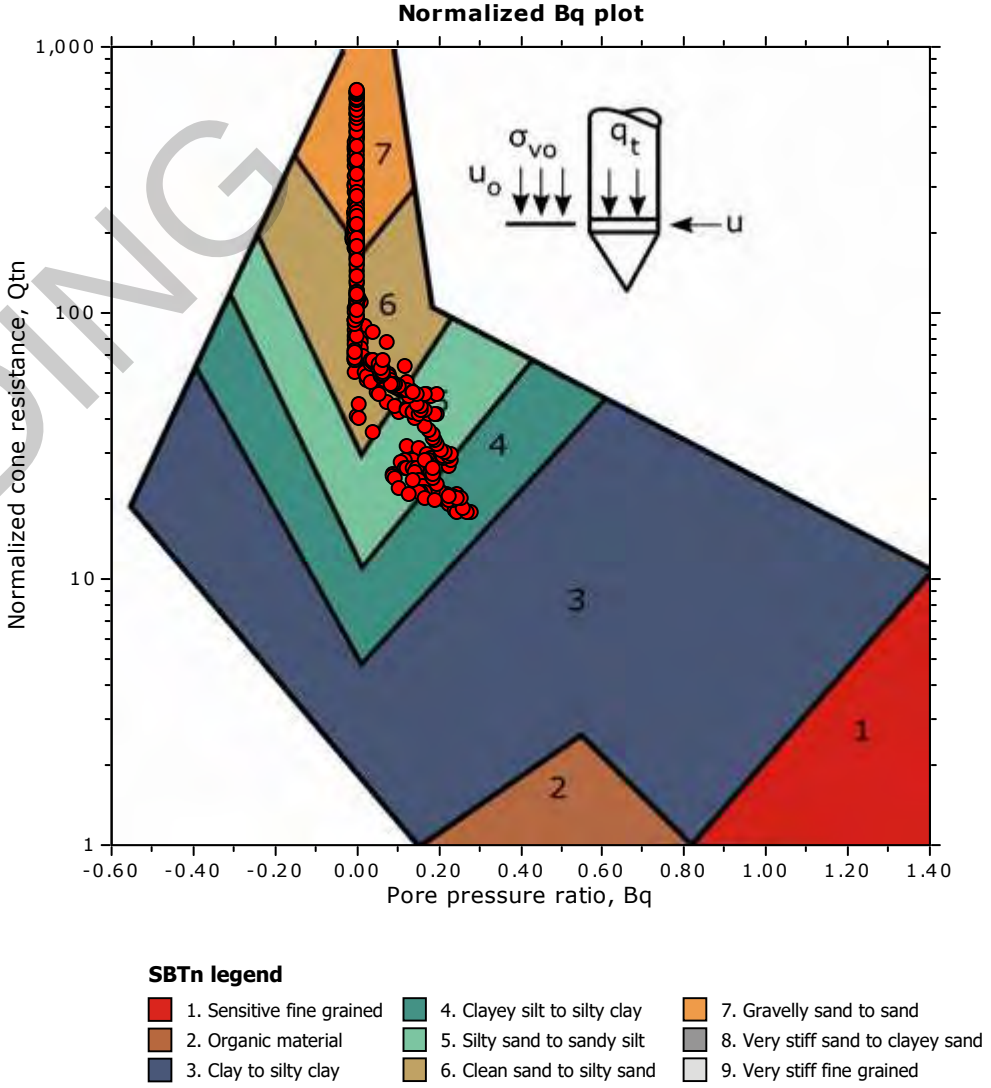




NOT FOR BIDDING

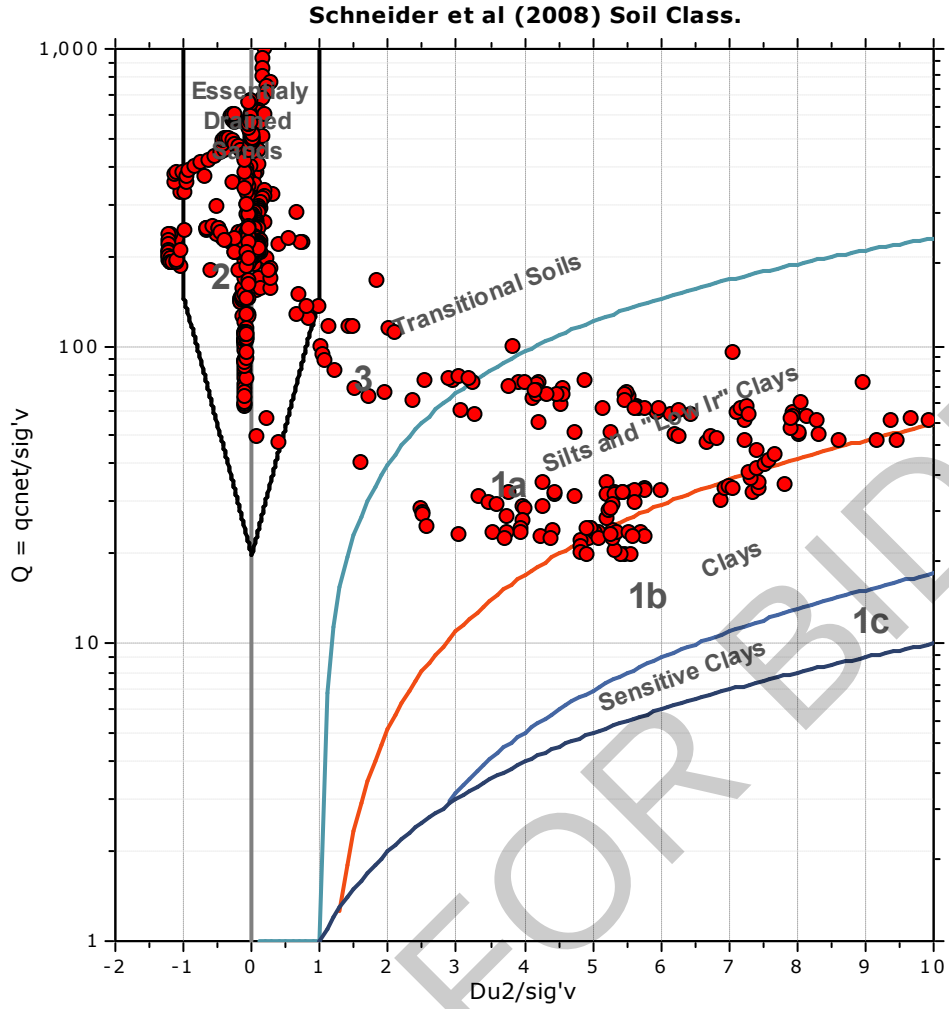
SBT - Bq plots (normalized)

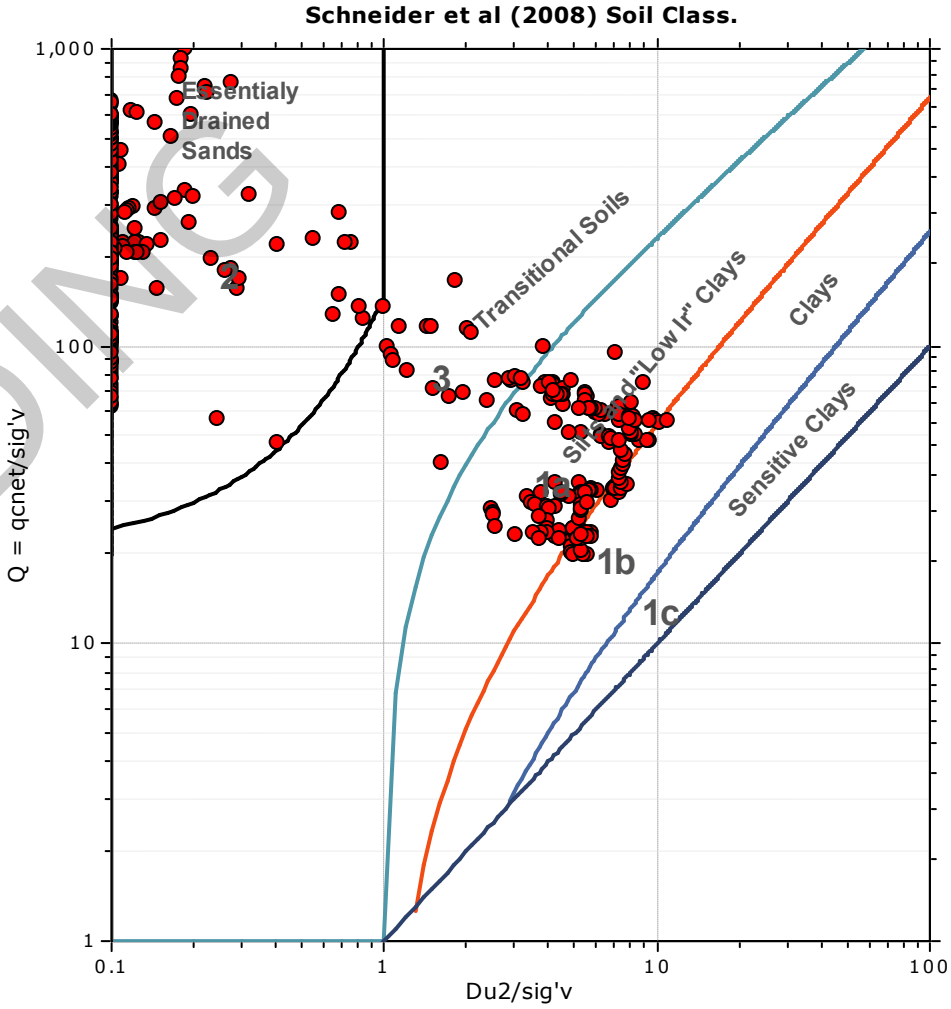




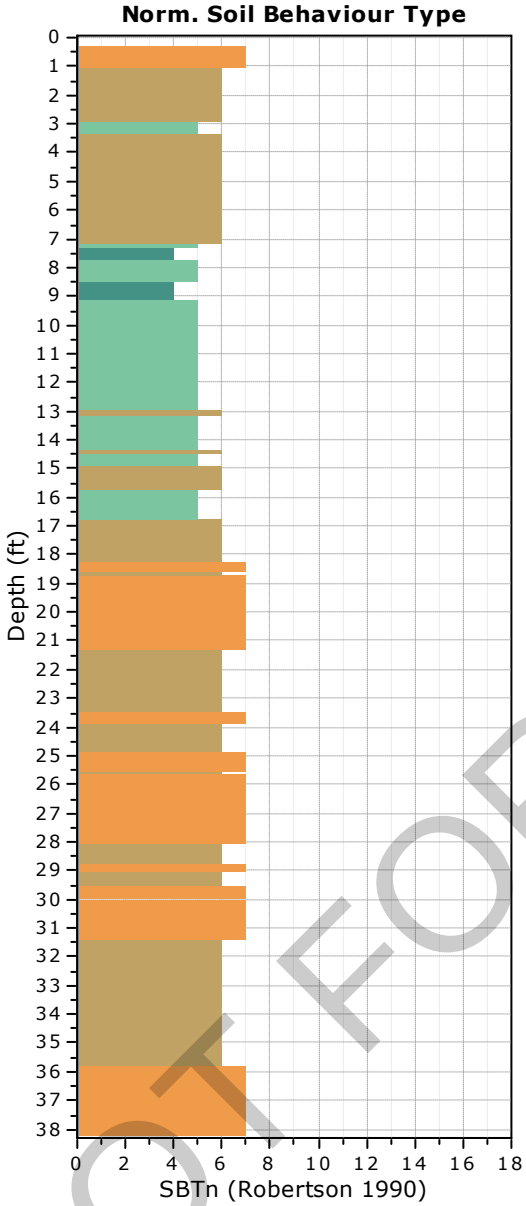
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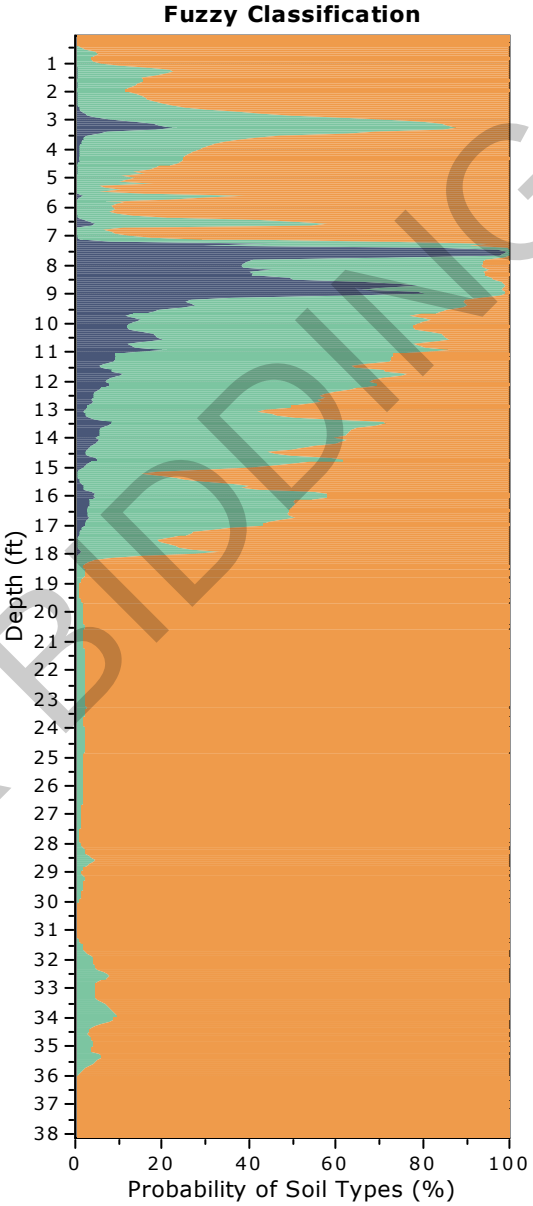
Bq plots (Schneider)





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Fuzzy classifiaction legend

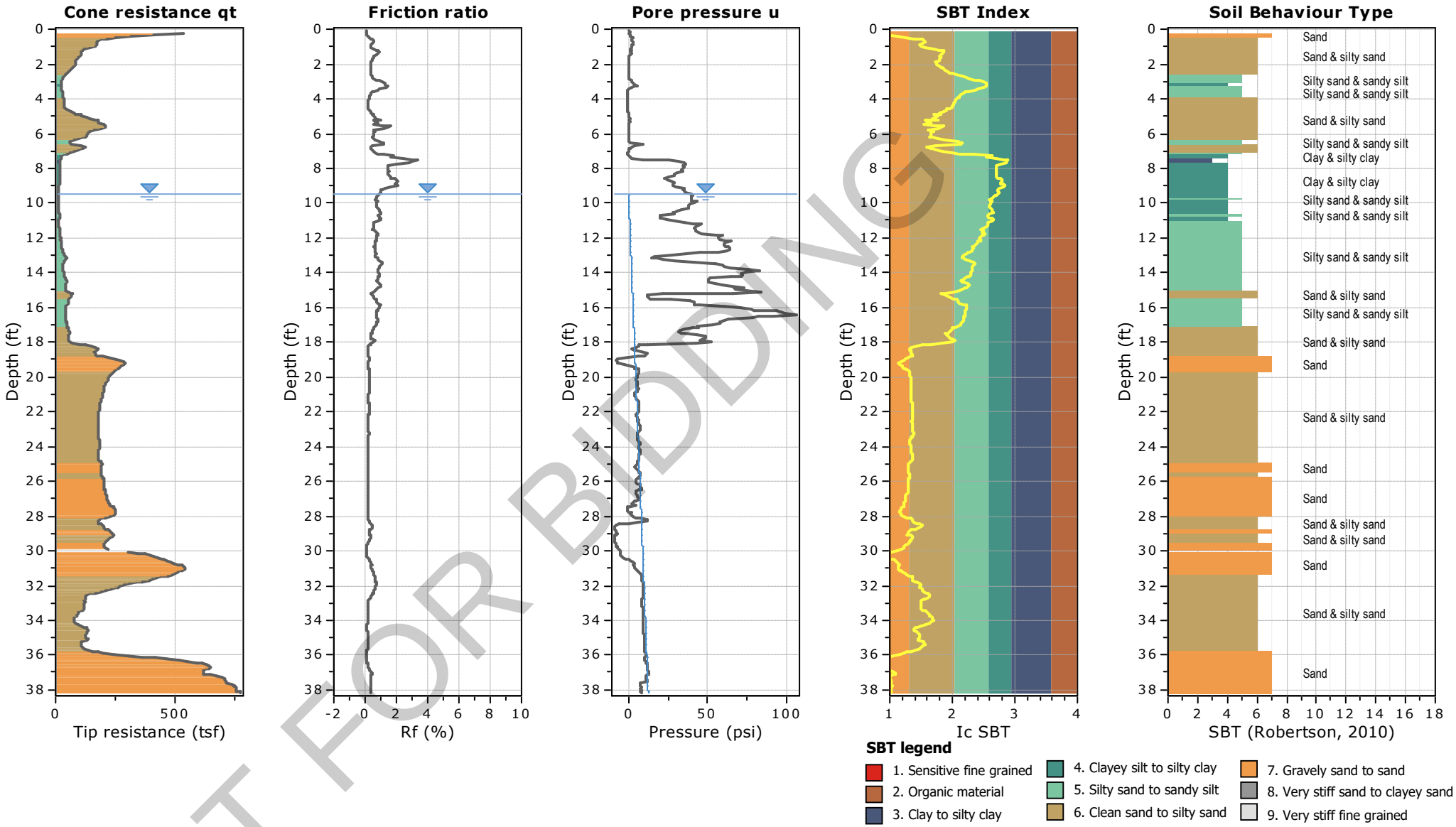
- Highly probable clayey soil
- Highly probable mixture soil
- Highly probable sandy soil

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Cone Type: NOVA U2
Cone Operator: R. Ward, P.E., F.Garcia, P.E., D.GE.

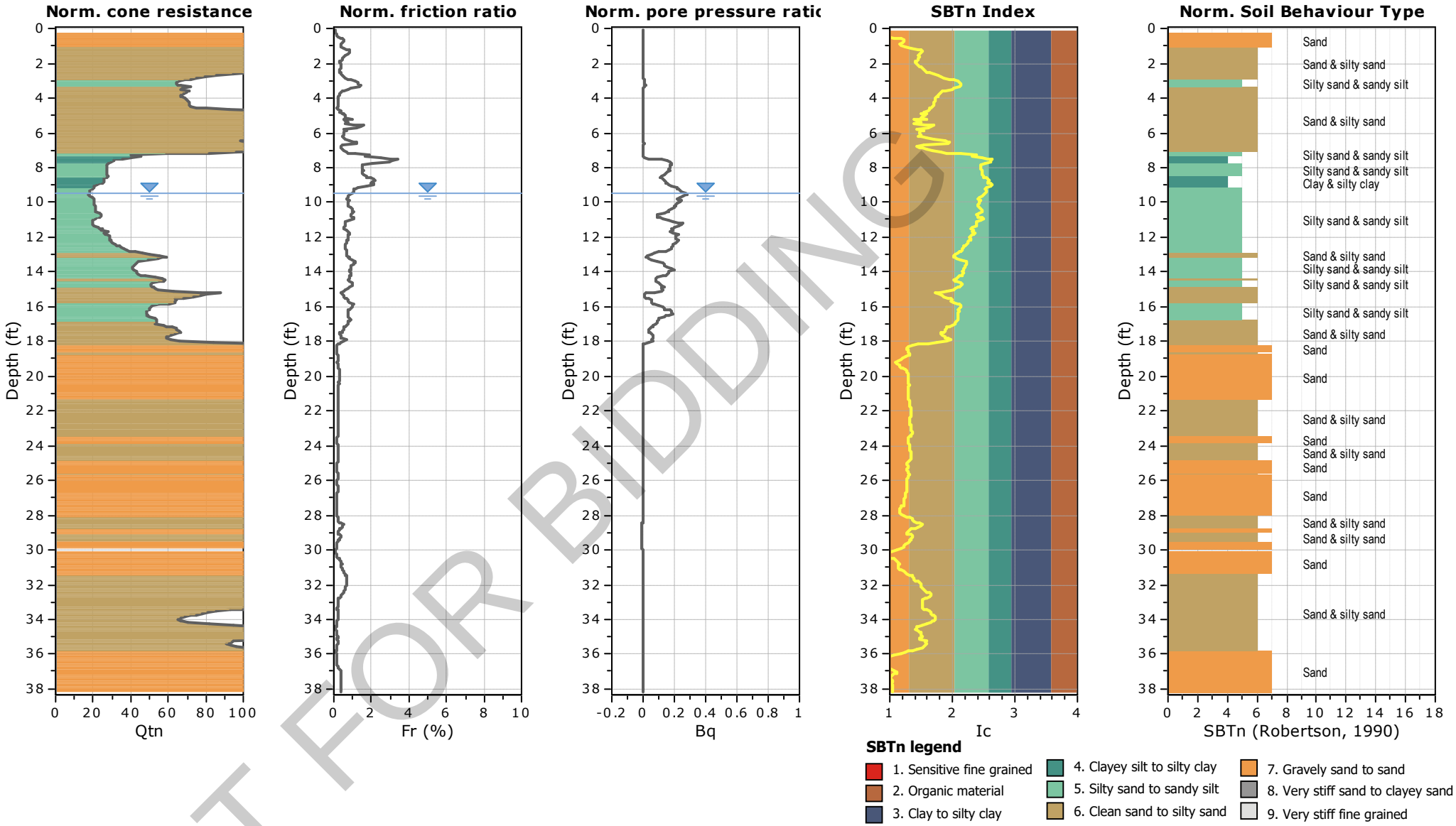


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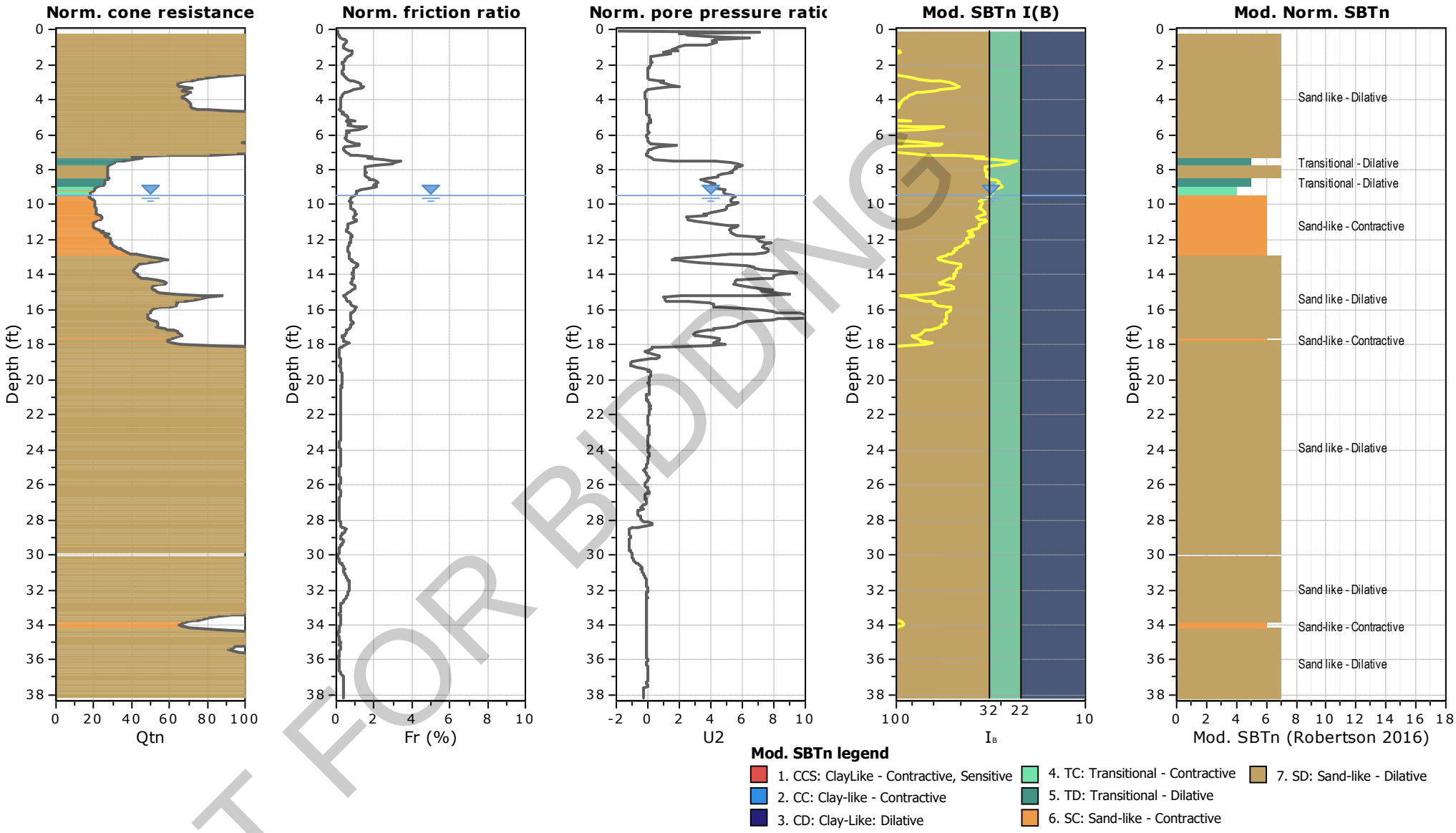


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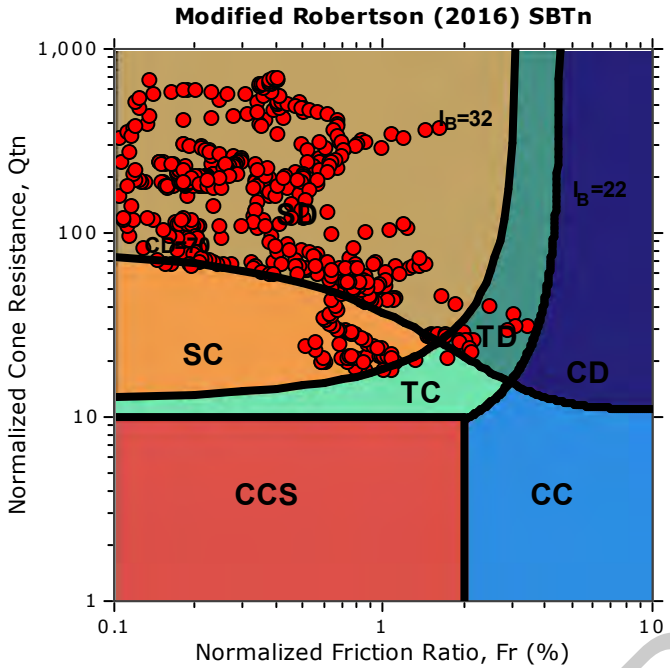
Project: - Leg Hall Project
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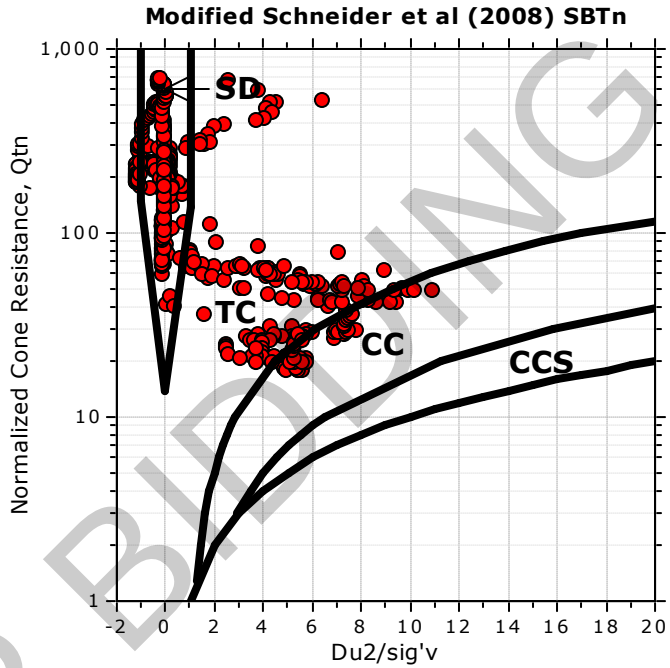
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Coords: N 0.0, E 0.0
Cone Type: NOVA U2
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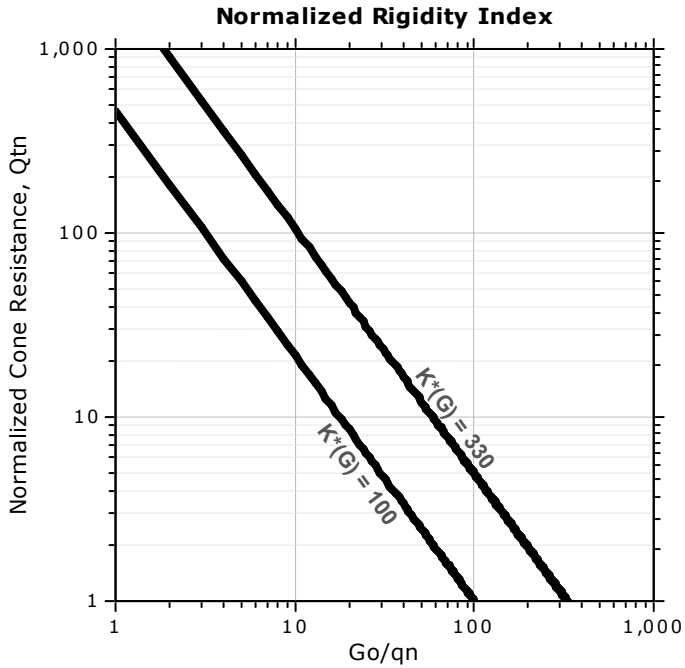


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Updated SBTn plots







CCS: Clay-like - Contractive - Sensitive
CC: Clay-like - Contractive
CD: Clay-like - Dilative
TC: Transitional - Contractive
TD: Transitional - Dilative
SC: Sand-like - Contractive
SD: Sand-like - Dilative

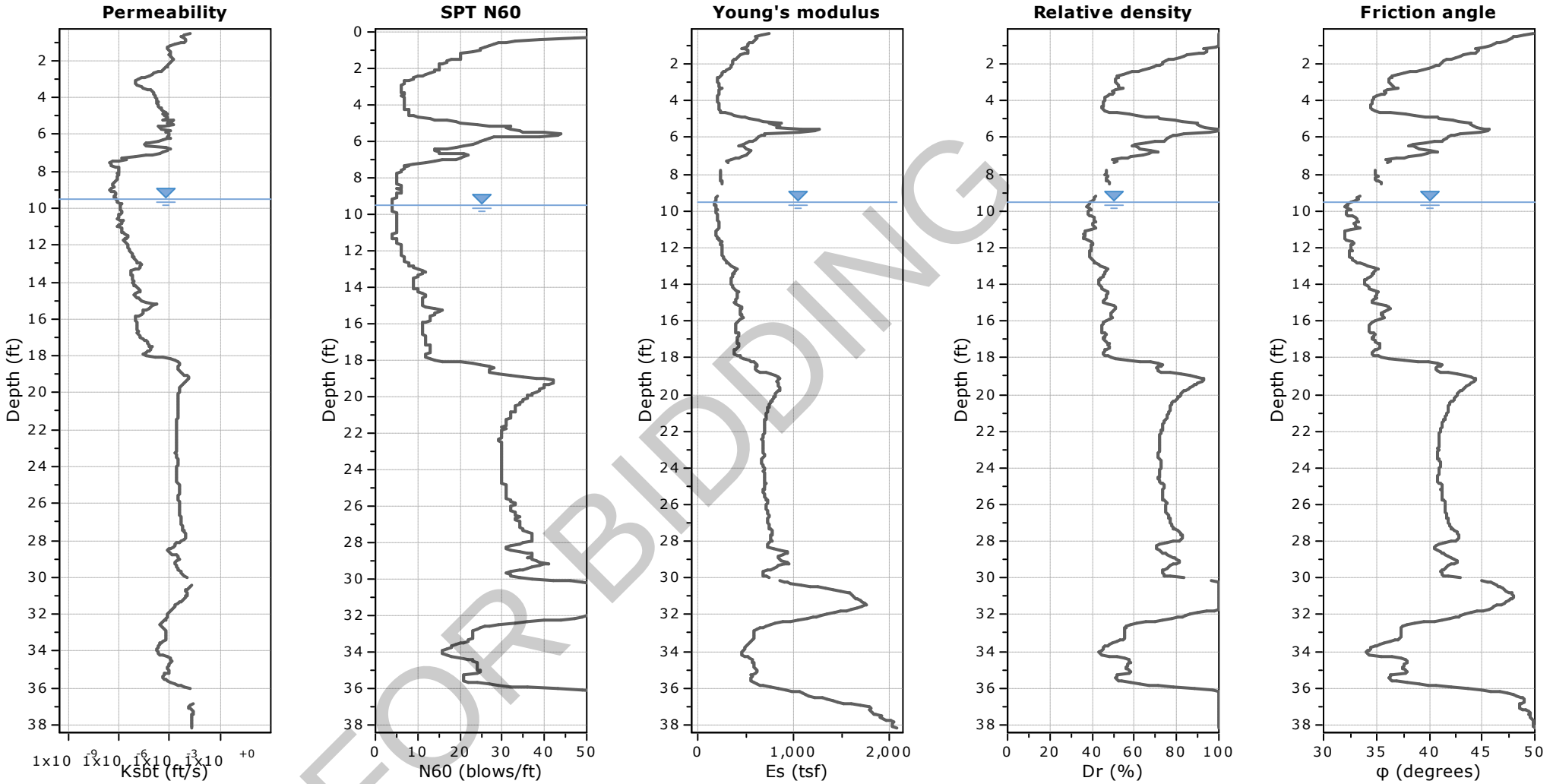
K(G) > 330: Soils with significant microstructure (e.g. age/cementation)

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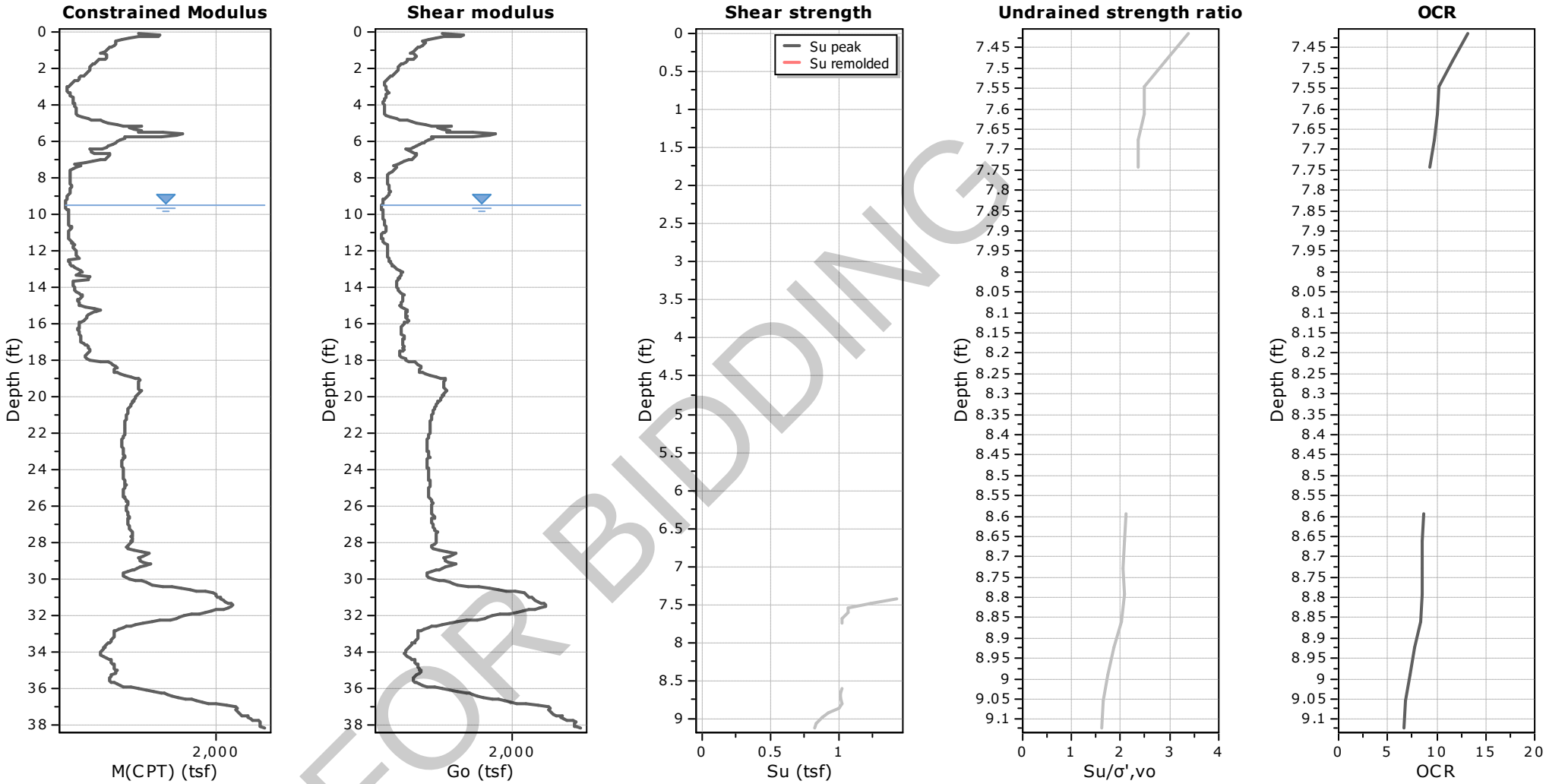
NOT FOR BIDDING

Calculation parameters
Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative density constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)

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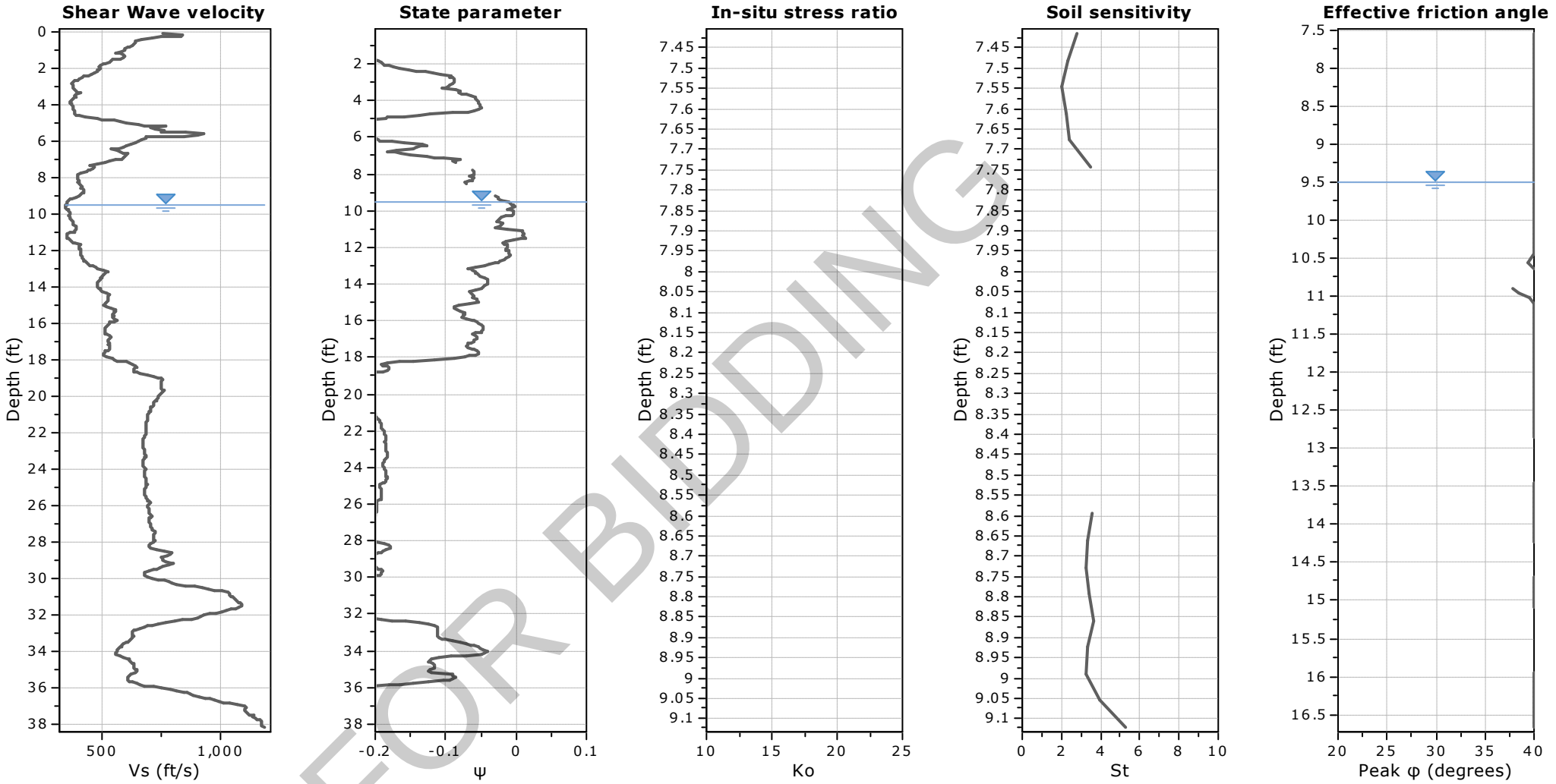
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
Flat Dilatometer Test data

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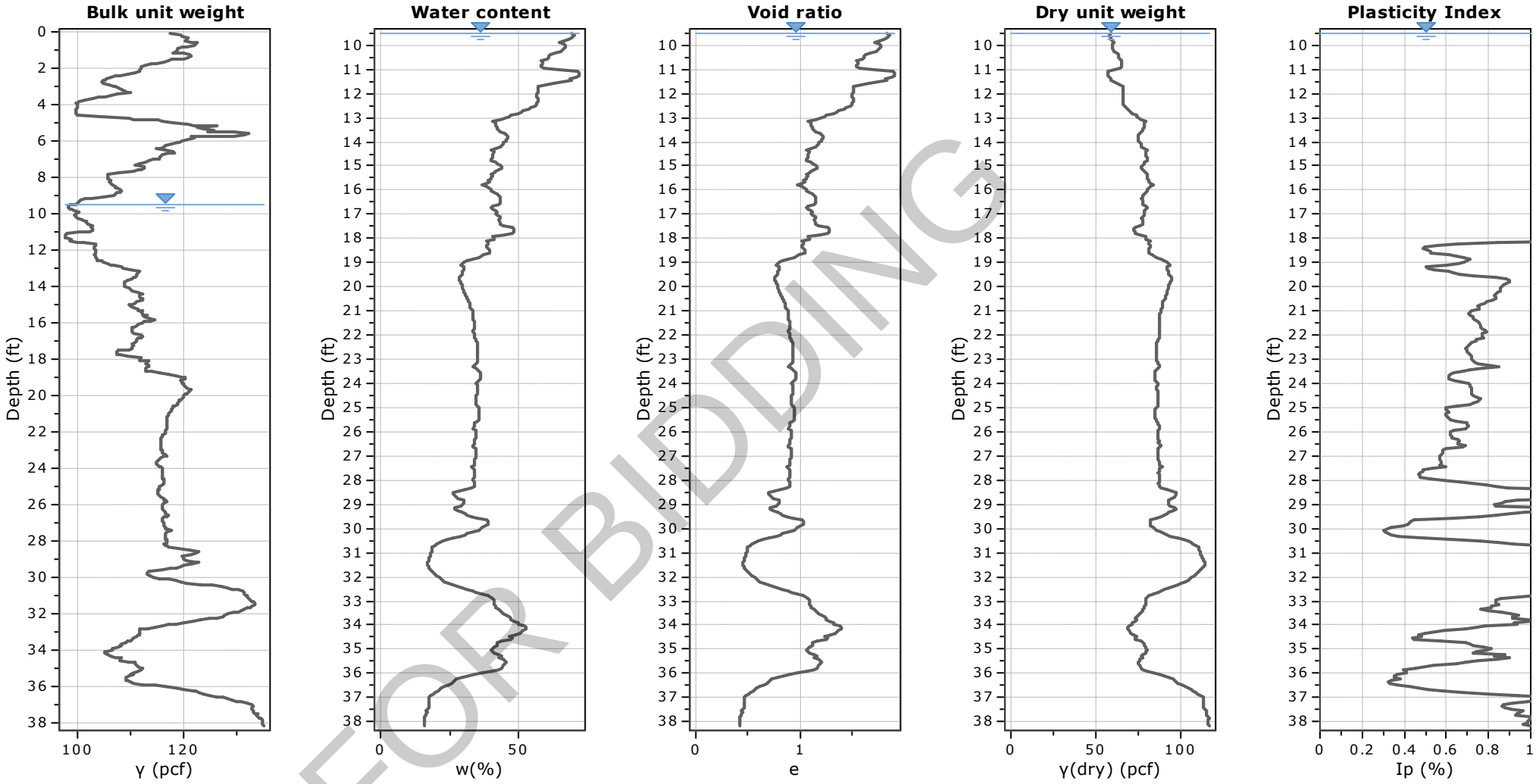
Calculation parameters

Soil Sensitivity factor, N_S: 7.00

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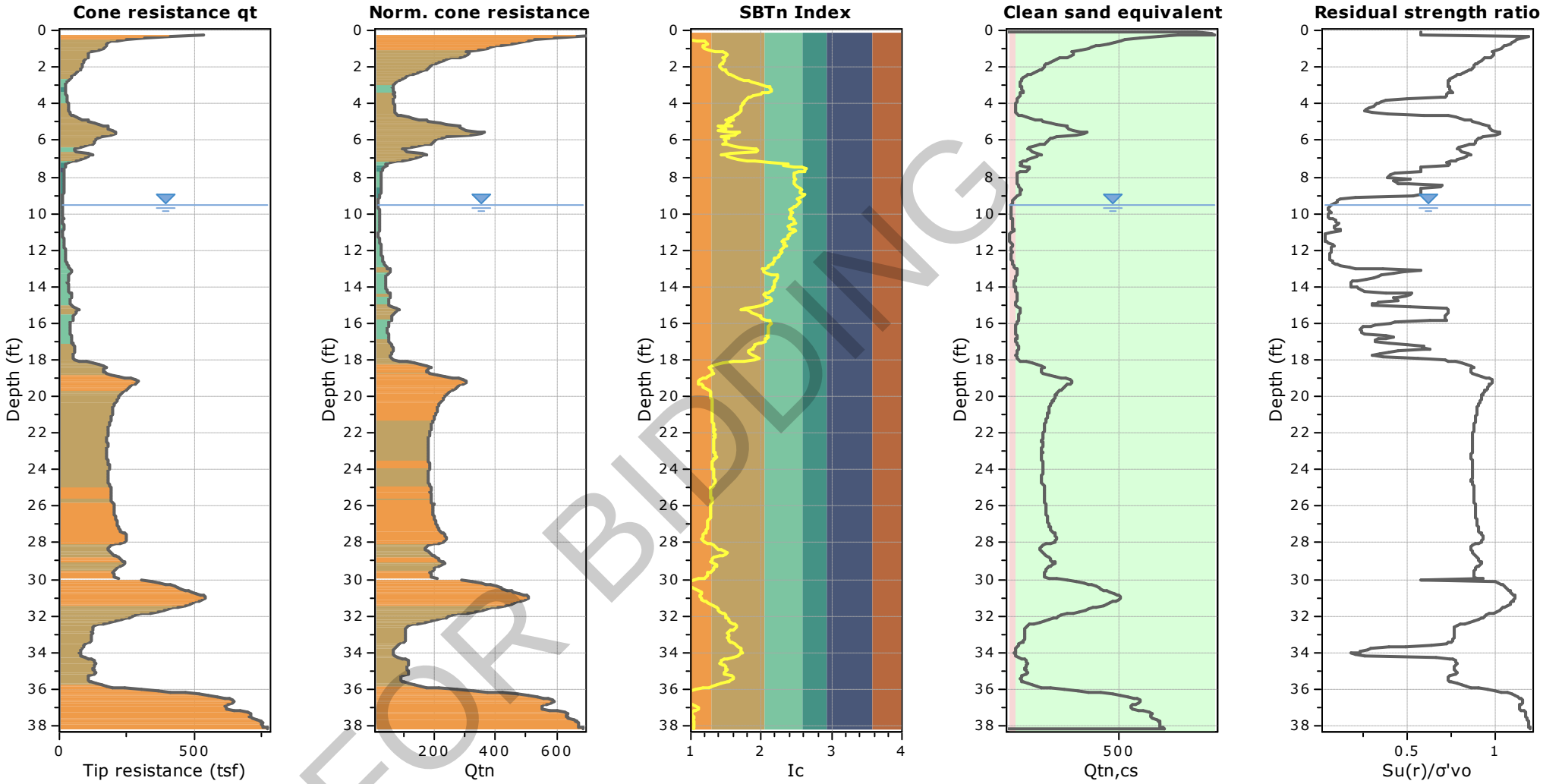


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Cone Type: NOVA U2
Cone Operator: R. Ward, P.E., F.Garcia, P.E., D.GE.



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Presented below is a list of formulas used for the estimation of various soil properties. The formulas are presented in SI unit system and assume that all components are expressed in the same units.

:: Unit Weight, g (kN/m³) ::

$$g = g_w \cdot \left(0.27 \cdot \log(R_f) + 0.36 \cdot \log(\frac{q_t}{p_a}) + 1.236 \right)$$

where g_w = water unit weight

:: Permeability, k (m/s) ::

$I_c < 3.27$ and $I_c > 1.00$ then $k = 10^{0.952-3.04 \cdot I_c}$

$I_c \leq 4.00$ and $I_c > 3.27$ then $k = 10^{-4.52-1.37 \cdot I_c}$

:: N_{SPT} (blows per 30 cm) ::

$$N_{60} = \left(\frac{q_c}{P_a} \right) \cdot \frac{1}{10^{1.1268-0.2817 \cdot I_c}}$$

$$N_{1(60)} = Q_{tn} \cdot \frac{1}{10^{1.1268-0.2817 \cdot I_c}}$$

:: Young's Modulus, Es (MPa) ::

$$(q_t - \sigma_v) \cdot 0.015 \cdot 10^{0.55 \cdot I_c + 1.68}$$

(applicable only to $I_c < I_{c_cutoff}$)

:: Relative Density, Dr (%) ::

$$100 \cdot \sqrt{\frac{Q_{tn}}{k_{DR}}}$$ (applicable only to SBT_n: 5, 6, 7 and 8 or $I_c < I_{c_cutoff}$)

:: State Parameter, ψ ::

$$\psi = 0.56 - 0.33 \cdot \log(Q_{tn,cs})$$

:: Drained Friction Angle, φ (°) ::

$$\varphi = \varphi'_{cv} + 15.94 \cdot \log(Q_{tn,cs}) - 26.88$$

(applicable only to SBT_n: 5, 6, 7 and 8 or $I_c < I_{c_cutoff}$)

:: 1-D constrained modulus, M (MPa) ::

If $I_c > 2.20$
$\alpha = 14$ for $Q_{tn} > 14$
$\alpha = Q_{tn}$ for $Q_{tn} \leq 14$
$M_{CPT} = \alpha \cdot (q_t - \sigma_v)$

If $I_c \geq 2.20$

$$M_{CPT} = 0.03 \cdot (q_t - \sigma_v) \cdot 10^{0.55 \cdot I_c + 1.68}$$

:: Small strain shear Modulus, Go (MPa) ::

$$G_0 = (q_t - \sigma_v) \cdot 0.0188 \cdot 10^{0.55 \cdot I_c + 1.68}$$

:: Shear Wave Velocity, Vs (m/s) ::

$$V_s = \left(\frac{G_0}{\rho} \right)^{0.50}$$

:: Undrained peak shear strength, Su (kPa) ::

$N_{kt} = 10.50 + 7 \cdot \log(F_r)$ or user defined

$$S_u = \frac{(q_t - \sigma_v)}{N_{kt}}$$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c_cutoff}$)

:: Remolded undrained shear strength, Su(rem) (kPa) ::

$S_{u(rem)} = f_s$ (applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c_cutoff}$)

:: Overconsolidation Ratio, OCR ::

$$k_{OCR} = \left[\frac{Q_{tn}^{0.20}}{0.25 \cdot (10.50 \cdot +7 \cdot \log(F_r))} \right]^{1.25}$$ or user defined

$OCR = k_{OCR} \cdot Q_{tn}$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c_cutoff}$)

:: In situ Stress Ratio, Ko ::

$$K_O = (1 - \sin\varphi') \cdot OCR^{\sin\varphi'}$$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c_cutoff}$)

:: Soil Sensitivity, S_t ::

$$S_t = \frac{N_S}{F_r}$$

(applicable only to SBT_n: 1, 2, 3, 4 and 9 or $I_c > I_{c_cutoff}$)

:: Peak Friction Angle, φ' (°) ::

$$\varphi' = 29.5° \cdot B_q^{0.121} \cdot (0.256 + 0.336 \cdot B_q + \log Q_t)$$

(applicable for $0.10 < B_q < 1.00$)

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References

• Robertson, P.K., Cabal K.L., Guide to Cone Penetration Testing for Geotechnical Engineering, Gregg Drilling & Testing, Inc., 5th Edition, November 2012

• Robertson, P.K., Interpretation of Cone Penetration Tests - a unified approach., Can. Geotech. J. 46(11): 1337–1355 (2009)

• N Barounis, J Philpot, Estimation of in-situ water content, void ratio, dry unit weight and porosity using CPT for saturated sands, Proc. 20th NZGS Geotechnical Symposium

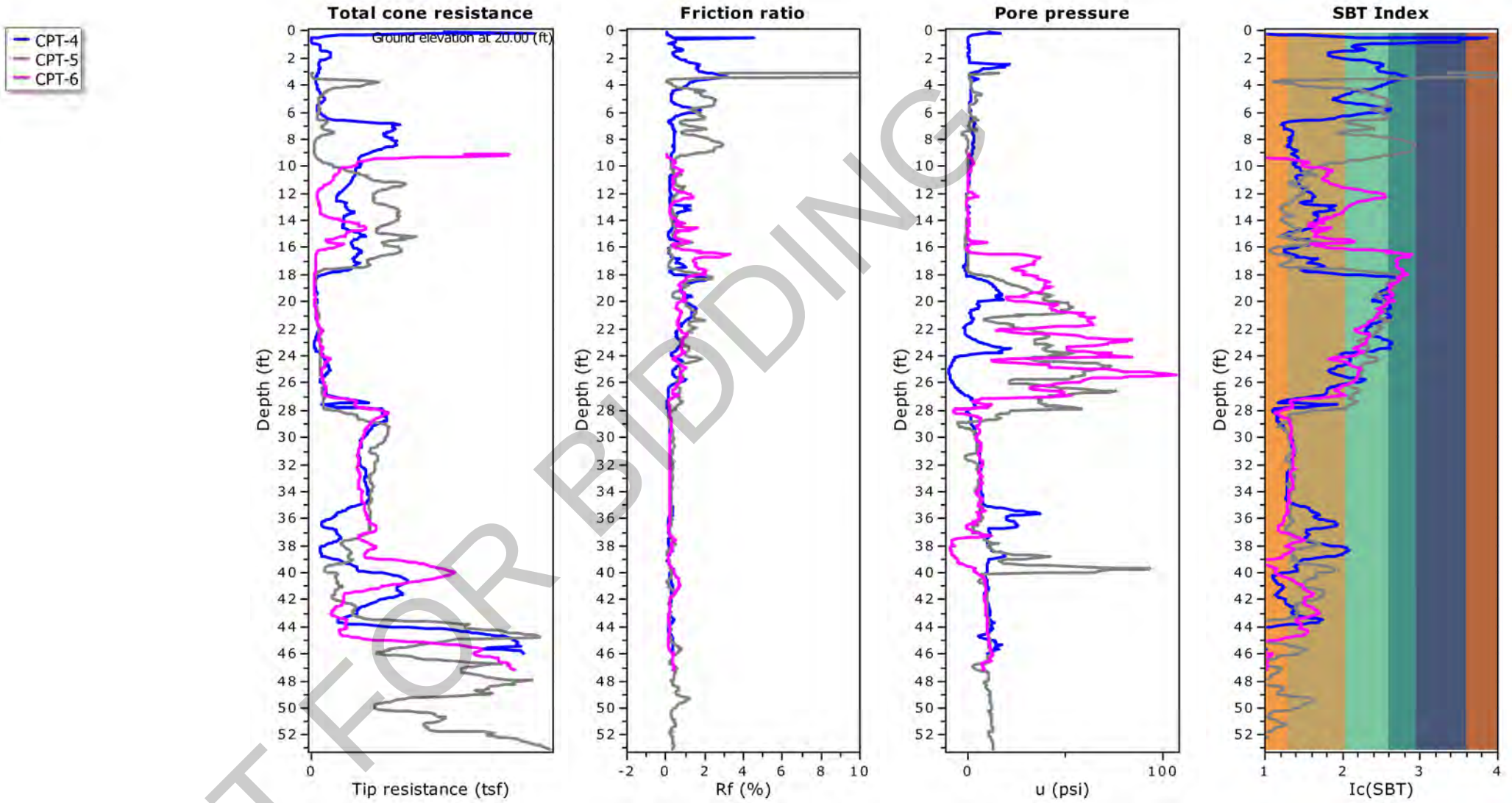
Terms & Conditions

Visual and numerical data provided by Stable Ground In-Situ, LLC is to be used at the client's discretion. Raw data (Depth, qc, fs, u2) is provided for separate characteristic and parameter verifications.

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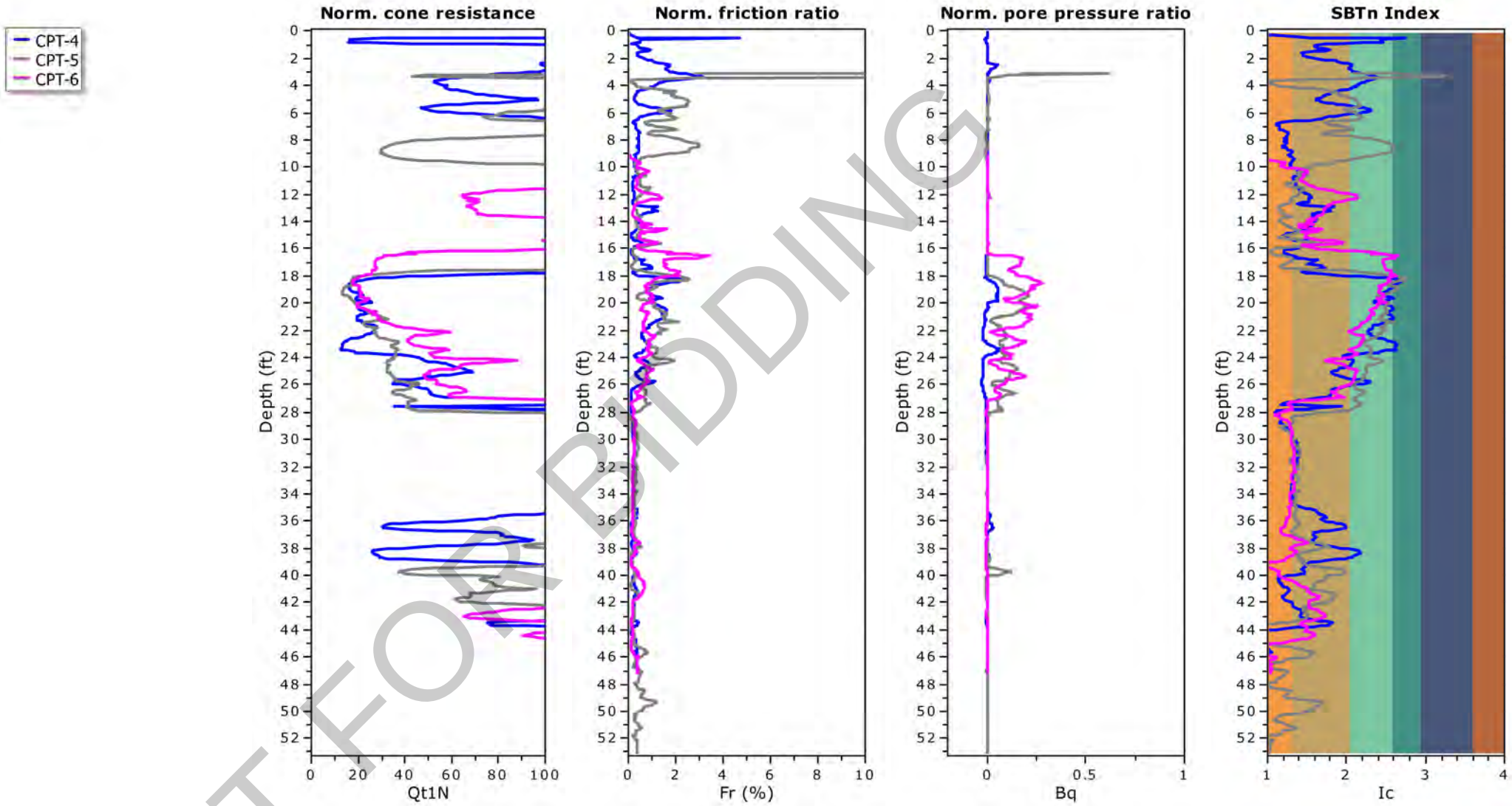
Overlay basic interpretation plots



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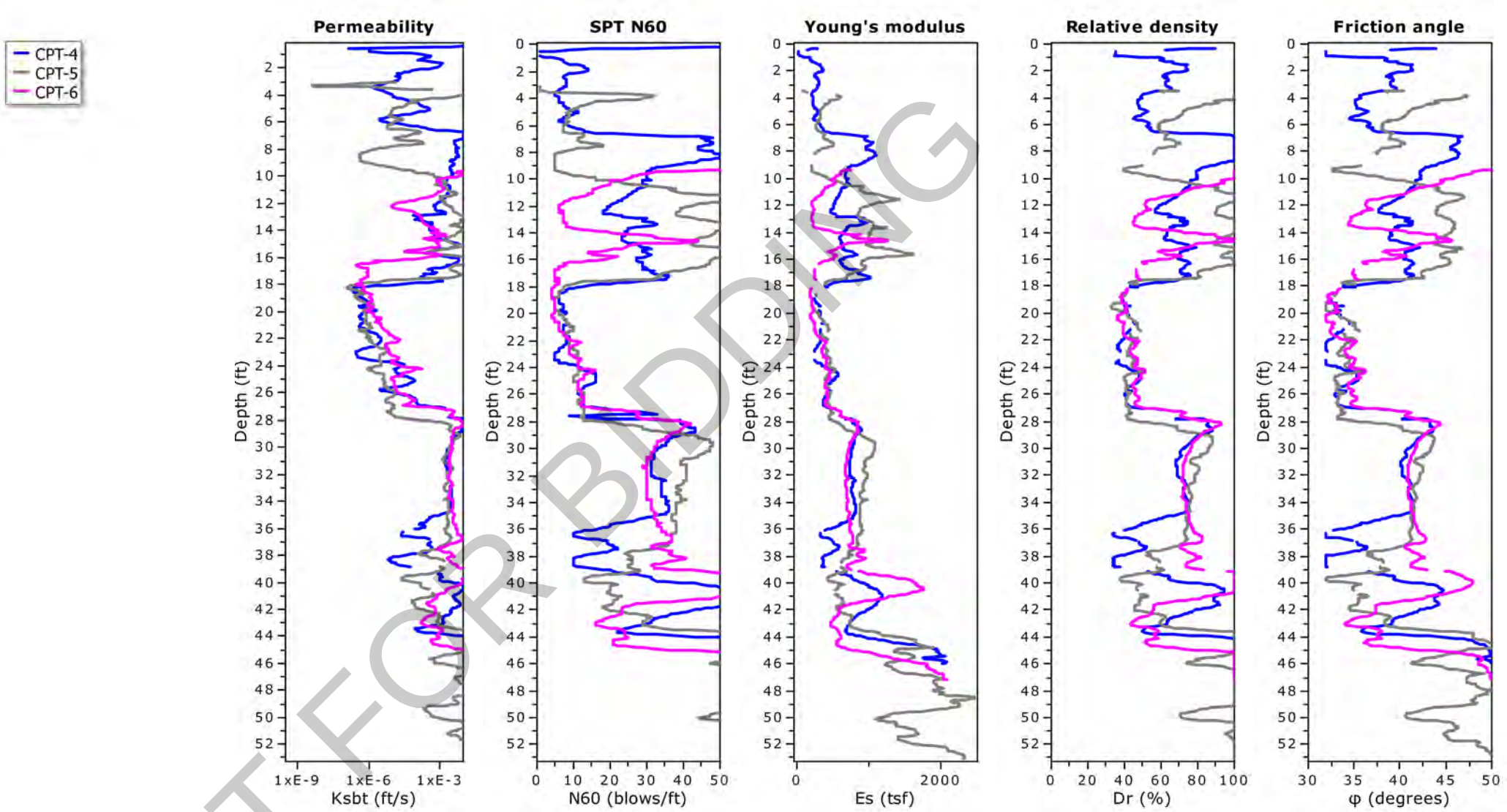
Normalized basic plots



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Location: **Dover, Delaware**

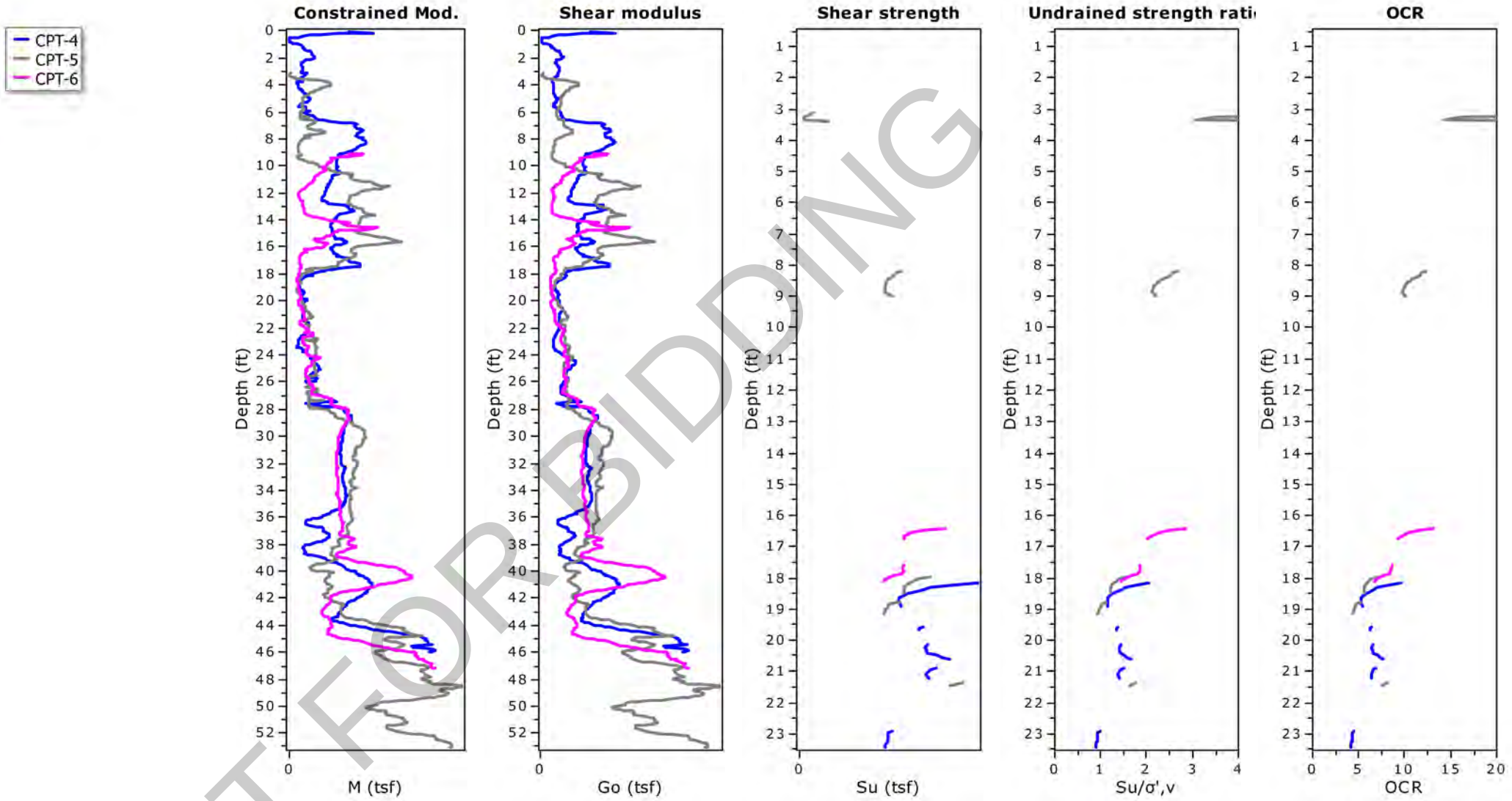
Overlay estimation plots (1)



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Project: **- Leg Hall Project**
Location: **Dover, Delaware**

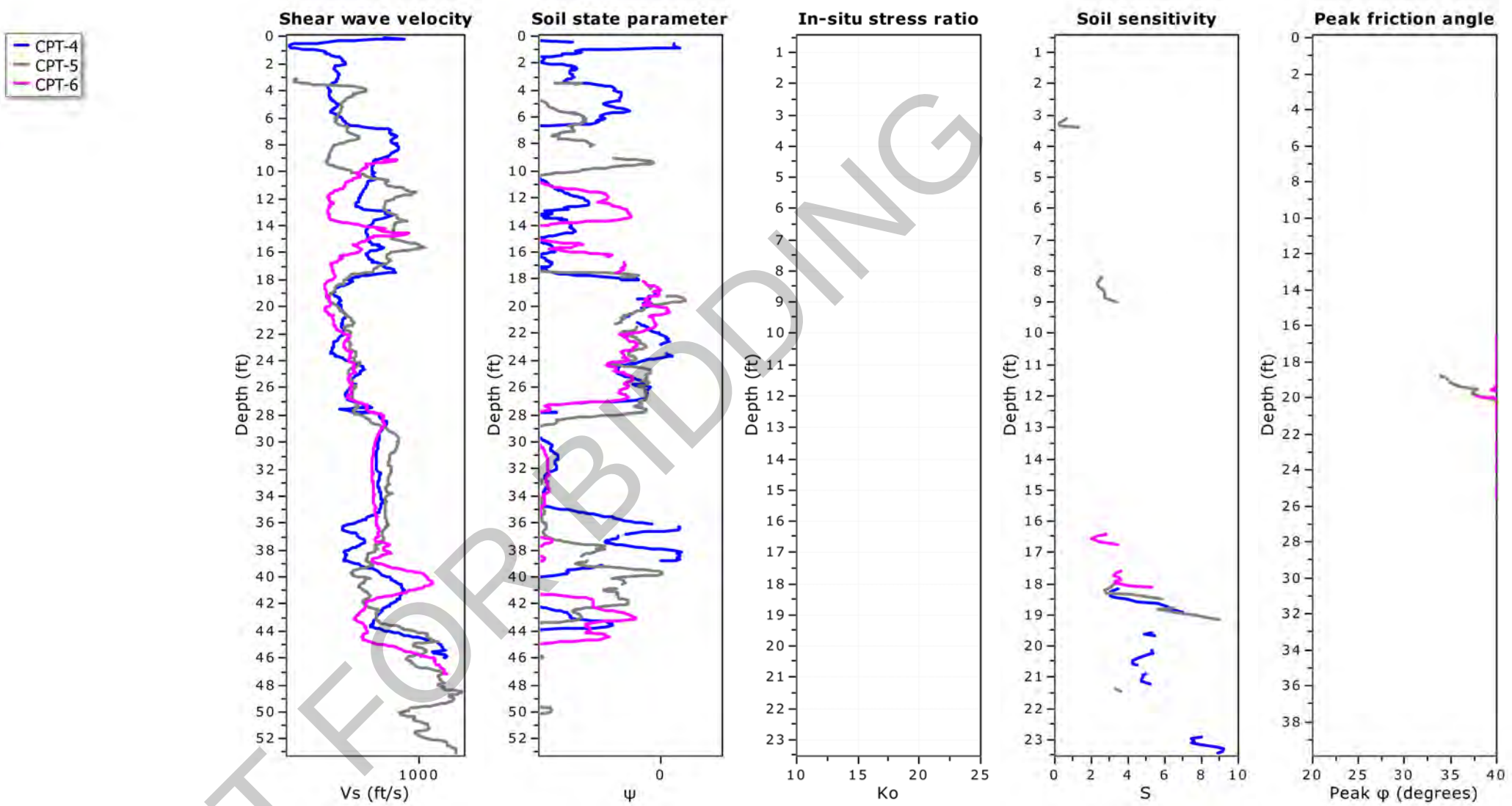
Overlay estimation plots (2)



NOT FOR BIDDING

Project: **- Leg Hall Project**
Location: **Dover, Delaware**

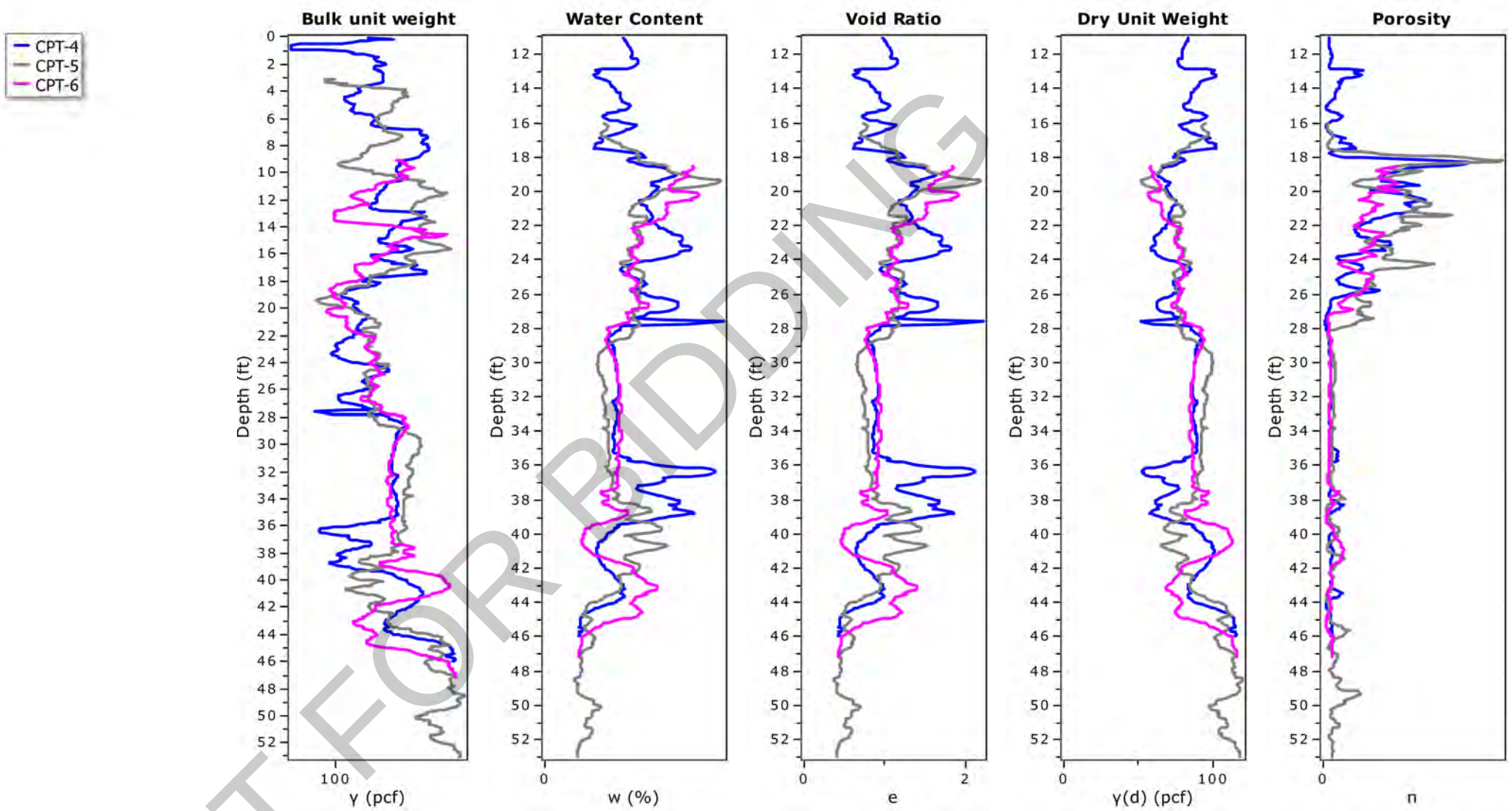
Overlay estimation plots (3)



NOT FOR BIDDING

Project: **- Leg Hall Project**
Location: **Dover, Delaware**

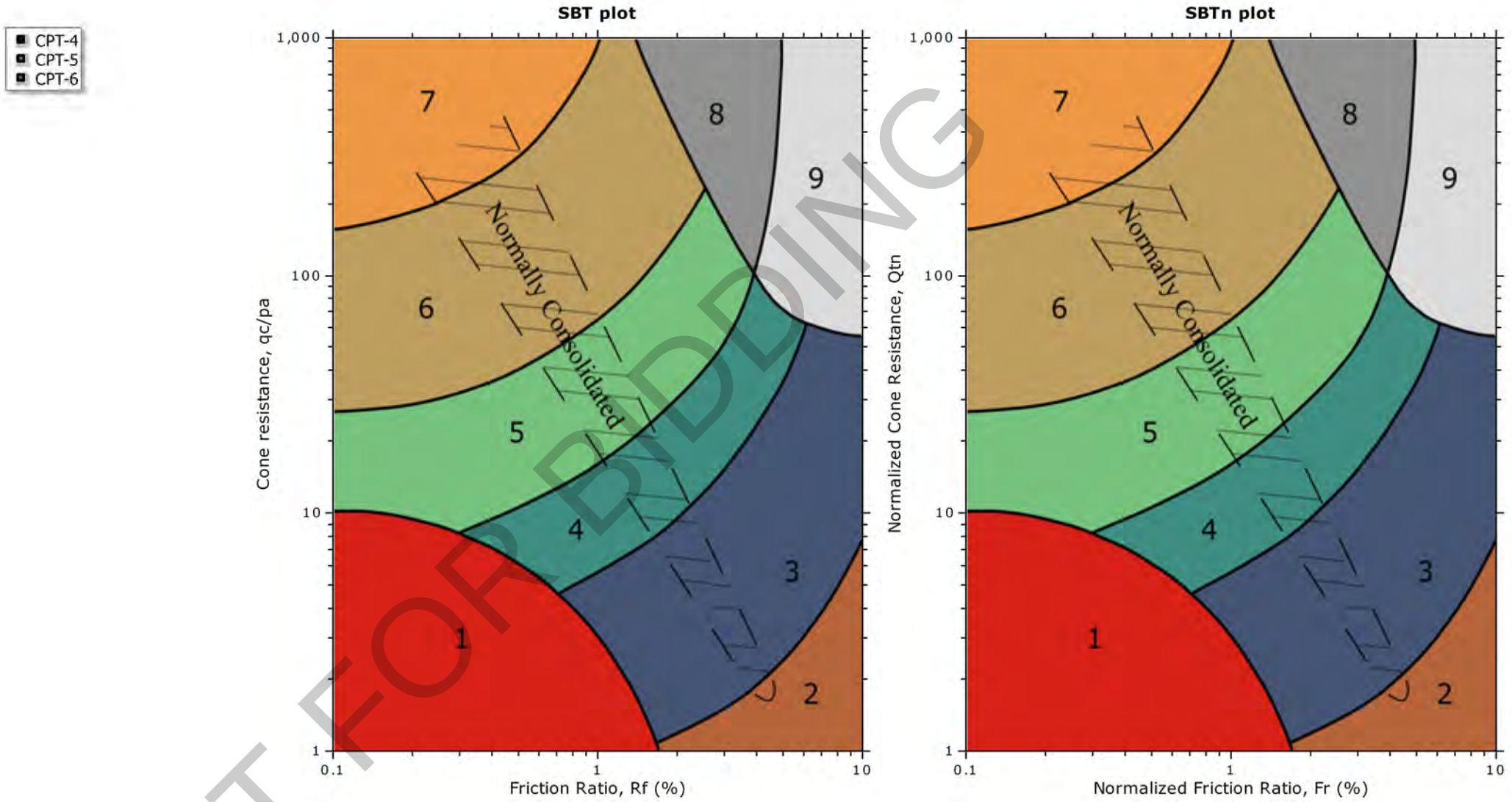
Overlay estimation plots (4)



NOT FOR BIDDING

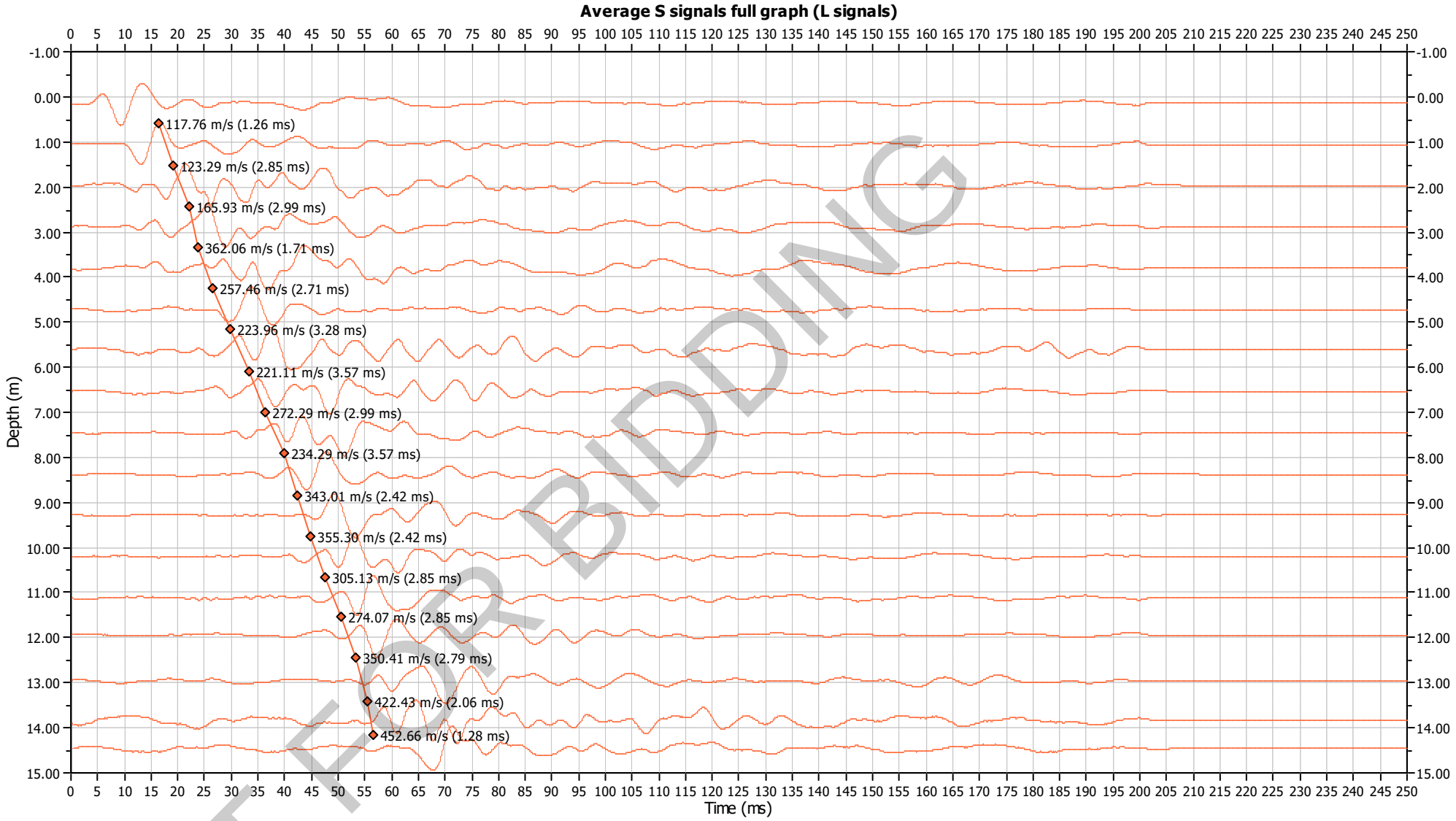
Project: **- Leg Hall Project**
Location: **Dover, Delaware**

Soil Behavior Type Plots



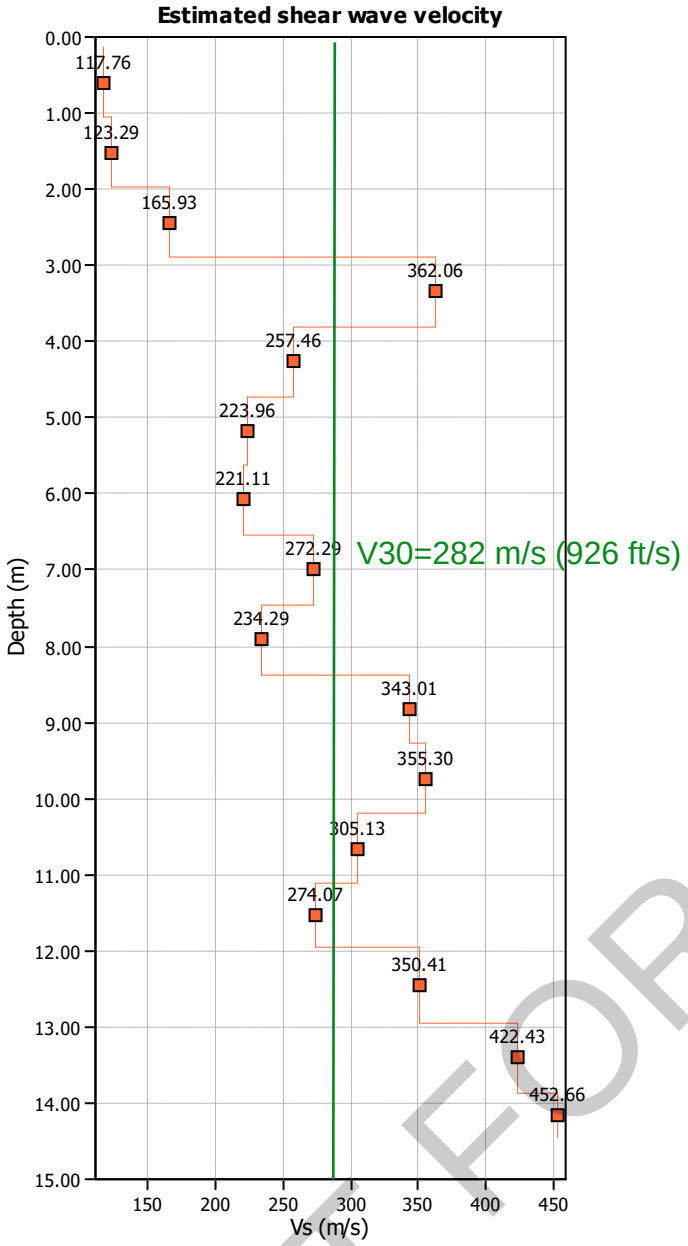
NOT FOR BIDDING

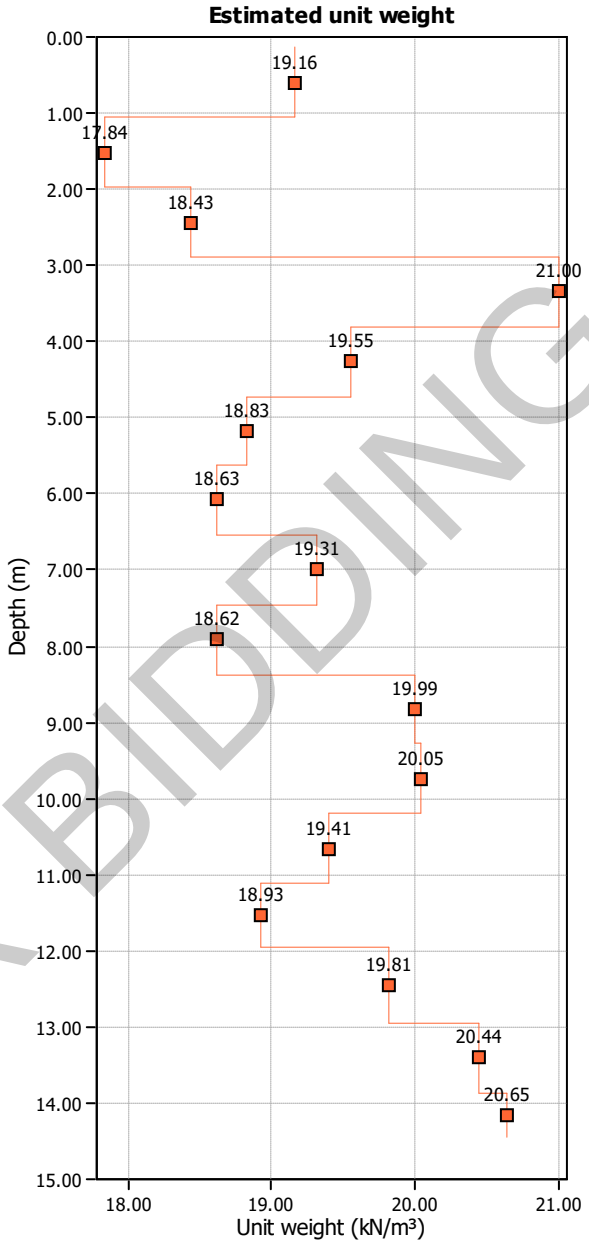
Project: SGI 24082 Leg Hall Project **Borehole ID: SCPT-5**

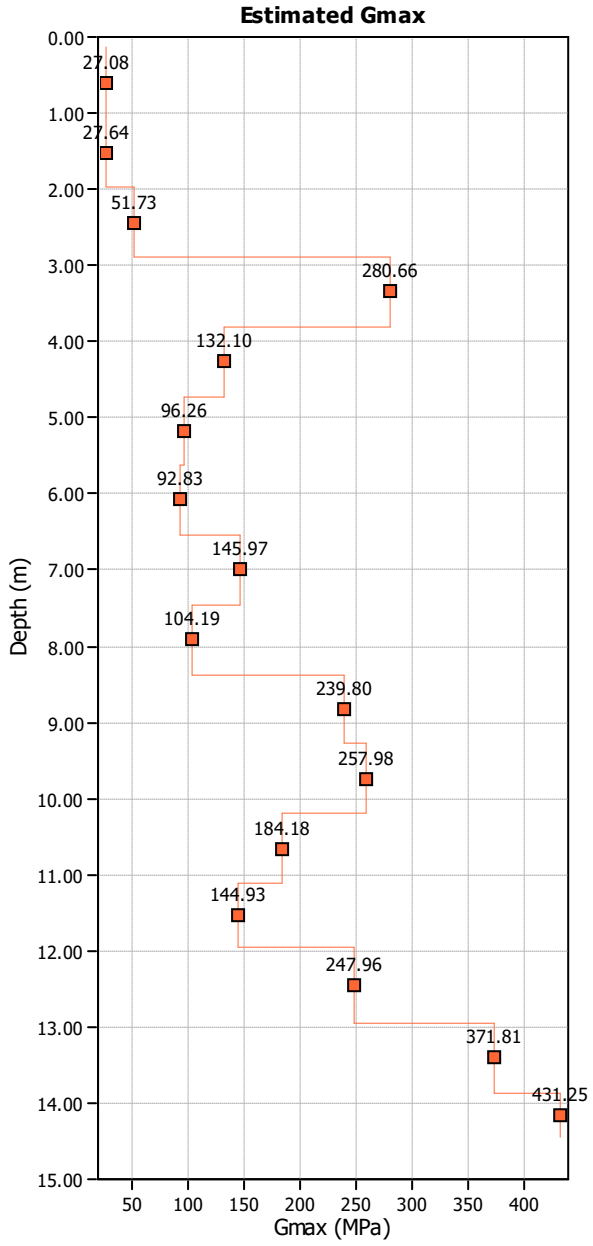


NOT FOR BIDDING

Detailed result plots over depth







NOT FOR BIDDING

NOT FOR BIDDING

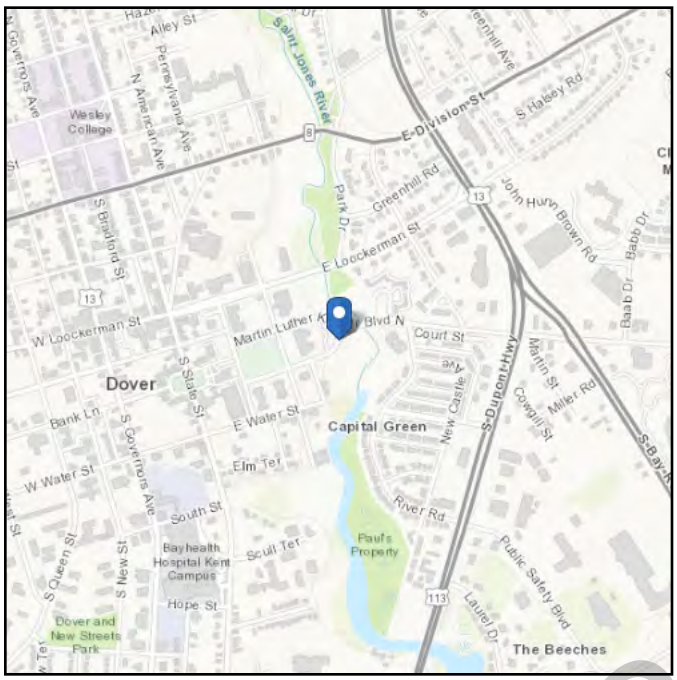
Appendix D

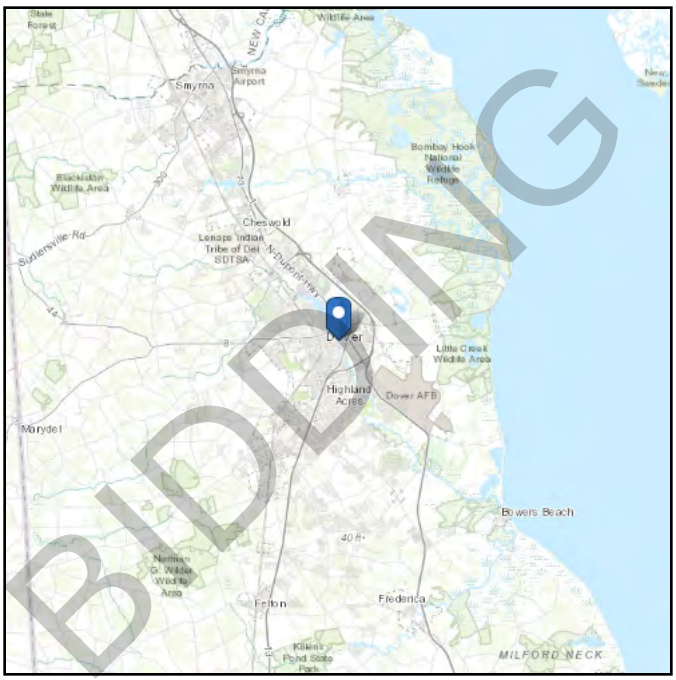
ASCE DESIGN HAZARDS REPORT

ASCE Hazards Report

Address:
Martin Luther King Jr Blvd
Dover, Delaware
19901

Standard:	ASCE/SEI 7-16	**Latitude:**	39.157349
Risk Category:	II	**Longitude:**	-75.518412
Soil Class:	D - Stiff Soil	**Elevation:**	18.938364300253358 ft (NAVD 88)





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Seismic

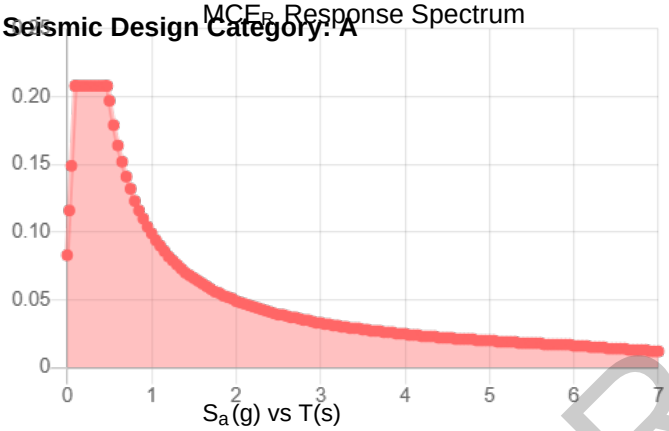
Site Soil Class: D - Stiff Soil

Results:

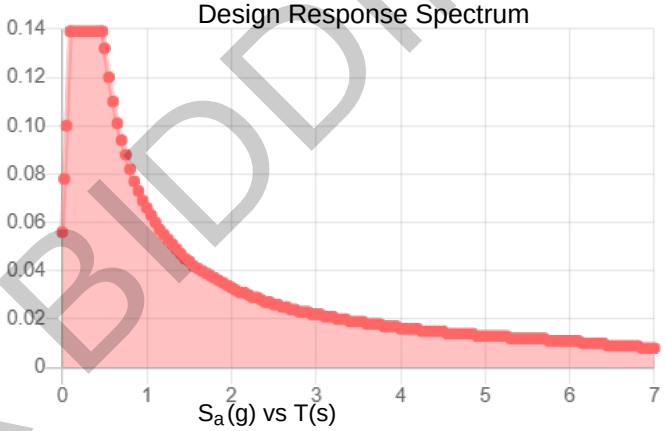
S_S :	0.13	S_{D1} :	0.066
S_1 :	0.041	T_L :	6
F_a :	1.6	PGA :	0.068
F_v :	2.4	PGA_M :	0.108
S_{MS} :	0.208	F_{PGA} :	1.6
S_{M1} :	0.099	I_e :	1
S_{DS} :	0.139	C_v :	0.7

Seismic Design Category: A

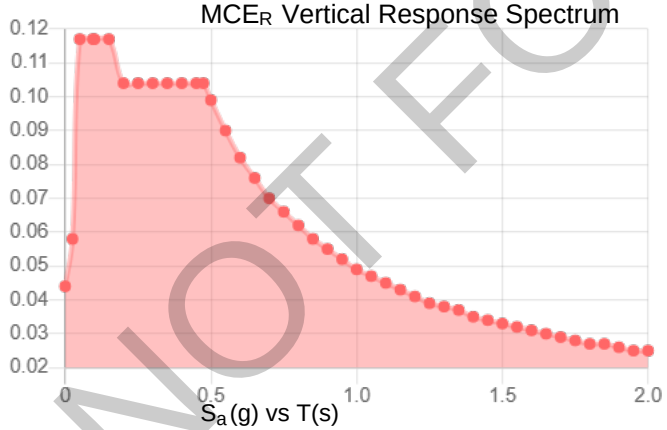
MCE_R Response Spectrum



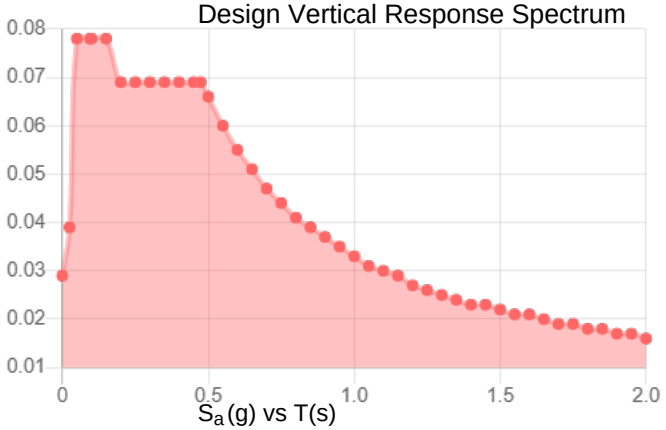
Design Response Spectrum



MCE_R Vertical Response Spectrum



Design Vertical Response Spectrum



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Data Accessed: **Mon Feb 03 2025**

Date Source:

USGS Seismic Design Maps based on ASCE/SEI 7-16 and ASCE/SEI 7-16 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-16 Ch. 21 are available from USGS.

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Appendix E

2024 CENTURY ENGINEERING EVALUATION REPORT

GEOTECHNICAL INVESTIGATION REPORT

Proposed 3 Story Parking Garage for Legislative Hall Dover, Delaware

PREPARED FOR:

Studio JAED

2500 Wrangle Hill Road

Suite 110

Bear, Delaware 19701

PREPARED BY:

CENTURY ENGINEERING

550 BAY ROAD
DOVER DELAWARE 19901

ELIZABETH M. CHANDLER
LICENSE
No. 25243
DELAWARE
PROFESSIONAL ENGINEER
3-21-2024

MARCH 21, 2024

CEI Project No. 24002670.001A

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CENTURY ENGINEERING
A Kleinfelder Company

APPENDICES

Appendix 1 – Project Vicinity Map
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Appendix 4 – Boring Log Graphics Key
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Appendix 6 – Soil Laboratory Results
Appendix 7 – Important Information about this Geotechnical Engineering Report
Appendix 8 – Specifications for Ground Improvement Contractor

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1.0 INTRODUCTION

1.1 GENERAL

This report presents the results of Century Engineering's geotechnical study for the proposed three-story parking garage to be located on the south side of Martin Luther King Jr. Boulevard South and at the northeast corner of the intersection with East Water Street across from Legislative Hall, City of Dover, Delaware. The purpose of our geotechnical study was to evaluate soil and groundwater conditions at the site and provide geotechnical recommendations for project design and construction.

This report includes a description of the work performed, a discussion of the geotechnical conditions observed at the site, and recommendations based on our experience with similar projects in the proposed area. We recommend that all individuals utilizing this report read the limitations section of this report.

1.2 PROJECT DESCRIPTION

The site is currently used as a paved parking lot for both Legislative Hall and the Capital Police, their employees, and visitors. The future plans are for a three-story parking garage, with the entrances at or near the current elevation of the existing parking lot. There will be two entrances; one for the employees of Legislative Hall and one for the visitors, likewise, there will be separate parking levels for employees and visitors.

1.3 SCOPE OF SERVICES

The purpose of our geotechnical study was to evaluate subsurface soil conditions beneath the site and to supply geotechnical recommendations for design and construction. The scope of our services for this geotechnical evaluation consisted of a subsurface exploration by performing 6 soil borings on the site, 5 within the footprint of the proposed garage and one outside the garage footprint to explore the soils for a potential underground walkway from the garage to the new addition for Legislative Hall. The 5 garage borings were taken to a depth of 30.5 feet below the existing paved parking area and the 6th boring was taken to a depth of 100 feet below the existing grade in the grassy area between the back of the sidewalk and the edge of the existing parking lot.

Data from the soil borings and laboratory testing was used to develop this geotechnical recommendation report for the structural engineer to use for foundation design. A description of the services provided to complete our work for this project was presented in our Client Professional Services Agreement dated September 20, 2023.

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2.0 SITE EXPLORATION PROGRAM

2.1 SOIL BORING LOGS

Century Engineering performed a site exploration program to assess the surface and subsurface conditions at the site. The following sections describe the site exploration activities performed. On December 19, 2023, we examined the subsurface conditions within the proposed development area by advancing a total of 6 test borings. The 100 foot boring was for the proposed underground walkway which is currently not approved and therefore will not be part of this report. The boring log is included for reference purposes only.

Five of the borings were performed with the proposed footprint of the three-story garage. The borings were field located and marked by our department associates the day before the arrival of the drill crews. The crew drilled the 5 borings using a Geoprobe 7822DT which appeared to be in excellent working order.

Data pertaining to the subsurface exploration documented in the field is presented i n Appendix 5 *Test Boring Logs.* The *Test Boring Logs* depict the strata of the subsurface conditions encountered within each test boring, including soil types, depths of individual strata, and recorded "N" values (hammer blows per 6 inches of penetration), and visual classifications of the subsurface materials encountered.

Soil sampling within the borings was performed using the Standard Penetration Test (SPT) in general accordance with ASTM D1586. The SPT involves advancing a 2-inch outer diameter, 1- 3/8-inch inner diameter, split-barrel sampler with a 140-pound weight (known as the hammer) falling 30 inches. The hammer used was an automatic hammer which provides a more uniform test throughout the sampling process. The sampler is advanced up to 24 inches and the number of blows to advance the sampler each 6-inch interval is recorded. If the sampler is advanced less than 6 inches in 50 blows, the test is stopped and the distance the spoon was driven with 50 blows is recorded on the boring logs and is noted as sampler refusal. The N-value, reported in blows per foot (bpf), equals the sum of the number of blows (N) required to drive a sampler over the depth interval of 6 to 18 inches. The first 6 inches is referred to as the seating interval and is not counted as part of the N-value.

A Century Engineering geo-professional observed the borings, maintained boring logs, and classified the soils in general accordance with ASTM D2488 Standard Practice for Description and Identification of Soils.

Descriptions of the soil strata encountered in the explorations are included in the Boring Logs provided in the Appendix 5. A key to the symbols used on the logs and a soil description key are also provided in Appendix 4 Boring Log Graphics Key.

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3.0 SITE AND SUBSURFACE CONDITIONS

3.1 EXISTING SITE CONDITIONS

The site is located on the south side of Martin Luther King Jr. Boulevard South and at the northeast corner of the intersection with East Water Street across from Legislative Hall, City of Dover, Delaware. The 5.9-acre project site is currently used as a parking lot.

3.2 REGIONAL AND SITE GEOLOGY

The project site is situated within the Coastal Plain Physiographic Province. The Coastal Plain consists primarily of unconsolidated marine sediments deposited during successive periods of fluctuating sea levels and moving shorelines. These sediments thicken in a west to east progression, starting at the Fall Line (the western edge of the Coastal Plain) to the ocean shoreline, where the sediments are often thousands of feet in thickness.

According to the Generalized Geologic Map of Delaware the project site is underlain by the Lynch Heights Formation of the Upper Pleistocene Period. The Pleistocene Period is the younger of the two formally recognized epochs that constitute the Quaternary Period and the latest interval of geologic time, covering approximately the last 11,700 years of Earth's history. The sediments of the Lynch Heights Formation are described as a heterogeneous unit of light grey to brown to a light yellowish brown, medium to fine sand with discontinuous beds of coarse sand, gravel, silt, fine to very fine sand, and organic-rich clayey silt to silty sand.

3.3 SOIL CONDITIONS

Description of existing surface cover and the major soil groups encountered within the borings advanced by Century Engineering are described in the following sections in the general order of their occurrence. Detailed descriptions of the soils are included in the Appendix.

Surficial Cover

The test borings, SB-1 to SB-5, advanced as part of this subsurface evaluation encountered 6 to 8 inches on bituminous asphalt followed by 5 to 8 inches of subbase stone.

In general, we encountered fill material below the subbase stone to a depth of approximately 4 feet below the top of asphalt. The material consisted of medium stiff to loose dark brown and grey Silty SAND to Clayey SAND.

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Stratum I - Silty Sand and Clayey Sand (USCS Classifications: SM, SP-SC, and SC)

Stratum I soils were encountered at each test boring from 6 to 10 feet below the surface. These soils were field classified as Very Loose to Medium Dense Silty Fine SAND and Clayey Fine SAND. The majority of the Clayey SANDS were observed in the 4 foot to 6 foot interval and the Silty SAND layers were predominately in the 6 foot to 10 foot layers. The Clayey SANDS were found to be dry to moist and loose to very loose. The exception was in SB-2 where we encountered a groundwater level of 6 feet below the surface resulting in moist to wet soil below 6 feet.

The Silty Fine SAND layers were loose to medium dense and contained varying amounts of small to medium gravel and were dry to wet as the groundwater was encountered at a depth of 10 to 13 feet below the surface, with the exception of SB-2.

Stratum II - Silty SAND, Clayey SAND, CLAY, and Silty CLAY (USCS Classifications: SM, SC, CL, and CL-ML)

Stratum II soils were encountered below the surface at 10 to 15 feet and mainly consisted of very Loose to Soft to Medium Dense Silty SAND and Silty CLAY and soft to Medium Dense Clayey SAND and Clay. The soils were moist to wet as we were below the groundwater table at the lower layers from 13 to 15 feet. Mottling was also observed throughout the majority of the samples. The SPT field N values within these materials ranged from 3 to 23 blows per foot (bpf), with an average of about 8.5 bpf, generally indicative of a stiff to loose consistency.

Stratum III – Poorly Graded SAND with Silt and Clay (USCS Classifications: SP)

The Stratum III soils ranged from 15 to 25 feet below the surface and contained a majority of Silty CLAY was described as black, wet, and loose with fine SAND. The SILT layer also a black, wet and loose layer and the Silty SAND was noted in SB-2 was also a black, wet, and medium dense Fine SAND. The N values in this Stratum ranged from 3 to 26 bpf with an average of 12 bpf indicating a medium dense to stiff layer.

Stratum IV – Silty Sand (USCS Classification SM)

The Stratum IV layer which ranged from 25 to 30.5 feet below the surface and was black with some brown to grey, medium dense to dense, and moist to wet. The bpf for Stratum IV was a range from 13 to 33 bpf with an average of 22 bpf which would indicate an apparent density of medium dense at 30.5 feet below the surface.

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3.4 GROUNDWATER

During test boring operations, groundwater levels in the boreholes were monitored during drilling and after pulling the augers prior to backfilling. Groundwater was encountered in all borings at depths ranging from 6 to 13 feet, averaging 10.8 feet below grade.

The occurrence of groundwater can vary due to many factors. These factors include seasonal changes, site topography, surface runoff, the layering and permeability of subsurface strata, water levels in waterways, utilities, and other factors not evident at the time of this study. The possibility of groundwater and its fluctuation should be considered when developing this project.

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4. GEOTECHNICAL DESIGN RECOMMENDATIONS

4.1 GENERAL

Based on the results of our evaluation, in our professional opinion, the project site can be developed for the proposed structures using conventional grading and foundation construction techniques, provided that the recommendations presented herein are incorporated into the design and construction of the project.

The following opinions, conclusions, and recommendations are based on the properties of the materials encountered in the borings, and our engineering analyses performed, and should be incorporated into the project design and subsequent construction.

4.2 SITE DEVELOPMENT

Based on our review of the available geotechnical data obtained to date, and our general understanding of the proposed site grading, the primary items of geotechnical concern for this project are described in the following paragraphs.

LOOSE NATURAL SOILS – FOUNDATIONS

The test borings identified the presence of the relatively loose to medium dense previously placed fill immediately below the asphalt and base course stone for the parking lot and also the loose Stratum I soil to a depth of approximately 8 feet.

The comparison of the “N” values ranged from 2bpf to 30bpf indicating a wide range of bearing capacities and therefore this lack of uniformity will render the top 8 feet below the asphalt and base course stone unacceptable for support of a foundation without modification.

Stratum II, from 10 to 15.5 feet, contained sands and clays with “N” values from 3bpf to 10 bpf and averaging 5.6 bpf. This severe drop in bearing capacity is most likely due to the area being below the water table.

4.3 FOUNDATIONS

We anticipate that the magnitude of estimated settlement will preclude the use of shallow foundations bearing in the existing soil without improvement. Therefore, we recommend one of the following options for structural and floor slab support.

On the basis of our experience with different methods of ground improvement, we judge that an appropriate method to improve the potentially liquefiable soil layers, given the existing subsurface conditions, are stone columns or deep soil mixing.

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Deep soil mixing is more costly than stone columns and, therefore, we are providing stone column recommendations herein. However, stone columns may not provide adequate bearing capacity. Therefore, structures may need to be supported on a rigid inclusion type of ground improvement, such as drilled displacement columns (DDCs) or auger-cast columns (ACCs).

Option 1

Installation of stone columns is a ground improvement technique that results in in-situ densification of granular soil. Stone column installation is accomplished using large, powerful, vibrating probes that are inserted to the desired depth of improvement and withdrawn. The voids created through densification are backfilled with gravel or crushed rock and compacted while withdrawing the probe, leaving a dense stone column typically 3 to 4 feet in diameter surrounded by densified soil. Stone columns also may serve as drains to allow dissipation of pore pressures, which may develop in adjacent soil during an earthquake. The vibratory probe method of installing stone columns is effective in sandy soil with less than about 25 percent fines. For a three-story parking garage, assuming 350 to 875 kips for column loads and 15 klf to 21 klf for wall loading, stone columns can normally improve the bearing capacity to 4000 pounds per square foot, which results in large footings but not prohibitively large.

The two common types of stone column installation are the vibro-replacement and vibro-displacement methods. The vibro-replacement method uses water jetting to advance the vibratory probe and the gravel or crushed stone is backfilled from the existing ground surface.

Spoils and water are typically transported to the ground surface during installation using the vibro-replacement method. The vibro-displacement method uses air jetting to advance the vibratory probe. This method does not “wash” out soil during insertions; therefore, it does not typically transport spoils or water to the ground surface. The vibro-displacement method is better suited for densifying the existing soil and therefore, we conclude would likely be the more suitable method for this site.

Installation of stone columns could cause ground heave due to displacement and/or settlement due to densification. Therefore, the site will likely require regrading after the stone columns are installed.

With the ground improvement method above we would anticipate that the differential settlement of adjacent footings to be equal to or less than ½ inch and long term settlement for footings to be equal to or less than 1 inch.

The frost depth for foundations in Delaware is 24 inches. Therefore, the contractor will place the ground improvements at a depth prescribed by the structural engineer at 24 inches below the proposed bottom of footing.

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Typically, this is done prior to the concrete contractor coming on site which will require the earthwork contractor to remove the overburden above the stone columns and tamp with a walk behind tamper to make sure the ground improvement has not been compromised prior to foundation construction.

Option 2

The structures can be supported on a drilled pile system such as augered cast-in-place (ACIP) piles or drilled displacement (DD) piles, which are low-vibration, low-noise, deep foundations. These pile types are designed and installed by specialty contractors. Driven piles are feasible as well; however, we have not included recommendations herein because of the noise caused during installation. We can provide recommendations for driven piles if requested. If the stone columns effectively mitigate the potential for liquefaction, the piles will not need to be designed for the effects of liquefaction only capacity.

Floor slabs can be designed to bear on grade over a combination of engineered fill (select fill or properly prepared subgrade) and stone columns designed to mitigate ground failure and to reduce liquefaction-induced settlement.

Option 3

Different methods used to support the structure and slab may result in different performance – the specialty ground improvement designer should coordinate with the structural engineer to provide a system that will perform as specified.

ACIP piles are installed by drilling to the required depth with a continuous flight auger that will produce spoils, as described above for ACCs.

DD piles are installed using a displacement tool with reverse flights at the bottom that cause displacement and densification of the surrounding soil resulting in little to no spoils. For either pile type, when the auger reaches the required depth, cement grout or concrete is injected through the bottom part of the hollow-stem auger. Grout or concrete is injected continuously as the augers, still rotating in a forward direction, are slowly withdrawn, replacing the soil. While the grout is still fluid, a steel reinforcing cage is inserted into the shaft. Piles should be designed to limit settlement to less than 1 inch under the design loads, based on the desired performance as determined by the structural engineer.

To confirm the design-build foundation contractor's design capacity, an extensive indicator and test pile program will be needed, including indicator piles and compression and uplift load tests. These piles can range in diameter; 16-, 18- and 24-inch-diameter piles are typical.

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4.4 SEISMIC SITE DESIGN DATA

Seismic Zone 1 – coefficient 0.8g Wind Zone 2, Maximum Wind Speed 160 mph

Risk Category	**II**
Site Class	**E – Soft Clay Soil**

Basic Parameters

Name	Value	Description
S_S	0.13	MCE_R ground motion (period=0.2s)
S_1	0.05	MCE_R ground motion (period=1.0s)
S_{MS}	0.324	Site-modified spectral acceleration value
S_{M1}	0.175	Site-modified spectral acceleration value
S_{DS}	0.216	Numeric seismic design value at 0.2s SA
S_{D1}	0.117	Numeric seismic design value at 1.0s SA

Additional Information

Name	Value	Description
SDC	B	Seismic design category
F_a	2.5	Site amplification factor at 0.2s
F_v	3.5	Site amplification factor at 1.0s
CR_S	0.889	Coefficient of risk (0.2s)
CR_1	0.903	Coefficient of risk (1.0s)
PGA	0.064	MCE_G peak ground acceleration
F_{PGA}	2.5	Site amplification factor at PGA
PGA_M	0.16	Site modified peak ground acceleration.
T_L	6	Long-period transition period (s)
SsRT	0.13	Probabilistic risk-targeted ground motion (0.2s)
SsUH	0.146	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.5	Factored deterministic acceleration value (0.2s)
S1RT	0.05	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.055	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	0.6	Factored deterministic acceleration value (1.0s)
PGAd	0.6	Factored deterministic acceleration value (PGA)

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4.5 SLABS ON GRADE

Soil-supported grade slabs may be used for the proposed building structures provided the subgrade is prepared according to the recommendations contained in this report.

Slabs-on-grade should be designed and constructed in accordance with the recommendations of the most recent versions of ACI Committee Reports 360R and 302.1R.

Concrete floor slabs are recommended to be jointed around columns and along footing-supported walls so that the slab and foundations can settle differentially without damage. Joints containing smooth dowels or keys may be used in the slab to permit rotational movement between parts of the slab without sharp vertical displacements or cracking. Control joints should be used to control shrinkage cracks.

Based on the subgrade preparation procedures recommended herein and the existing soil conditions, a subgrade modulus (k) of 120 pounds per cubic inch (pci) is estimated for slab design. We recommend supporting the slab on a minimum 6 inches of graded aggregate base (or approved equivalent) material and a vapor barrier a minimum of 10 mils to serve as a capillary break and provide uniform support of the slab.

If portions of the floor slabs may not be subjected to building heat during freezing weather and may be susceptible to frost heave, the soils beneath these slabs should consist of non-frost susceptible, free-draining fill for a minimum one-foot of depth. The soil should contain drainage provisions to mitigate surface water from being trapped within the drainage layer. It is typical for construction activities to disturb the floor slab area between the time the pad is prepared, and the new floor slab is constructed.

Century Engineering recommends that just prior to vapor retarder installation and slab construction, the slab area subgrade be proofrolled, and any unstable zones be stabilized at the recommendation of Century Engineering.

The moisture content of the subgrade soils should be maintained within the recommended range until floor slabs are completed.

4.6 RETAINING WALLS

The design of the parking garage will require two retaining walls to be constructed for the ramp from the ground level to the second deck. Since the foundations for the walls will be founded on the improved ground an effective friction angle will be 32^0. If the retaining walls were to be founded on the natural soil of clayey sand and gravel then a friction angle of 32^0 would still be applicable. The backfill material will be available from the material that is removed to reach the subgrade of the footing provided it is free of organics or other deleterious material. Our borings indicated the majority of the soil five feet below the asphalt and subbase stone was a clayey sand with low plasticity, with an estimated unit weight of 135 pcf. It is recommended that any and all structural fill material be approved by the geotechnical engineer of record to assure compliance.

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5. CONSTRUCTION CONSIDERATIONS

Construction is expected to include the excavations and fills to achieve finished grades and the preparation of subgrades for building foundations and pavements.

Construction site safety is the sole responsibility of the contractor, who shall also be solely responsible for the means, methods, and sequencing of construction operations. The contractor should also be aware that temporary slope height, slope inclination, or excavation depths (including utility trench excavations) should in no-case exceed those specified in local, State, and/or Federal safety regulations, such as OSHA Health and Safety Standard for Excavations, or more stringent applicable regulations.

Surface drainage should be carefully controlled to prevent flow of water into the excavations. The site should be graded to prevent surface water from ponding in construction areas and accumulating in excavations.

Earthwork should be performed under the full-time observation by a Century Engineering representative including but not limited to:

- Initial site preparation and topsoil stripping.
- Proof-rolling and subgrade evaluation.
- Subgrade improvement procedures; and
- Fill placement and compaction.
-

5.1 EXCAVATION

The test borings completed for the proposed improvements indicate construction of the project will take place primarily in the fill areas identified as Staratum I .

These materials may be removed using conventional earth moving equipment and techniques as recommended above. All excavations should be adequately sloped, benched, or supported to minimize collapse and protect personnel.

All excavations should be completed in accordance with OSHA requirements.

5.2 GROUNDWATER

The borings were advanced using techniques that allowed for direct and indirect observations of seepage and groundwater during drilling operations.

Groundwater was generally encountered at depths ranging from about 7.5 to 8 feet below existing grades. Static groundwater levels should be avoided during earthwork or foundation construction.

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The fine-grained soils of Stratum I I are generally considered to be moisture-sensitive and prone to developing perched groundwater tables. In most cases, depending on seasonal conditions, seepage into construction excavations should be handled by conventional dewatering methods such as by pumping from sumps, and the use of interceptor trenches.

5.3 MOISTURE MANAGEMENT

We recommend that construction activities and sequencing be directed to minimize the potential for surficial runoff and precipitation impacts to proposed soil subgrades as follows:

- Construction subgrades should be oriented to direct surficial water away to minimize the accumulation of water within structural areas (building pad and pavement subgrades). This can typically be achieved by use of temporary swales and drainage channels directed to non-structural or green areas of the site.

- If temporary sloping of site subgrades is not feasible, consideration should be given to the use of interceptor trenches. These trenches are typically on the order of about 12 to 18 inches in width and depth and are lined with a non-woven filter fabric and backfilled with clean stone. These trenches should be directed to lower-lying non-structural or green areas of the project site.

- Provisions should be made to minimize the potential for off-site surface runoff from entering the site during construction.

5.4 SITE PREPARATION

The area of development is defined herein as the footprint of where cuts and fills are proposed to facilitate development. According to the initial site plan, within the area of development, sparse vegetation and topsoil should be removed as part of the initial site preparation activities. The depth of stripping and/or undercutting should be extended to include the root mat and other soft surficial layers as necessary to provide a suitable subgrade for placement and compaction of earthwork.

The stripping depth should be based on field observations with particular attention given to old drainage areas, uneven topography, and excessively wet soils. Topsoil was not encountered within our borings, due to the pavement overlay, however there were areas of landscaping between parking rows and as such, we recommend that prior to development of the site that all plantings be removed and or replanted elsewhere if possible.

NOT FOR BIDDING

5.5 PROOFROLLING

The soil subgrades in the parking and other paved areas to receive new structural fill, and soil subgrades in cut areas, should be compacted in-place and proof-rolled to determine if suitable soils are present.

The proof-rolling should be performed with a heavy-duty, 10 ton smooth-drum vibratory roller or a loaded dump truck. Proof-rolling should uniformly cover the subgrade in perpendicular directions in accordance with recommendations by Century Engineering. In areas where it is infeasible or not recommended to have large construction equipment, proof-rolling should be performed using lighter compaction equipment such as a walk-behind trench roller as well as evaluation of the subgrade with a hand probe. The objective of proof-rolling is to identify zones of weakness in the subgrade where further evaluation and possible stabilization may be required.

Areas of observed or suspected instability should be further explored by methods that may include test pits or laboratory testing, to identify causes and/or extents of instability. Soft or loose soils with elevated moisture contents are expected to be encountered at exposed subgrade elevations prior to placement of new structural fills. Our experience with similar soils indicates that these materials may be unstable under the weight of compaction and earthmoving equipment. After clearing and grubbing of surficial topsoil and organic materials, we recommend that these areas be temporarily stabilized in-place prior to the placement of new structural fill. This process, described below, should be conducted under the observation of the Geotechnical Engineer:

- Prior to the placement of new structural fill, the exposed subgrades should be proof rolled with available on-site construction equipment. Soils displaying rutting greater than approximately 6 to 8 inches should be removed prior to structural fill placement.

- It should be anticipated that minor subgrade instability will remain following the proof-roll operations due to the elevated moisture contents of the subgrade soils.

- It is anticipated that this instability can be appropriately bridged with the use of bridge lifts utilizing appropriately moisture-conditioned coarse-grained soils or imported materials determined to be suitable by the Geotechnical Engineer. These materials may also be stabilized in place with large-size stone (No. 1 or 2 recycled concrete aggregate or stone aggregate).

- Evidence of severe pumping or instability prior to the placement of structural fill may require chemical treatment or limited undercut and replacement prior to fill placement.

- The conditions should be thoroughly evaluated though prior to the commencement of fill operations to appropriately determine the appropriate course of action.

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5.6 STRUCTURAL FILL

Our recommendations regarding suitable imported fill and reuse of on-site soils as structural fill are provided in the sections below.

5.6.1 Imported Fill

Imported structural fill should meet the following criteria:

5.6.1.1 USCS Classification GP, GP-GM, GM, SP, SP-SM, SM
5.6.1.2 Liquid Limit (LL) less than 40
5.6.1.3 Plasticity Index (PI) less than 10
5.6.1.4 Free of large rock or asphalt fragments (greater than 3 inches in diameter) and organic materials (less than 3 percent by weight).
5.6.1.5 The use of larger rock in structural fill must be carefully monitored and tested by Century Engineering
5.6.1.6 Percent passing washed No. 200 sieve of less than 15 percent
5.6.1.7 Free of deleterious, organic, and hazardous materials

Alternate soils proposed for use which differ from those specified above should be evaluated by Century Engineering regarding their suitability prior to placement at the site.

5.6.2 RE-USE OF ON-SITE SOILS

Stratum I – Silt, Clay, and Clayey/Silty SAND

The near-surface Stratum I materials on-site were found to consist of silt, silty and sandy clay, and clayey sand (USCS Classifications: SW-SC, and SM) of low to moderate plasticity. Based on this information, these soils are considered marginally suitable for re-use as structural fill.

Therefore moisture-conditioning and/or chemical treatment of these soils (utilizing lime or cement) should generally be anticipated during construction to facilitate the re-use of these soils.

If earthwork operations are scheduled to occur during the summer or fall months, portions of these materials may be properly moisture-conditioned by mixing with coarser sands and gravels or scarified and aerated prior to their re-use. If earthwork operations are scheduled to occur during the winter or spring months, we recommend that a contingency be included for either chemical treatment or removal and replacement of unsuitable soils with imported structural fill.

Stratum II – Silty Sand and Clayey Sands

The test borings generally encountered relatively fine to medium-grained soils, namely silty sand, clayey sands (USCS: SW-SC, SM, SC). These soils are expected to be suitable for re-use as structural fill on-site.

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Material excavated from perched groundwater areas or below the groundwater table may require additional discing or aeration to facilitate re-use. Our analysis of the suitability of the on-site soil for reuse as structural fill is based on data collected from the test locations completed at the site. Soil suitability should be confirmed in the field during construction by Century Engineering.

5.7 COMPACTION REQUIREMENTS

Structural fill should be placed in lifts not exceeding 10 inches in loose thickness where heavy compaction equipment can be utilized and 6 inches in loose thickness where hand-operated equipment is necessary. The optimum lift thickness and number of repetitive passes with compaction equipment necessary to achieve the required percentage compaction values should be determined in the field with test passes of the chosen compaction equipment.
New structural fill should be placed at or deviate nominally from (±2%) the optimum moisture content as determined in accordance with ASTM D698 or ASTM D1557 and compacted to the minimum percentages of maximum dry density as indicated below.

Recommended Compaction Criteria

Fill Area	Percent of Maximum Dry Density per Standard Proctor (ASTM D698)	Percent of Maximum Dry Density per Modified Proctor (ASTM D1557)
Foundation Support	98	95
Foundation Backfill	98	95
Slab-On-Grade & Parking Areas	98	95
Non-Structural/Green Areas	92	90

5.8 STRUCTURAL CONCRETE

Prior to the placement of concrete, where required, the subgrades should be densified and compacted using a walk-behind vibratory roller, gas-powered automatic tamper, or similar equipment. Densification should be performed to provide uniform density of the subgrade materials. Proper compaction and densification of the foundation subgrade should be verified by Century Engineering prior to placement of concrete.

- It is emphasized that caution should be exercised to not disturb subgrade soils. Should the subgrade be disturbed, the soil should be compacted in place, or weak or yielding materials should be removed and replaced with controlled structural fill.

- Exposure to the environment may weaken the materials present at the footing bearing levels if the excavations remain open for an extended period. Therefore, the use of a concrete "mud-mat" constructed over the bearing materials should be considered.

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- Concrete should be placed the same day that excavation occurs or as soon as practical.

- Every effort should be made to prevent water from entering open excavations. If the bearing soils are softened by surface water intrusion or exposure, the softened soils must be removed from the excavation bottom immediately prior to placement of concrete.

- The bearing area should be level.

- Any loosened soil, debris, or ponded water should be removed from the excavation prior to concrete placement.

- Care should be exercised during winter months to prevent freezing of subgrade soils and backfill prior to or after the placement of concrete.

- Concrete should not be placed on frozen or saturated subgrades.

5.9 FLOOR SLABS

Prior to the placement of granular subbase materials, Century Engineering should review slab subgrade conditions prior to grade slab construction and provide corrective recommendations if weak or yielding conditions are identified. The subgrade should be proof rolled with a loaded dump truck or by other approved methods to detect any excessively yielding subgrade conditions.

Soil-supported grade slabs should not bear on excessively yielding, saturated, or loose soils. The floor slab subgrade should be proof rolled with a loaded dump truck, or by other approved methods, to detect any excessively yielding subgrade conditions.

If at the time of construction, the slab subgrade is found to be excessively wet or soft and yielding, it may be necessary to stabilize the subgrade soils by disking, aerating, and re-compacting. However, if it is not possible to improve the subgrade soils in this manner due to soil moisture, weather conditions, or other constraints, alternate methods may be necessary.

The preferred method for stabilizing the slab subgrade should be determined in the field at the time of construction based upon the actual field conditions in conjunction with the specific soil type encountered at the locations requiring stabilization, the size of the areas requiring stabilization, and the construction schedule.

5.10 PAVEMENTS

The following general recommendations are provided herein relating to pavement subgrade construction:

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- The suitability of the subgrade soils for pavement construction should be confirmed by Century Engineering after careful visual examination and by the results of laboratory tests performed on the subgrade soil samples.

- Prior to pavement construction, Century Engineering should review subgrade conditions and provide recommendations for weak or yielding conditions identified. Care should be exercised to thoroughly proof roll the subgrade with a loaded dump truck or by other approved methods to detect any excessively yielding conditions in accordance with the recommendations provided in this report.

- Pavement sections are typically designed to accommodate post-construction traffic only. Partial construction of the pavement sections is not recommended.

- Consideration should be given to the construction of designated haul roads to accommodate heavy construction equipment at the site. This can be accomplished by increasing the thickness of a select granular subbase and/or asphalt course has been increased to account for the heavy construction traffic.

- As paving and grading are typically performed by separate contractors, a time lapse generally occurs between the end of grading operations and the commencement of paving. Disturbance, desiccation, and/or wetting of the subgrade prior to completion of paving can result in deterioration of the previously completed subgrade. Non-uniform subgrades can result in poor pavement performance and local failures relatively soon after pavements are constructed. Where applicable, we recommend the pavement subgrade be proof rolled within two days prior to commencement of actual paving operations. If any significant temperature changes or precipitation events occur after proof-rolling, the subgrade should be reviewed by Century Engineering prior to placing the pavement. The subgrade should be in its finished form at the time of the final review.

- Pavement subbase should be placed as soon as possible after the subgrade has been approved.

- The pavement sections should also be placed as soon as possible after the subbase has been tested and approved. These recommendations are provided to help prevent the subgrade and the subbase from being disturbed by weather and construction traffic. It will also help reduce the potential for the subbase from becoming contaminated with soil.

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6 LIMITATIONS

This geotechnical study has been prepared for the exclusive use of the Client and their agents for specific application to the proposed facility mentioned in this report. The findings, conclusions and recommendations presented in this report were prepared in accordance with generally accepted geotechnical engineering practice. No other warranty, express or implied, is made.

The scope of services was limited to a background data review and the field exploration described previously. It should be recognized that definition and evaluation of subsurface conditions are difficult Judgments leading to conclusions and recommendations are generally made with incomplete knowledge of the subsurface conditions present due to the limitations of data from field studies. The conclusions of this assessment are based on our field exploration and laboratory testing programs, and engineering analyses.

Century Engineering offers various levels of investigative and engineering services to suit the varying needs of different clients. Although risk can never be eliminated, more detailed and extensive studies yield more information, which may help understand and manage the level of risk. Since detailed study and analysis involves greater expense, our clients participate in determining levels of service, which provide information for their purposes at acceptable levels of risk.

The client and key members of the design team should discuss the issues covered in this report with Century Engineering, so that the issues are understood and applied in a manner consistent with the owner's budget, tolerance of risk and expectations for future performance and maintenance.

Recommendations contained in this report are based on our field observations and subsurface explorations, limited laboratory tests, and our present knowledge of the proposed construction. It is possible that soil or groundwater conditions could vary between or beyond the points explored. If soil or groundwater conditions are encountered during construction that differ from those described herein, the client is responsible for ensuring that Century Engineering is notified immediately so that we may reevaluate the recommendations of this report. If the scope of the proposed construction, including the estimated traffic volumes or locations of the improvements, changes from that described in this report, the conclusions and recommendations contained in this report are not considered valid until the changes are reviewed, and the conclusions of this report are modified or approved in writing, by Century Engineering.

The scope of services for this subsurface exploration and geotechnical report did not include environmental assessments or evaluations regarding the presence or absence of wetlands or hazardous substances in the soil, surface water, or groundwater at this site. Century Engineering cannot be responsible for interpretation by others of this report, or the conditions encountered in the field.

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Century Engineering must be retained so that all geotechnical aspects of construction will be monitored on a full-time basis by Century Engineering, including site preparation, preparation of foundations, and placement of structural fill and trench backfill.

These services provide Century Engineering the opportunity to observe the actual soil and groundwater conditions encountered during construction and to evaluate the applicability of the recommendations presented in this report to the site conditions. If Century Engineering is not retained to provide these services, we will cease to be the engineer of record for this project and will assume no responsibility for any potential claim during or after construction on this project. If changed site conditions affect the recommendations presented herein, Century Engineering must also be retained to perform a supplemental evaluation and to issue a revision to our original report.

This report, and any future addenda or reports regarding this site, may be made available to bidders to supply them with only the data contained in the report regarding subsurface conditions and laboratory test results at the point and time noted. Bidders may not rely on interpretations, opinion, recommendations, or conclusions contained in the report. Because of the limited nature of any subsurface study, the contractor may encounter conditions during construction which differ from those presented in this report. In such event, the contractor should promptly notify the owner so that Century Engineering can be contacted to confirm those conditions. We recommend the contractor describe the nature and extent of the differing conditions in writing and that the construction contract include provisions for dealing with differing conditions. Contingency funds should be reserved for potential problems during earthwork and foundation construction.

This report may be used only by the client and only for the purposes stated, within a reasonable time from its issuance, but in no event later than one year from the date of the report.

Land use, site conditions (both on site and off site) or other factors may change over time, and additional work may be required with the passage of time. Any party, other than the client who wishes to use this report shall notify Century Engineering of such intended use. Based on the intended use of this report and the nature of the new project, Century Engineering may require that additional work be performed and that an updated report be issued.

Non-compliance with any of these requirements by the client or anyone else will release Century Engineering from any liability resulting from the use of this report by any unauthorized party and the client agrees to defend, indemnify, and hold harmless Century Engineering from any claims or liability.

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APPENDIX 1

PROJECT VICINITY MAP

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LEGISLATIVE HALL PARKING GARAGE
150 EAST WATER STREET
PROJECT VICINITY MAP

APPENDIX 1	Designed By:	Drawn By:
Date: 1.31.2024	Project#: 24002670.001A	Scale: None



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APPENDIX 2

BORING LOCATION PLAN

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LEGISLATIVE HALL PARKING GARAGE
150 EAST WATER STREET
BORING LOCATION PLAN

APPENDIX 2	Designed By:	Drawn By:
Date: 1.31.2024	Project#: 24002670.001A	Scale: None



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APPENDIX 3

SOIL DESCRIPTION KEY

GRAIN SIZE[1]

DESCRIPTION		SIEVE SIZE	GRAIN SIZE
Boulders		>12 in.	>12 in. (304.8 mm.)
Cobbles		3 - 12 in.	3 - 12 in. (76.2 - 304.8 mm.)
Gravel	coarse	3/4 -3 in.	3/4 -3 in. (19 - 76.2 mm.)
	fine	#4 - 3/4 in.	0.19 - 0.75 in. (4.8 - 19 mm.)
Sand	coarse	#10 - #4	0.079 - 0.19 in. (2 - 4.9 mm.)
	medium	#40 - #10	0.017 - 0.079 in. (0.43 - 2 mm.)
	fine	#200 - #40	0.0029 - 0.017 in. (0.07 - 0.43 mm.)
Fines		Passing #200	<0.0029 in. (<0.07 mm.)

SECONDARY CONSTITUENT[1]

Term of Use	AMOUNT	
	Secondary Constituent is Fine Grained	Secondary Constituent is Coarse Grained
Trace	<5%	<15%
With	≥5 to <15%	≥15 to <30%
Modifier	≥15%	≥30%

PLASTICITY[1]

DESCRIPTION	CRITERIA
Non-Plastic	A 1/8 in. (3 mm) thread cannot be rolled at any water content.
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit.
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.

MOISTURE CONTENT[1]

DESCRIPTION	FIELD TEST
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

CONSISTENCY - FINE-GRAINED SOIL[2, 3]

CONSISTENCY	SPT - N (# blows / ft)	Pocket Pen (tsf)	UNCONFINED COMPRESSIVE STRENGTH (Q_u)(psf)	VISUAL / MANUAL CRITERIA
Very Soft	<2	PP < 0.25	<500	Easily penetrated several inches by fist
Soft	2 - 4	0.25 ≤ PP <0.5	500 - 1,000	Easily penetrated several inches by thumb
Medium Stiff	4 - 8	0.5 ≤ PP <1	1,000 - 2,000	Can be penetrated several inches by thumb with moderate effort
Stiff	8 - 15	1 ≤ PP <2	2,000 - 4,000	Readily indented by thumb but penetrated only with great effort
Very Stiff	15 - 30	2 ≤ PP <4	4,000 - 8,000	Readily indented by thumbnail
Hard	>30	4 ≤ PP	>8,000	Indented by thumbnail with difficulty

APPARENT DENSITY - COARSE-GRAINED SOIL[2]

APPARENT DENSITY	SPT-N (# blows / ft)
Very Loose	<4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	>50

STRUCTURE[1]

DESCRIPTION	CRITERIA
Stratified	Alternating layers of varying material or color with layers at least 1/4-in. (6mm) thick, note thickness.
Laminated	Alternating layers of varying material or color with the layers less than 1/4-in. (6 mm) thick, note thickness.
Fissured	Breaks along definite planes of fracture with little resistance to fracturing.
Slickensided	Fracture planes appear polished or glossy, sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown.
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay; note thickness.
Homogeneous	Same color and appearance throughout

ANGULARITY[1]

DESCRIPTION	CRITERIA
Angular	Particles have sharp edges and relatively plane sides with unpolished surfaces.
Subangular	Particles are similar to angular description but have rounded edges.
Subrounded	Particles have nearly plane sides but have well-rounded corners and edges.
Rounded	Particles have smoothly curved sides and no edges.

REACTION WITH HYDROCHLORIC ACID[1]

DESCRIPTION	FIELD TEST
None	No visible reaction
Weak	Some reaction, with bubbles forming slowly
Strong	Violent reaction, with bubbles forming immediately

CEMENTATION[1]

DESCRIPTION	FIELD TEST
Weakly	Crumbles or breaks with handling or little finger pressure
Moderately	Crumbles or breaks with considerable finger pressure
Strongly	Will not crumble or break with finger pressure

REFERENCES

1. American Society for Materials and Testing (ASTM), 2017, ASTM D2488: Standard Practice for Description and Identification of Soils (Visual Manual Procedures).
2. Terzaghi, K and Peck, R., 1948, Soil Mechanics in Engineering Practice, John Wiley & Sons, New York.
3. United States Department of the Interior Bureau of Reclamation (USBR), 1998, Earth Manual, Part I.

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PROJECT NO.: 20230485.001A
DRAWN BY:
CHECKED BY:
DATE:

APPENDIX 3
SOIL DESCRIPTION KEY

PROPOSED RELOCATION OF THE MAIN GATE
2600 SPRUANCE DRIVE
NEW CASTLE, DELAWARE

PLOTTED: 09/09/2022 01:18 PM BY: WTucker
OFFICE FILTER: OWINGS MILLS
PROJECT NUMBER: 20230485.001A
gINT FILE: Klf_gint_master_2023
gINT TEMPLATE: E:\KLF_STANDARD_GINT_LIBRARY_2023.GLB [KLF_GEO_LEG2_SOIL_DESC_KEY]

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APPENDIX 4

BORING LOG GRAPHIC KEY

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DRILLING METHOD/SAMPLER TYPE GRAPHICS

STANDARD PENETRATION SPLIT SPOON SAMPLER (2 in. (50.8 mm.) outer diameter and 1-3/8 in. (34.9 mm.) inner diameter)

GROUND WATER GRAPHICS

- WATER LEVEL (level where first observed)
- WATER LEVEL (level after stabilizing period)
- WATER LEVEL (additional levels after exploration)
- OBSERVED SEEPAGE

NOTES

- The report and graphics key are an integral part of these logs. All data and interpretations in this log are subject to the explanations and limitations stated in the report.
- Solid lines separating strata on the logs represent approximate boundaries only, dashed lines are inferred or extrapolated boundaries. Actual transitions may be gradual or differ from those represented.
- No warranty is provided as to the continuity of soil or rock conditions between individual sample locations.
- Logs represent general soil or rock conditions observed at the point of exploration on the date indicated.
- In general, Unified Soil Classification System (ASTM D2488/D2487) designations presented on the logs were based on visual classification in the field and were modified where appropriate based on gradation and index property testing.
- Fine grained soils that plot within the hatched area on the Plasticity Chart, and coarse grained soils with between 5% and 12% passing the No. 200 sieve require dual USCS symbols, ie., CL-ML, GW-GM, GP-GM, GW-GC, GP-GC, GC-GM, SW-SM, SP-SM, SW-SC, SP-SC, SC-SM.
- If sampler is not able to be driven at least 6 inches then 50/X indicates number of blows required to drive the identified sampler X inches with a 140 pound hammer falling 30 inches.

ABBREVIATIONS
WOH - Weight of Hammer
WOR - Weight of Rod

REFERENCES
1. American Society for Materials and Testing (ASTM), 2011, ASTM D2487: Classification of Soils for Engineering Purposes (Unified Soil Classification System).

UNIFIED SOIL CLASSIFICATION SYSTEM[1]

COARSE GRAINED SOILS (More than 50% retained on No. 200 Sieve)	**GRAVELS** (More than 50% of coarse fraction retained on No. 4 Sieve)	CLEAN GRAVEL WITH <5% FINES	**GW**	WELL-GRADED GRAVEL, WELL-GRADED GRAVEL WITH SAND
			GP	POORLY GRADED GRAVEL, POORLY GRADED GRAVEL WITH SAND
		GRAVELS WITH 5% TO 12% FINES	**GW-GM**	WELL-GRADED GRAVEL WITH SILT, WELL-GRADED GRAVEL WITH SILT AND SAND
			GW-GC	WELL-GRADED GRAVEL WITH CLAY (OR SILTY CLAY), WELL-GRADED GRAVEL WITH CLAY AND SAND (OR SILT CLAY AND SAND)
			GP-GM	POORLY GRADED GRAVEL WITH SILT, POORLY GRADED GRAVEL WITH SILT AND SAND
			GP-GC	POORLY GRADED GRAVEL WITH CLAY (OR SILTY CLAY), POORLY GRADED GRAVEL WITH CLAY AND (OR SILTY CLAY AND SAND)
		GRAVELS WITH > 12% FINES	**GM**	SILTY GRAVEL, SILTY GRAVEL WITH SAND
			GC	CLAYEY GRAVEL, CLAYEY GRAVEL WITH SAND
			GC-GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL WITH SAND
	SANDS (50% or more of coarse fraction passes the No. 4 Sieve)	CLEAN SANDS WITH <5% FINES	**SW**	WELL-GRADED SAND, WELL-GRADED SAND WITH GRAVEL
			SP	POORLY GRADED SAND, POORLY GRADED SAND WITH GRAVEL
		SANDS WITH 5% TO 12% FINES	**SW-SM**	WELL-GRADED SAND WITH SILT, WELL-GRADED SAND WITH SILT AND GRAVEL
			SW-SC	WELL-GRADED SAND WITH CLAY (OR SILTY CLAY), WELL-GRADED SAND WITH CLAY AND GRAVEL (OR SILTY CLAY AND GRAVEL)
			SP-SM	POORLY GRADED SAND WITH SILT, POORLY GRADED SAND WITH SILT AND GRAVEL
			SP-SC	POORLY GRADED SAND WITH CLAY, POORLY GRADED SAND WITH CLAY AND GRAVEL (OR SILTY CLAY AND GRAVEL)
		SANDS WITH > 12% FINES	**SM**	SILTY SAND, SILTY SAND WITH GRAVEL
			SC	CLAYEY SAND, CLAYEY SAND WITH GRAVEL
			SC-SM	SILTY, CLAYEY SAND, SILTY, CLAYEY SAND WITH GRAVEL

FINE GRAINED SOILS (50% or more passes the No. #200 sieve)	(Liquid Limit less than 50)	**ML**	SILT, SILT WITH SAND, SILT WITH GRAVEL
		CL	LEAN CLAY, LEAN CLAY WITH SAND, LEAN CLAY WITH GRAVEL
		CL-ML	SILTY CLAY, SILTY CLAY WITH SAND, SILTY CLAY WITH GRAVEL
		OL	ORGANIC CLAY, ORGANIC CLAY WITH SAND, ORGANIC CLAY WITH GRAVEL, ORGANIC SILT, ORGANIC SILT WITH SAND, ORGANIC SILT WITH GRAVEL
	SILTS AND CLAYS (Liquid Limit 50 or greater)	**MH**	ELASTIC SILT. ELASTIC SILT WITH SAND, ELASTIC SILT WITH GRAVEL
		CH	FAT CLAY, FAT CLAY WITH SAND, FAT CLAY WITH GRAVEL
		OH	ORGANIC CLAY, ORGANIC CLAY WITH SAND, ORGANIC CLAY WITH GRAVEL, ORGANIC SILT, ORGANIC SILT WITH SAND, ORGANIC SILT WITH GRAVEL

NOTE: USE MATERIAL DESCRIPTION ON THE LOG TO DEFINE A GRAPHIC THAT MAY NOT BE PROVIDED ON THIS LEGEND.

NOT FOR BIDDING

CENTURY ENGINEERING
A Kleinfelder Company

PROJECT NO.: 20233371.002A
DRAWN BY:
CHECKED BY:
DATE:

APPENDIX 4
BORING LOG GRAPHICS KEY

PROPOSED RELOCATION OF THE MAIN GATE
2600 SPRUANCE DRIVE
NEW CASTLE, DELAWARE

gINT FILE: Klf_gint_master_2023
gINT TEMPLATE: E:\KLF_STANDARD_GINT_LIBRARY_2023.GLB [_KLF_GEO_LEG1_GRAPHICS_KEY_W_USCS]
PROJECT NUMBER: 20230485.001A
OFFICE FILTER: OWINGS MILLS
PLOTTED: 09/09/2022 01:17 PM BY: WTucker

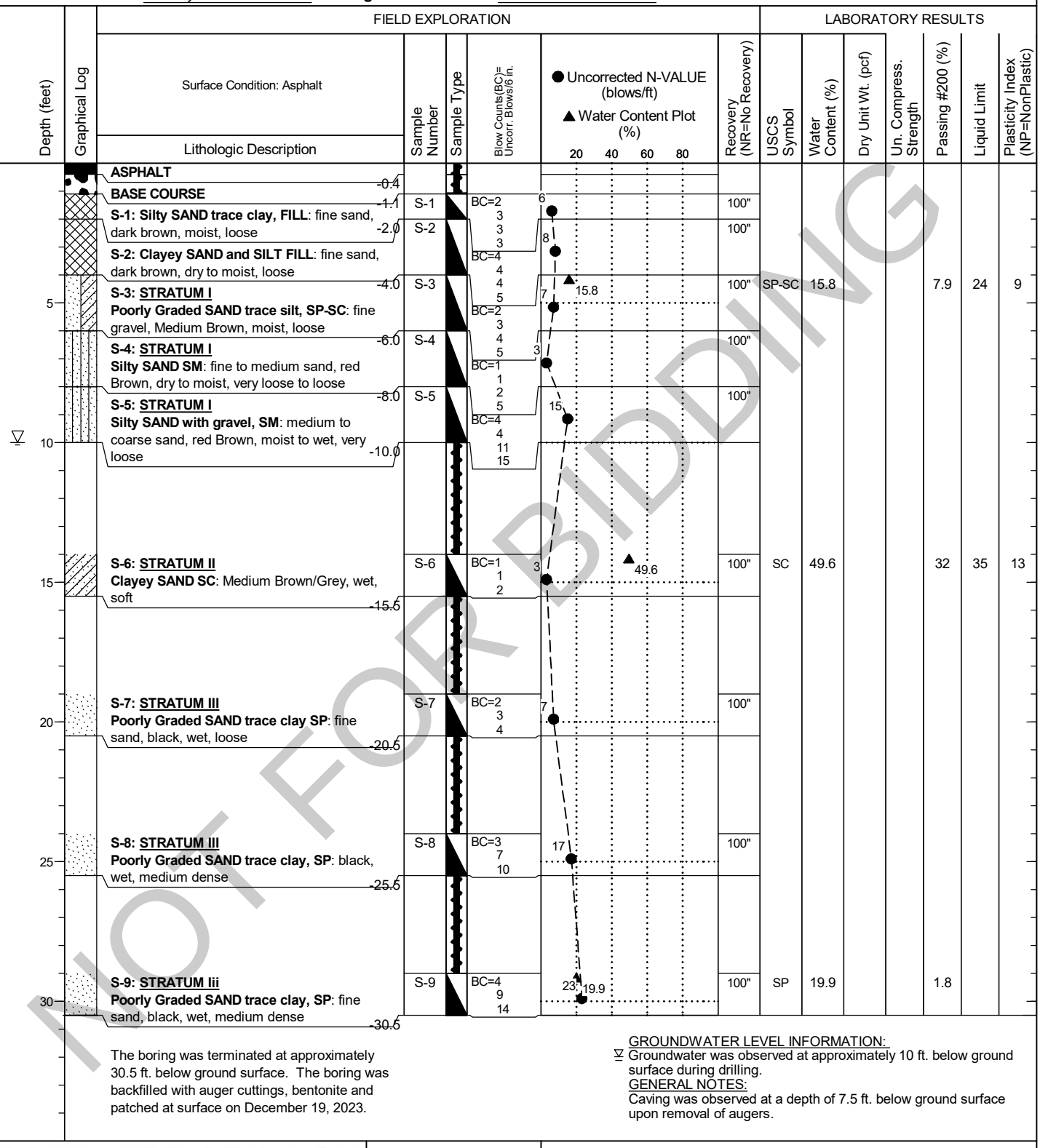
CENTURY ENGINEERING
A Kleinfelder Company

APPENDIX 5

BORING LOGS

NOT FOR BIDDING

Date Begin - End:	12/19/2023	**Drilling Company:**	John D. Hynes & Associates	**BORING LOG SB-1**	
Logged By:	DFJ	**Drill Crew:**	Brian		
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe 7822DT	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger		
Weather:	Windy and Cold	**Auger Diameter:**	4 in. O.D.		



The boring was terminated at approximately 30.5 ft. below ground surface. The boring was backfilled with auger cuttings, bentonite and patched at surface on December 19, 2023.

GROUNDWATER LEVEL INFORMATION:
▽ Groundwater was observed at approximately 10 ft. below ground surface during drilling.
GENERAL NOTES:
Caving was observed at a depth of 7.5 ft. below ground surface upon removal of augers.

NOT FOR BIDDING

CENTURY ENGINEERING
A Kleinfelder Company

PROJECT NO.: 24002670.001A
DRAWN BY: DFJ
CHECKED BY: EMC
DATE: 12/26/2023

BORING LOG SB-1

LEGISLATIVE HALL PARKING GARAGE
150 East Water Street
Dover, Kent County, Delaware

PLOTTED: 03/21/2024 01:31 PM BY: djohns
OFFICE FILTER: DOVER
PROJECT NUMBER: 24002670.001A
gINT FILE: Klf_gint_master_2024
gINT TEMPLATE: E:\KLF_STANDARD_GINT_LIBRARY_2024.GLB [KLF_BORING WITH N-PLOT]

Date Begin - End:	12/19/2023	**Drilling Company:**	John D. Hynes & Associates	**BORING LOG SB-2**	
Logged By:	DFJ	**Drill Crew:**	Brian		
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe 7822DT	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger		
Weather:	Windy and Cold	**Auger Diameter:**	4 in. O.D.		

FIELD EXPLORATION | LABORATORY RESULTS

Surface Condition: Asphalt

Depth (feet)	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Uncorrected N-VALUE (blows/ft) / Water Content Plot (%)	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Un. Compress. Strength	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)
0	**ASPHALT** -0.33												
	BASE COURSE -0.83	S-1		BC=4 6 5	11	100%							
	S-1: Clayey SAND trace silt, SC, FILL: coarse sand, grey, dry to moist, medium dense -2.0	S-2		BC=7 4 6	14	100%							
	S-2: Silty SAND and GRAVEL trace sand, SM+G: fine to medium sand, dark brown, dry to moist, loose -4.0	S-3		BC=8 8 3	7	100%							
5	**S-3: STRATUM I** **Poorly Graded SAND trace silt, trace gravel, SP-SC**: fine sand, reddish brown, moist to wet, loose -6.0	S-4		BC=2 5 4	13	100%							
	S-4: STRATUM I **Silty SAND trace silt, some gravel, SM**: fine to medium sand, brown, moist to wet, loose -8.0	S-5		BC=3 6 7	3	100%							
10	**S-5: STRATUM I** **SAND and GRAVEL with silt, SM+G**: coarse sand, brown, wet, very loose to loose -10.0			BC=9 1 2 2									
	S-6: STRATUM II **Silty CLAY some sand, mottled, CL-ML**: fine sand, Grey Brown to Black, moist to wet, stiff -15.5	S-6		BC=3 4 6	10	100%							
15													
20	**S-7: STRATUM III** **Poorly Graded SAND trace clay, SP**: fine sand, black, moist to wet, medium dense -20.5	S-7		BC=5 9 13	22	100%							
	S-8: STRATUM III **Poorly Graded SAND trace clay, SP**: fine sand, black, moist to wet, medium dense -25.5	S-8		BC=6 11 15	26	100%							
25													
30	**S-9: STRATUM III** **Poorly Graded SAND trace clay, SP**: fine to medium sand, black, moist to wet, dense -30.5	S-9		BC=8 14 19	33	100%	SP				1.2		

The boring was terminated at approximately 30.5 ft. below ground surface. The boring was backfilled with auger cuttings, bentonite and patched at surface on December 19, 2023.

GROUNDWATER LEVEL INFORMATION:
▽ Groundwater was observed at approximately 6 ft. below ground surface during drilling.
GENERAL NOTES:
Caving was observed at a depth of 8 ft. below ground surface upon removal of augers.

NOT FOR BIDDING

CENTURY ENGINEERING
A Kleinfelder Company

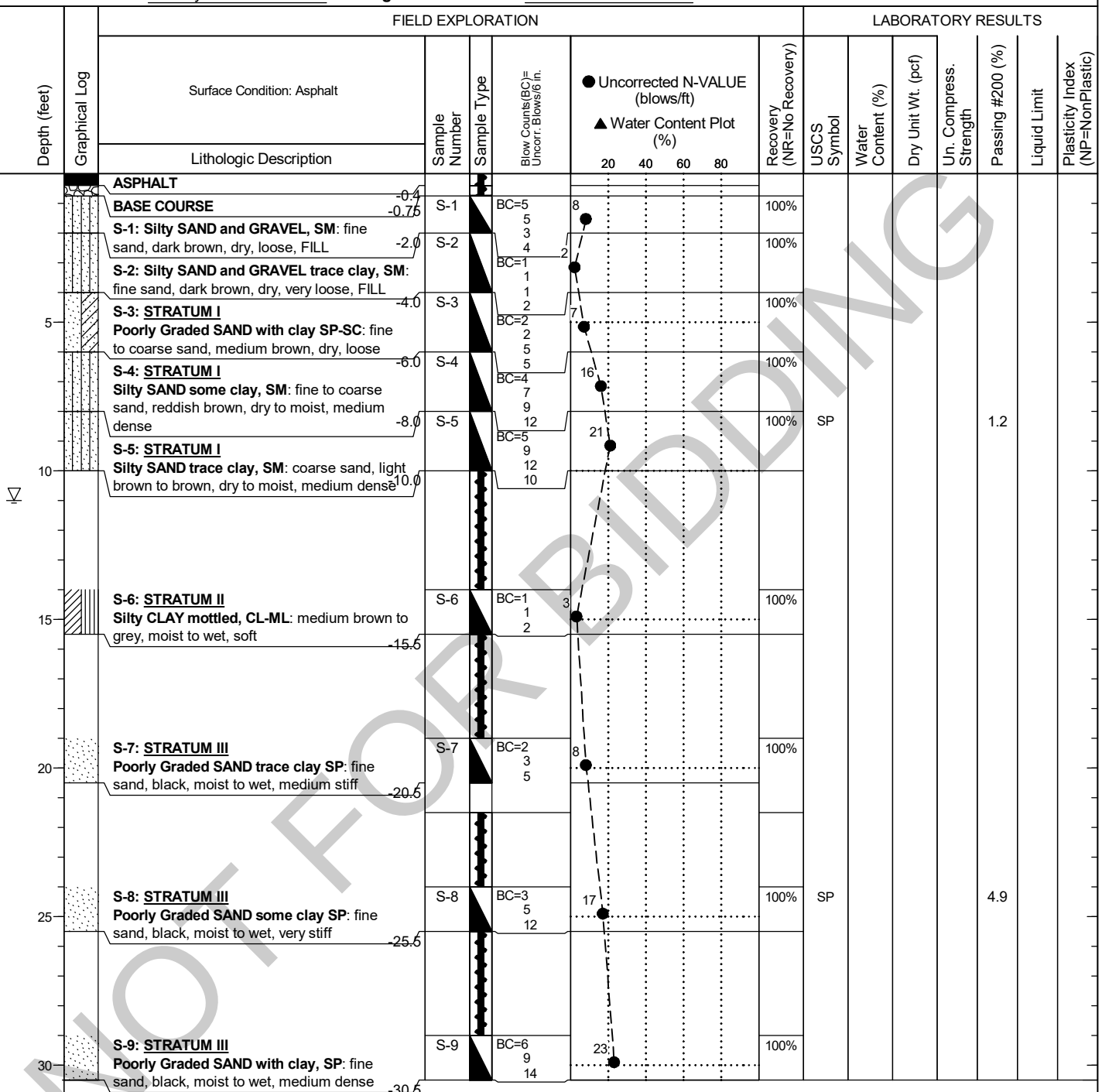
PROJECT NO.: 24002670.001A
DRAWN BY: DFJ
CHECKED BY: EMC
DATE: 12/27/2023

BORING LOG SB-2

LEGISLATIVE HALL PARKING GARAGE
150 East Water Street
Dover, Kent County, Delaware

PLOTTED: 03/21/2024 01:31 PM BY: djohns
OFFICE FILTER: DOVER
PROJECT NUMBER: 24002670.001A
gINT FILE: Klf_gint_master_2024
gINT TEMPLATE: E:\KLF_STANDARD_GINT_LIBRARY_2024.GLB [KLF_BORING WITH N-PLOT]

Date Begin - End:	12/19/2023	**Drilling Company:**	John D. Hynes & Associates	**BORING LOG SB-3**	
Logged By:	DFJ	**Drill Crew:**	Brian		
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe 7822DT	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger		
Weather:	Windy and Cold	**Auger Diameter:**	4 in. O.D.		



The boring was terminated at approximately 30.5 ft. below ground surface. The boring was backfilled with auger cuttings, bentonite and patched at surface on December 19, 2023.

GROUNDWATER LEVEL INFORMATION:
▽ Groundwater was observed at approximately 11 ft. below ground surface during drilling.
GENERAL NOTES:
Caving was observed at a depth of 8 ft. below ground surface upon removal of augers.

NOT FOR BIDDING

CENTURY ENGINEERING
A Kleinfelder Company

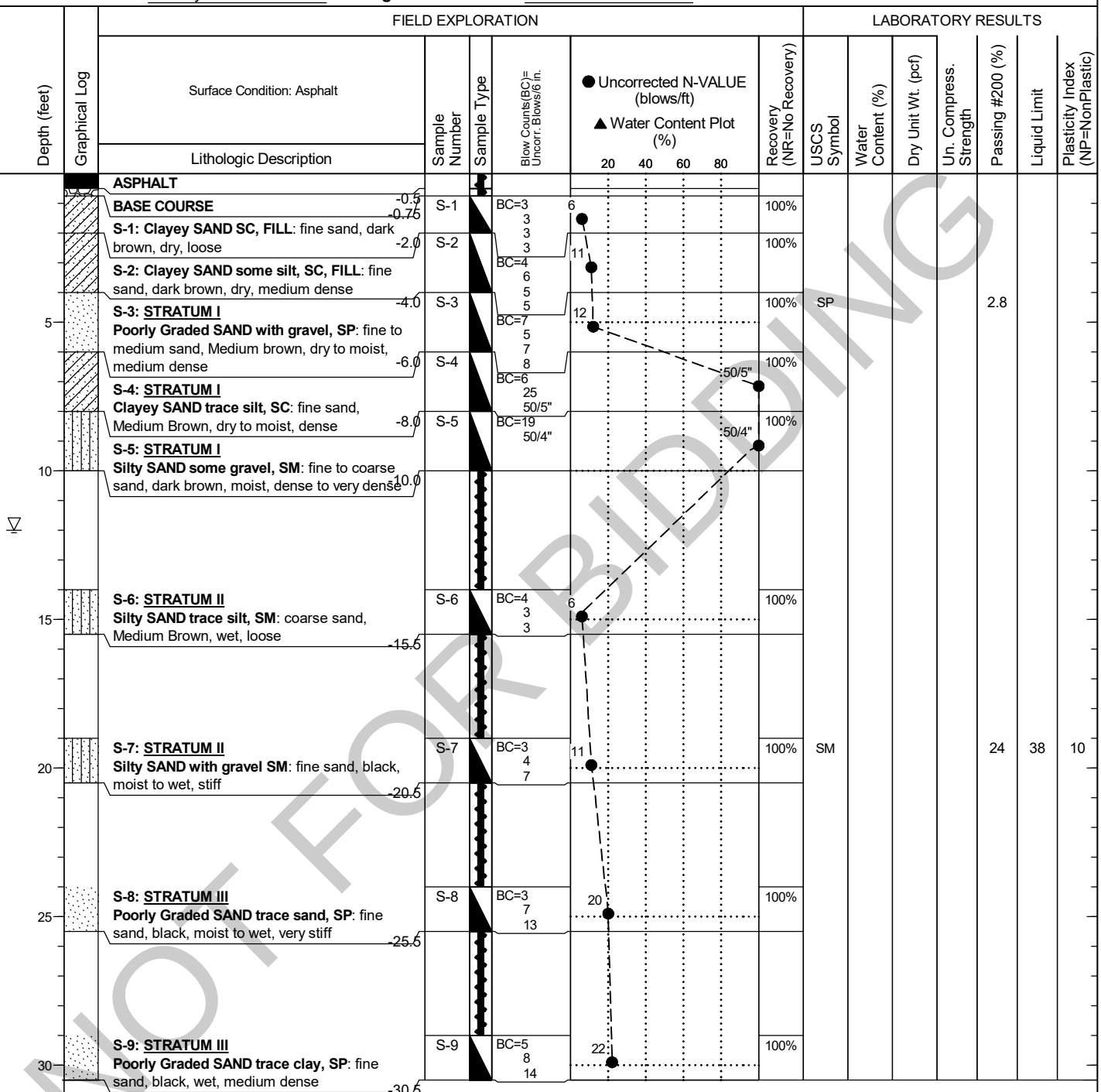
PROJECT NO.:	24002670.001A
DRAWN BY:	DFJ
CHECKED BY:	EMC
DATE:	12/27/2023

BORING LOG SB-3

LEGISLATIVE HALL PARKING GARAGE
150 East Water Street
Dover, Kent County, Delaware

PLOTTED: 03/21/2024 01:32 PM BY: djohns
OFFICE FILTER: DOVER
PROJECT NUMBER: 24002670.001A
gINT FILE: Klf_gint_master_2024
gINT TEMPLATE: E:\KLF_STANDARD_GINT_LIBRARY_2024.GLB [KLF_BORING WITH N-PLOT]

Date Begin - End:	12/19/2023	**Drilling Company:**	John D. Hynes & Associates	**BORING LOG SB-4**	
Logged By:	DFJ	**Drill Crew:**	Brian		
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe 7822DT	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger		
Weather:	Windy and Cold	**Auger Diameter:**	4 in. O.D.		



The boring was terminated at approximately 30.5 ft. below ground surface. The boring was backfilled with auger cuttings, bentonite and patched at surface on December 19, 2023.

GROUNDWATER LEVEL INFORMATION:
▽ Groundwater was observed at approximately 12 ft. below ground surface during drilling.
GENERAL NOTES:
Caving was observed at a depth of 9.5 ft. below ground surface upon removal of augers.

NOT FOR BIDDING

CENTURY ENGINEERING
A Kleinfelder Company

PROJECT NO.:	24002670.001A
DRAWN BY:	DFJ
CHECKED BY:	EMC
DATE:	12/27/2023

BORING LOG SB-4

LEGISLATIVE HALL PARKING GARAGE
150 East Water Street
Dover, Kent County, Delaware

PLOTTED: 03/21/2024 01:32 PM BY: djohns
OFFICE FILTER: DOVER
PROJECT NUMBER: 24002670.001A
gINT FILE: Klf_gint_master_2024
gINT TEMPLATE: E:\KLF_STANDARD_GINT_LIBRARY_2024.GLB [KLF_BORING WITH N-PLOT]

Date Begin - End:	12/19/2023	**Drilling Company:**	John D. Hynes & Associates	**BORING LOG SB-5**	
Logged By:	DFJ	**Drill Crew:**	Brian		
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe 7822DT	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger		
Weather:	Windy and Cold	**Auger Diameter:**	4 in. O.D.		

Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Uncorrected N-VALUE (blows/ft) / Water Content Plot (%)	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Un. Compress. Strength	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)
		Surface Condition: Asphalt				20 40 60 80								
		ASPHALT												
		BASE COURSE -0.95												
		S-1: Silty CLAY trace sand, fill, FILL: fine sand, brown/Black, dry, medium stiff -1.25 -2.0	S-1		BC=3 3 2 2	5 4	100%							
		S-2: Clayey SAND trace silt, SC: fine sand, Medium Brown, dry, loose -4.0	S-2		BC=2 2 2 4	3	100%							
5		**S-3: STRATUM I** **Clayey SAND trace silt, SC**: fine sand, Medium Brown, dry to moist, very loose -6.0	S-3		BC=1 2 1 2	22	100%							
		S-4: STRATUM I **Silty SAND and CLAY trace clay, SM**: coarse sand, brown/white, dry to moist, medium dense to dense -8.0	S-4		BC=6 8 14 16	16	100%	SP				0.5		
10		**S-5: STRATUM I** **Poorly Graded SAND trace clay, SP**: coarse sand, brown, dry to moist, medium dense -10.0	S-5		BC=5 7 9 12									
		▽												
15		**S-6: STRATUM II** **Clayey SAND trace silt, mottled, SC**: fine to coarse sand, Medium Brown/white, moist, loose -15.5	S-6		BC=1 2 4	6	100%							
20		**S-7: STRATUM III** **Silty CLAY CL-ML**: fine sand, light brown to red brown, wet, stiff -20.5	S-7		BC=1 1 2	3	100%							
25		**S-8: STRATUM III** **Silty CLAY with sand, mottled, CL-ML**: fine to medium sand, red brown/grey, moist to wet, medium stiff -25.5	S-8		BC=1 2 2	4	100%							
30		**S-9: STRATUM IV** **Poorly Graded SAND trace clay, SP**: fine sand, brown to Grey, moist to wet, medium dense -30.5	S-9		BC=6 8 11	19	100%	SP				1.2		

The boring was terminated at approximately 30.5 ft. below ground surface. The boring was backfilled with auger cuttings, bentonite and patched at surface on December 19, 2023.

GROUNDWATER LEVEL INFORMATION:
▽ Groundwater was observed at approximately 13 ft. below ground surface during drilling.
GENERAL NOTES:
Caving was observed at a depth of 8.5 ft. below ground surface upon removal of augers.

NOT FOR BIDDING

CENTURY ENGINEERING
A Kleinfelder Company

PROJECT NO.: 24002670.001A
DRAWN BY: DFJ
CHECKED BY: EMC
DATE: 12/27/2023

BORING LOG SB-5

LEGISLATIVE HALL PARKING GARAGE
150 East Water Street
Dover, Kent County, Delaware

PLOTTED: 03/21/2024 01:32 PM BY: djohns
OFFICE FILTER: DOVER
PROJECT NUMBER: 24002670.001A
gINT FILE: Klf_gint_master_2024
gINT TEMPLATE: E:\KLF_STANDARD_GINT_LIBRARY_2024.GLB [KLF_BORING WITH N-PLOT]

Date Begin - End:	12/19/2023	**Drilling Company:**	John D. Hynes & Associates	**BORING LOG SB-6**	
Logged By:	DFJ	**Drill Crew:**	Ben		
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe 3230DT	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger		
Weather:	Windy and Cold	**Auger Diameter:**	4 in. O.D.		

Depth (feet)	Graphical Log	Surface Condition: Grass Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Uncorrected N-VALUE (blows/ft) ▲ Water Content Plot (%) 20 40 60 80	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Un. Compress. Strength	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)
		TOPSOIL												
		S-1: Silty SAND trace clay, trace gravel, fill 0.75 **SM**: fine sand, dark brown, dry, very loose to loose	S-1		BC=2 1 2	3	100%							
		-2.0 **S-2: Sandy CLAY trace gravel,fill, CL-ML**: fine sand, light brown to dark brown, dry to moist, soft to medium	S-2		2 BC=1 1 1 4	2	100%							
5		**S-3: STRATUM I** -4.0 **Clayey SAND trace silt, fill, SC**: fine sand, dark brown/grey, dry to moist, very loose	S-3		BC=2 2 1 1	3	100%							
		S-4: STRATUM I -6.0 **Silty SAND trace gravel, SM**: fine to medium sand, medium brown, dry to moist, loose to medium dense	S-4		BC=2 3 4 7	7	100%							
		S-5: STRATUM I -8.0 **Silty SAND trace clay, SM**: fine to medium sand, medium brown, wet, medium dense	S-5		BC=6 7 9 14	16	100%							
10		-10.0												
▽		**S-6: STRATUM II** **Silty SAND and GRAVEL, SM**: fine to coarse sand, brown, moist, loose to medium dense	S-6		BC=4 9 14	23	100%							
15		-15.5												
		S-7: STRATUM III **Poorly Graded SAND and clay, SP**: fine sand, black, moist, loose	S-7		BC=WOH/2" 6 2	WOH/2"	100%							
20		-20.5												
		S-8: STRATUM III **Poorly Graded SAND trace clay SP**: fine sand, black, moist, loose	S-8		BC=2 3 3	6	100%							
25		-25.5												

NOT FOR BIDDING

CENTURY ENGINEERING
A Kleinfelder Company

PROJECT NO.: 24002670.001A
DRAWN BY: DFJ
CHECKED BY: EMC
DATE: 12/27/2023

BORING LOG SB-6

LEGISLATIVE HALL PARKING GARAGE
150 East Water Street
Dover, Kent County, Delaware

PLOTTED: 03/21/2024 01:32 PM BY: djohns
OFFICE FILTER: DOVER
PROJECT NUMBER: 24002670.001A
gINT FILE: Klf_gint_master_2024
gINT TEMPLATE: E:\KLF_STANDARD_GINT_LIBRARY_2024.GLB [KLF_BORING WITH N-PLOT]

Date Begin - End:	12/19/2023	**Drilling Company:**	John D. Hynes & Associates	**BORING LOG SB-6**	
Logged By:	DFJ	**Drill Crew:**	Ben		
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe 3230DT	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger		
Weather:	Windy and Cold	**Auger Diameter:**	4 in. O.D.		

FIELD EXPLORATION | LABORATORY RESULTS

Surface Condition: Grass

Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Uncorrected N-VALUE (blows/ft) / Water Content Plot (%)	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Un. Compress. Strength	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)
30		**S-9: STRATUM IV** **Poorly Graded SAND trace clay, SP**: fine sand, black, moist to wet, medium dense	S-9		BC=4 4 9	13	100%							
		-30.5												
35		**S-10: STRATUM IV** **Poorly Graded SAND trace clay, SP**: fine sand, black, wet, medium dense	S-10		BC=3 4 7	11	100%							
		-35.5												
40		**S-11: STRATUM IV** **Silty SAND, SM**: fine to medium sand, medium brown, wet, medium dense	S-11		BC=2 4 7	11	100%							
		-40.5												
45		**S-12: STRATUM IV** **Silty SAND trace clay, trace gravel, SM**: fine to medium sand, medium brown, moist to wet, very dense	S-12		BC=10 34 50/3"	50/3"	100%							
		-45.5												
50		**S-13: STRATUM IV** **Silty SAND trace gravel, SM**: fine to medium sand, light brown, moist to wet, very dense	S-13		BC=10 22 33	55	100%							
		-50.5												
55		**S-14: STRATUM V** **Clayey SILT trace sand, mottled, CL-ML**: fine sand, black/Grey, moist, very stiff	S-14		BC=6 7 21	28	100%							
		-55.5												

NOT FOR BIDDING

CENTURY ENGINEERING
A Kleinfelder Company

PROJECT NO.: 24002670.001A
DRAWN BY: DFJ
CHECKED BY: EMC
DATE: 12/27/2023

BORING LOG SB-6

LEGISLATIVE HALL PARKING GARAGE
150 East Water Street
Dover, Kent County, Delaware

PLOTTED: 03/21/2024 01:32 PM BY: djohns
OFFICE FILTER: DOVER
PROJECT NUMBER: 24002670.001A
gINT FILE: Klf_gint_master_2024
gINT TEMPLATE: E:\KLF_STANDARD_GINT_LIBRARY_2024.GLB [KLF_BORING WITH N-PLOT]

Date Begin - End:	12/19/2023	**Drilling Company:**	John D. Hynes & Associates	**BORING LOG SB-6**	
Logged By:	DFJ	**Drill Crew:**	Ben		
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe 3230DT	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger		
Weather:	Windy and Cold	**Auger Diameter:**	4 in. O.D.		

FIELD EXPLORATION | LABORATORY RESULTS

Surface Condition: Grass

Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Uncorrected N-VALUE (blows/ft) ▲ Water Content Plot (%) 20 40 60 80	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Un. Compress. Strength	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)
60		**S-15: STRATUM V** **Silty CLAY, CL-ML**: dark grey, moist, medium stiff	S-15		BC=2 2 5	7	100%							
		-60.5												
65		**S-16: STRATUM V** **Poorly Graded SAND SP**: black, wet, medium stiff	S-16		BC=2 2 5	7	100%							
		-65.5												
70		**S-17: STRATUM V** **Poorly Graded SAND trace clay SP**: fine sand, black, wet, stiff	S-17		BC=3 4 7	11	100%							
		-70.5												
75		**S-18: STRATUM V** **Poorly Graded SAND trace clay, SP**: fine sand, black, wet, stiff	S-18		BC=3 4 7	11	100%							
		-75.5												
80		**S-19: STRATUM VI** **Poorly Graded SAND trace clay, SP**: fine sand, black, wet, medium dense	S-19		BC=7 10 16	26	100%							
		-80.5												

NOT FOR BIDDING

CENTURY ENGINEERING
A Kleinfelder Company

PROJECT NO.: 24002670.001A
DRAWN BY: DFJ
CHECKED BY: EMC
DATE: 12/27/2023

BORING LOG SB-6

LEGISLATIVE HALL PARKING GARAGE
150 East Water Street
Dover, Kent County, Delaware

PLOTTED: 03/21/2024 01:32 PM BY: djohns
OFFICE FILTER: DOVER
PROJECT NUMBER: 24002670.001A
gINT FILE: Klf_gint_master_2024
gINT TEMPLATE: E:\KLF_STANDARD_GINT_LIBRARY_2024.GLB [KLF_BORING WITH N-PLOT]

Date Begin - End:	12/19/2023	**Drilling Company:**	John D. Hynes & Associates	**BORING LOG SB-6**	
Logged By:	DFJ	**Drill Crew:**	Ben		
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Geoprobe 3230DT	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Hollow Stem Auger		
Weather:	Windy and Cold	**Auger Diameter:**	4 in. O.D.		

FIELD EXPLORATION | LABORATORY RESULTS

Depth (feet)	Graphical Log	Surface Condition: Grass / Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in.	Uncorrected N-VALUE (blows/ft) ● / Water Content Plot (%) ▲ (20 40 60 80)	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Un. Compress. Strength	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)
85		**S-20: STRATUM VI** **Poorly Graded SAND trace clay SP**: fine sand, black, wet, medium dense	S-20		BC=2 8 13	21	100%							
		-85.5												
90		**S-21: STRATUM VI** **Poorly Graded SAND trace clay, SP**: fine sand, black, wet, medium dense	S-21		BC=8 9 13	22	100%							
		-90.5												
95		**S-22: STRATUM VII** **Poorly Graded SAND trace clay SP**: fine sand, black, wet, very soft to soft	S-22		BC=4 7 14	21	100%							
		-95.5												
100		**S-23: STRATUM VII** **Poorly Graded SAND trace silt,gravel, SP**: coarse sand, dark green/white, wet, very dense	S-23		BC=7 23 50/5"	50/5"	100%							
		-100.5												
105														
110														

The boring was terminated at approximately 100.5 ft. below ground surface. The boring was backfilled with auger cuttings, bentonite and patched at surface on December 19, 2023.

GROUNDWATER LEVEL INFORMATION:
▽ Groundwater was observed at approximately 13 ft. below ground surface during drilling.
GENERAL NOTES:
Caving was observed at a depth of 8 ft. below ground surface upon removal of augers.

NOT FOR BIDDING

CENTURY ENGINEERING
A Kleinfelder Company

PROJECT NO.:	24002670.001A
DRAWN BY:	DFJ
CHECKED BY:	EMC
DATE:	12/27/2023

BORING LOG SB-6

LEGISLATIVE HALL PARKING GARAGE
150 East Water Street
Dover, Kent County, Delaware

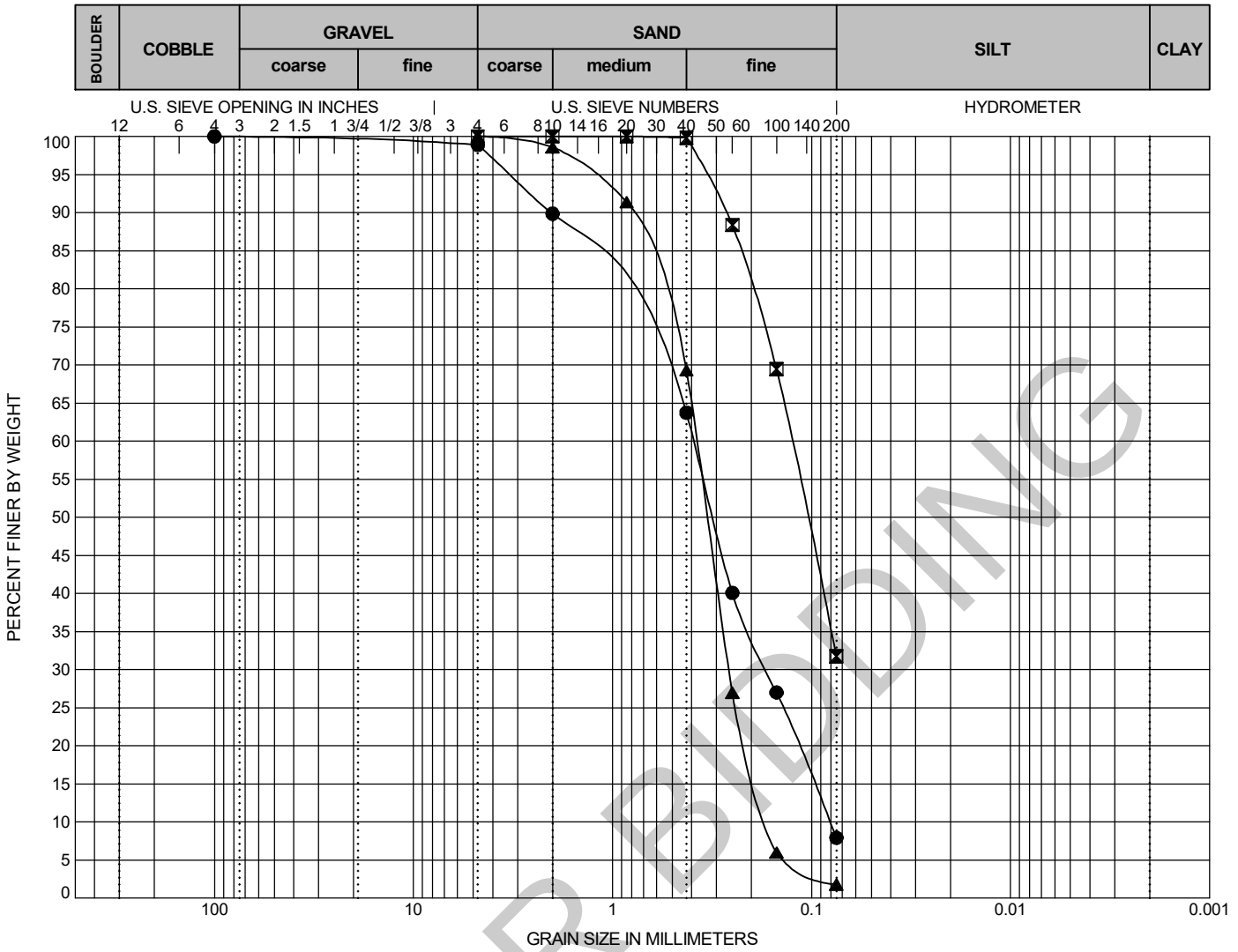
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CENTURY ENGINEERING
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APPENDIX 6

SOIL LABORATORY RESULTS

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Exploration ID		Depth (ft.)	Sample Number	Sample Description	LL	PL	PI
●	SB-1	4 - 6	S-3	SILTY SAND	24	15	9
⊠	SB-1	14 - 15.5	S-6	CLAYEY SAND (SC)	35	22	13
▲	SB-1	29 - 30.5	S-9	POORLY GRADED SAND (SP)	NM	NM	NM

Exploration ID		Depth (ft.)	D_{100}	D_{60}	D_{30}	D_{10}	Cc	Cu	Passing 3/4"	Passing #4	Passing #200	%Silt*	%Clay*
●	SB-1	4 - 6	100	0.391	0.169	0.081	0.90	4.83		99	7.9	NM	NM
⊠	SB-1	14 - 15.5	4.75	0.126	NM	NM	NM	NM		100	32	NM	NM
▲	SB-1	29 - 30.5	4.75	0.378	0.26	0.166	1.08	2.29		100	1.8	NM	NM

*These numbers represent silt-sized and clay-sized content but may not indicate the percentage of the material with the engineering properties of silt or clay. Sieve Analysis and Hydrometer Analysis testing performed in general accordance with ASTM D6913(Sieve Analysis) and ASTM D7928 (Hydrometer Analysis).
NP = Nonplastic
NA = Not Available
NM = Not Measured

Coefficients of Uniformity - $C_u = D_{60} / D_{10}$
Coefficients of Curvature - $C_C = (D_{30})^2 / D_{60} D_{10}$
D_{60} = Grain diameter at 60% passing
D_{30} = Grain diameter at 30% passing
D_{10} = Grain diameter at 10% passing

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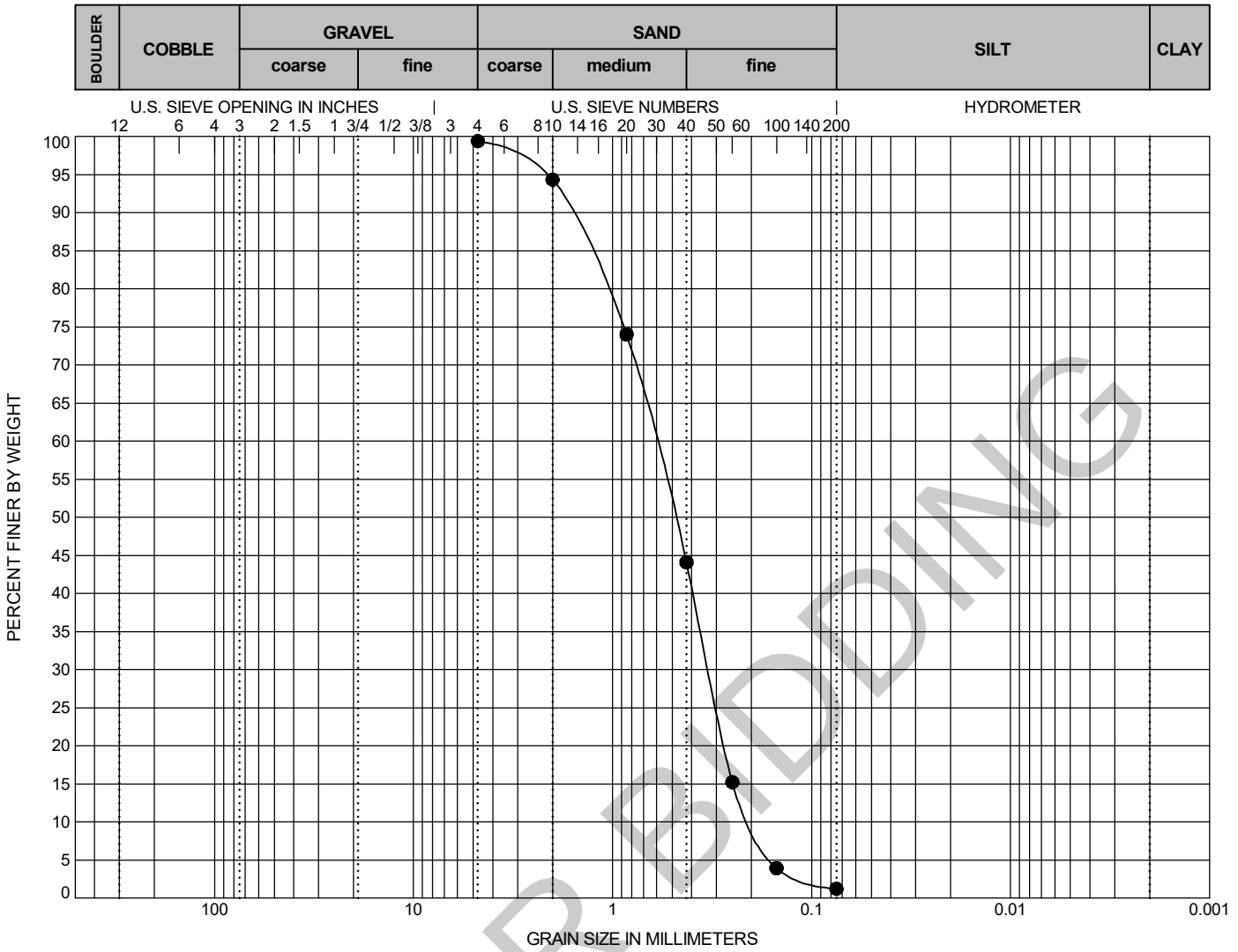
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SIEVE ANALYSIS

LEGISLATIVE HALL PARKING GARAGE
150 East Water Street
Dover, Kent County, Delaware

TABLE

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Exploration ID	Depth (ft.)	Sample Number	Sample Description	LL	PL	PI
● SB-2	29 - 30.5	S-9	POORLY GRADED SAND (SP)	NM	NM	NM

Exploration ID	Depth (ft.)	D_{100}	D_{60}	D_{30}	D_{10}	Cc	Cu	Passing 3/4"	Passing #4	Passing #200	%Silt*	%Clay*
● SB-2	29 - 30.5	4.75	0.615	0.328	0.198	0.89	3.11		99	1.2	NM	NM

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CENTURY ENGINEERING
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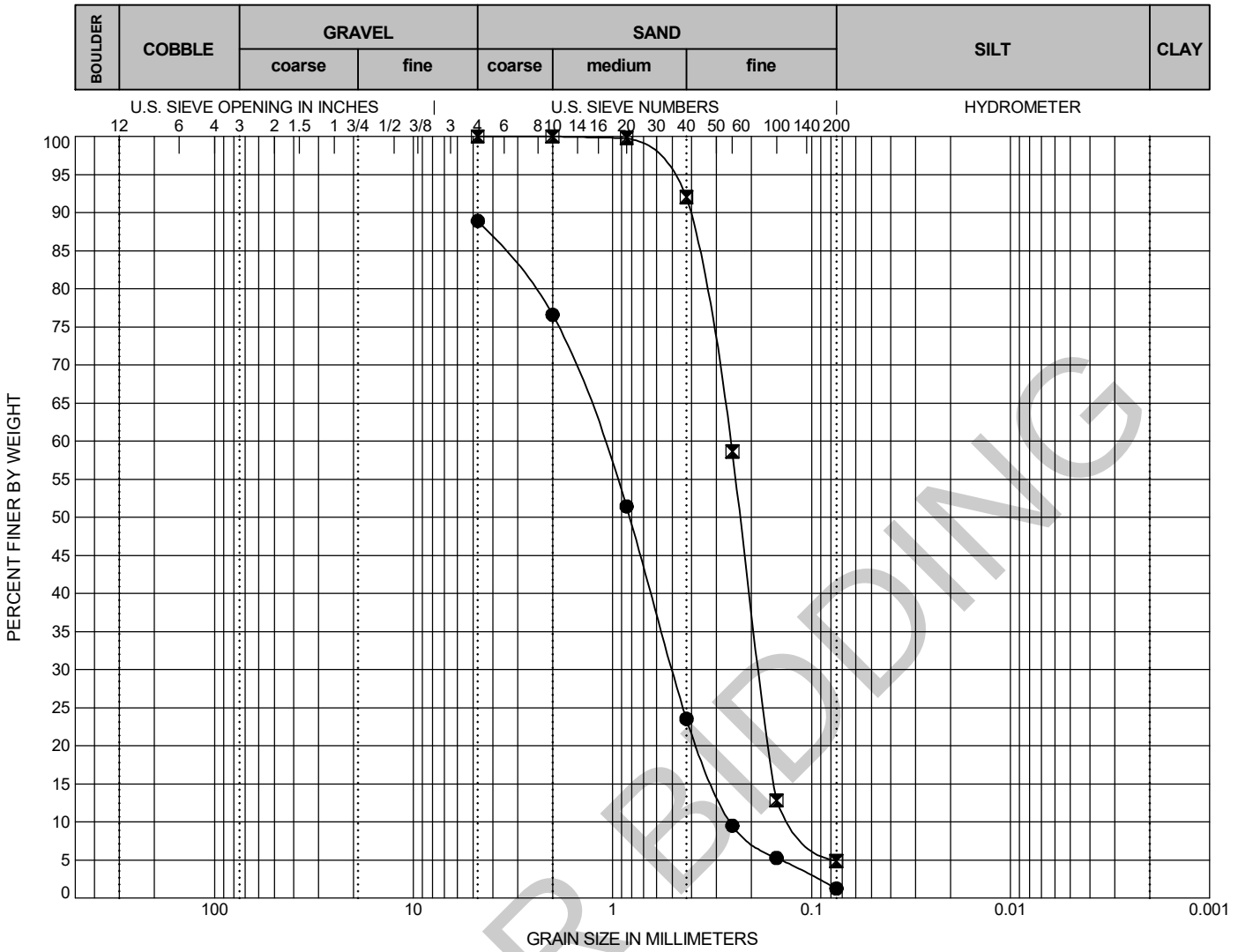
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150 East Water Street
Dover, Kent County, Delaware

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Exploration ID		Depth (ft.)	Sample Number	Sample Description	LL	PL	PI
●	SB-3	8 - 10	S-5	POORLY GRADED SAND (SP)	NM	NM	NM
⊠	SB-3	24 - 25.5	S-8	POORLY GRADED SAND (SP)	NM	NM	NM

Exploration ID		Depth (ft.)	D_{100}	D_{60}	D_{30}	D_{10}	Cc	Cu	Passing 3/4"	Passing #4	Passing #200	%Silt*	%Clay*
●	SB-3	8 - 10	4.75	1.138	0.499	0.255	0.86	4.47		89	1.2	NM	NM
⊠	SB-3	24 - 25.5	4.75	0.256	0.182	0.117	1.10	2.18		100	4.9	NM	NM

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D_{60} = Grain diameter at 60% passing
D_{30} = Grain diameter at 30% passing
D_{10} = Grain diameter at 10% passing

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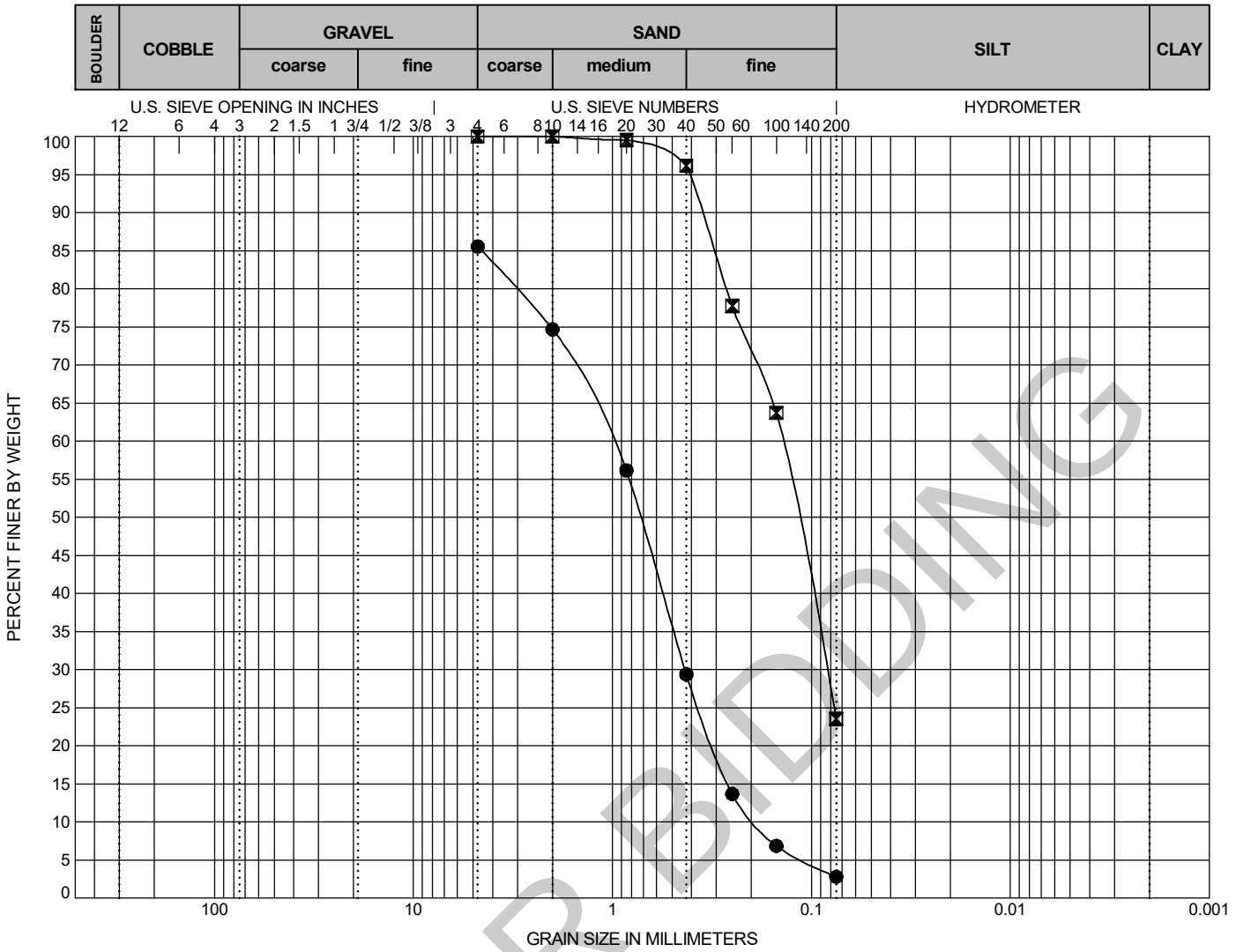
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LEGISLATIVE HALL PARKING GARAGE
150 East Water Street
Dover, Kent County, Delaware

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Exploration ID	Depth (ft.)	Sample Number	Sample Description	LL	PL	PI
● SB-4	4 - 6	S-3	POORLY GRADED SAND (SP)	NM	NM	NM
⊠ SB-4	19 - 20.5	S-7	SILTY SAND (SM)	38	28	10

Exploration ID	Depth (ft.)	D_{100}	D_{60}	D_{30}	D_{10}	Cc	Cu	Passing 3/4"	Passing #4	Passing #200	%Silt*	%Clay*
● SB-4	4 - 6	4.75	1.016	0.432	0.19	0.97	5.35		86	2.8	NM	NM
⊠ SB-4	19 - 20.5	4.75	0.141	0.084	NM	NM	NM		100	24	NM	NM

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D_{30} = Grain diameter at 30% passing
D_{10} = Grain diameter at 10% passing

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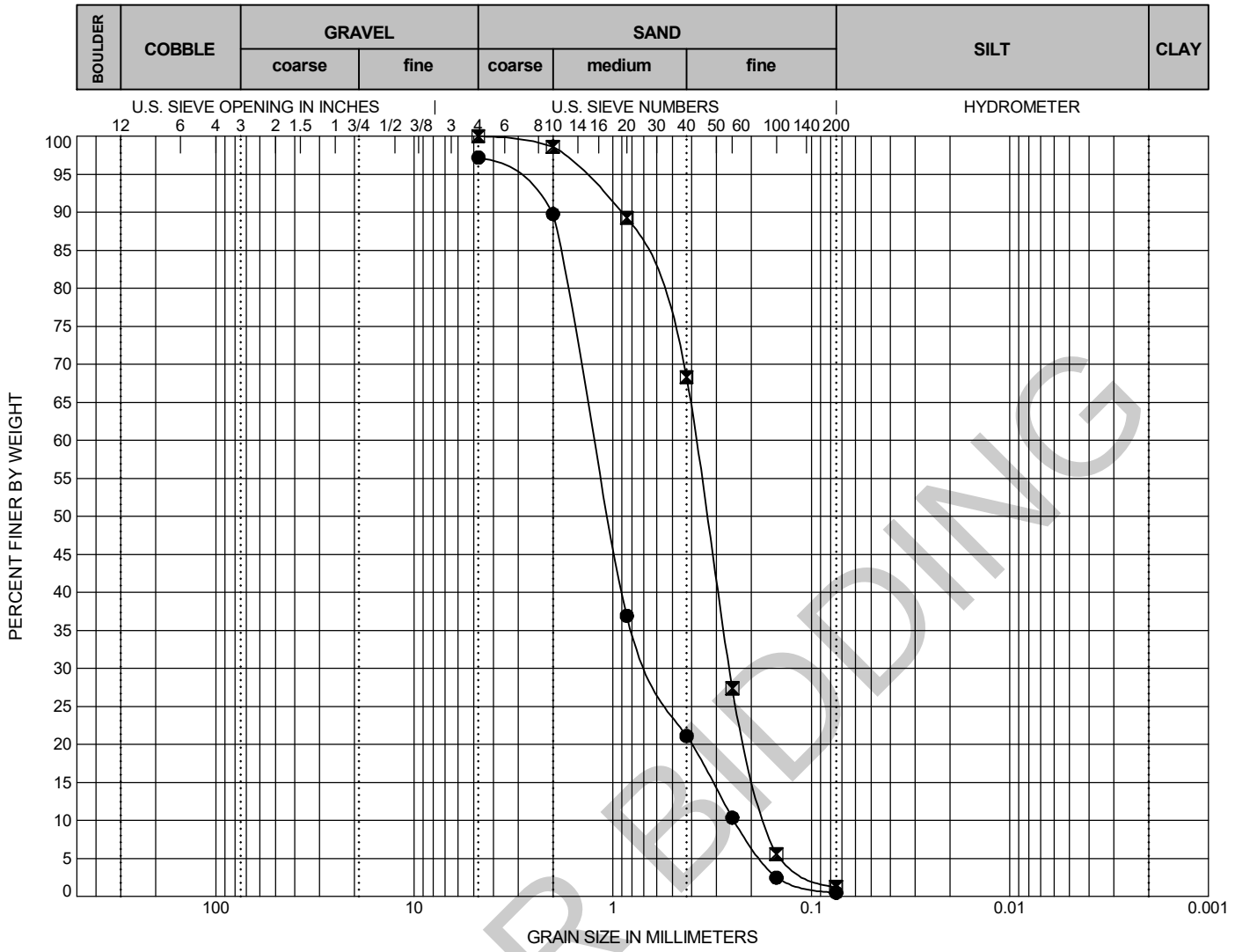
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Exploration ID		Depth (ft.)	Sample Number	Sample Description	LL	PL	PI
●	SB-5	8 - 10	S-5	POORLY GRADED SAND (SP)	NM	NM	NM
⊠	SB-5	29 - 30.5	S-9	POORLY GRADED SAND (SP)	NM	NM	NM

Exploration ID		Depth (ft.)	D_{100}	D_{60}	D_{30}	D_{10}	Cc	Cu	Passing 3/4"	Passing #4	Passing #200	%Silt*	%Clay*
●	SB-5	8 - 10	4.75	1.235	0.628	0.245	1.31	5.05		97	0.5	NM	NM
⊠	SB-5	29 - 30.5	4.75	0.382	0.259	0.166	1.05	2.29		100	1.2	NM	NM

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CENTURY ENGINEERING
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LEGISLATIVE HALL PARKING GARAGE
150 East Water Street
Dover, Kent County, Delaware

TABLE

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APPENDIX 7

IMPORTANT INFORMATION ABOUT THIS ENGINEERING REPORT

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Project Number
24002670.001A

March 11, 2024
www.centuryeng.com

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

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responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

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GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

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APPENDIX 8

SPECIFICATIONS FOR GROUND IMPROVEMENT

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Project Number
24002670.001A

March 11, 2024
www.centuryeng.com

SPECIFICATION FOR GROUND IMPROVEMENT SYSTEMS

PART 1: GENERAL REQUIREMENTS

1.01 Description

Work shall consist of designing, furnishing, and installing Ground Improvements to the lines and grades designated on the project foundation plan and as specified herein. The Ground Improvements shall be constructed by either augering a cavity or driving a hollow mandrel to the design depth and vertically ramming lifts of aggregate using the specially designed tamper head and high-energy impact densification equipment to create the compacted Ground Improvement. The Ground Improvement elements shall be in a columnar-type configuration and shall be used to produce an Intermediate system for support of foundation loads.

1.02 Work Included

A. Provision of all equipment, material, labor, and supervision to design and install Ground Improvement elements. Design shall rely on subsurface information presented in the project geotechnical report. Site/working grade preparation, layout of Ground Improvement elements, spoil removal (as required), footing excavations, and subgrade preparation following Ground Improvement installation is not included.

B. The Ground Improvement design and installation shall adhere to all methods and standards described in this Specification.

C. Drawings and General Provisions of the Contract, including General and Supplemental Conditions, and Division 1 Specifications, apply to the work in this specification.

1.03 Approved Installers

A. The Ground Improvement Installer (the Installer) shall be approved by the Owner's Engineer prior to bid opening. Without exception, no alternate installer will be accepted unless approved by the Owner's Engineer at least two (2) weeks prior to bid opening.

B. Installers of Ground Improvement systems shall have a minimum of 5 years of experience with the installation of Ground Improvement systems and shall have completed at least 50 projects.

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1.04 Reference Standards

A. Design

1. "Control of Settlement and Uplift of Structures Using Short Ground Improvements," by Evert C. Lawton (Assoc. Prof., Dept. of Civil Eng., Univ. of Utah), Nathaniel S. Fox (President, Geopier Foundation Co., Inc.), and Richard L. Handy (Distinguished Prof. Emeritus, Iowa State Univ., Dept. of Civil Eng.), reprinted from *IN-SITU DEEP SOIL IMPROVEMENT, Proceedings of sessions sponsored by the Geotechnical Engineering Division/ASCE in conjunction with the ASCE National Convention held October 9-13, 1994, Atlanta, Georgia.*

2. "Settlement of Structures Supported on Marginal or Inadequate Soils Stiffened with Short Ground Improvements," by Evert C. Lawton and Nathaniel S. Fox. *Geotechnical Special Publication No. 40: Vertical and Horizontal Deformations of Foundations and Embankments,* ASCE, 2, 962-974.

3. "Behavior of Geopier®-Supported Foundation Systems during Seismic Events," by Kord Wissmann, Evert C. Lawton, and Tom Farrell. Geopier Foundation Company, Inc. Blacksburg, VA ©1999.

B. Modulus and Uplift Testing

1. ASTM D 1143 - Pile Load Test Procedures
2. ASTM D 1194 - Spread Footing Load Test

C. Materials and Inspection

1. ASTM D 1241 - Aggregate Quality
2. ASTM D 422 - Gradation of Soils

D. Where specifications and reference documents conflict, the Ground Improvement Designer shall make the final determination of the applicable document.

1.05 Certifications and Submittals

A. Design Calculations - The Installer shall submit detailed design calculations and construction drawings prepared by the Ground Improvement Designer (the Designer) for review and approval by the Owner or Owner's Engineer. All plans shall be sealed by a Professional Engineer in the State in which the project is constructed.

B. Professional Liability Insurance - The Ground Improvement Designer shall have Errors and Omissions design insurance for the work. The insurance policy should provide a minimum coverage of $3 million per occurrence.

C. Modulus and Uplift Test Reports – A modulus test(s) is performed on non-production Ground Improvement elements as required by the Ground Improvement Designer to verify the design assumptions.

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The Installer shall furnish the General Contractor a description of the installation equipment, installation records, complete test data, analysis of the test data and verification of the design parameter values based on the modulus test results. The report shall be prepared under direction of a Registered Professional Engineer.

D. Daily Ground Improvement Progress Reports – The Installer shall furnish a complete and accurate record of Ground Improvement installation to the General Contractor. The record shall indicate the pier location, length, volume of aggregate used or number of lifts, densification forces during installation, and final elevations or depths of the base and top of piers. The record shall also indicate the type and size of the installation equipment used, and the type of aggregate used. The Installer shall immediately report any unusual conditions encountered during installation to the General Contractor, to the Designer and to the Testing Agency.

PART 2: MATERIALS

2.01 Aggregate

A. Aggregate used by the Ground Improvement Installer for pier construction shall be pre- approved by the Designer and shall demonstrate suitable performance during modulus testing. Typical aggregate consists of Type 1 Grade B in accordance with ASTM D-1241-68, No. 57 stone, recycled concrete or other graded aggregate approved by the Designer.

B. Potable water or other suitable source shall be used to increase aggregate moisture content where required. The General Contractor shall provide such water to the Installer.

PART 3: DESIGN REQUIREMENTS

3.01 Ground Improvement Design

A. The design of the Ground Improvement system shall be based on the service load bearing pressure and the allowable total and differential settlement criteria of all footings indicated by the design team for support by the Ground Improvement system. The Ground Improvement system shall be designed in accordance with generally accepted engineering practice and the methods described in Section 1 of these Specifications. The design life of the structure shall be 50 years.

B. The design shall meet the following criteria:

Maximum Allowable Bearing Pressure for Footings supported by Ground Improvement Reinforced Soils	4Ksf
Estimated Total Long-Term Settlement for Footings:	≤ 1- inch
Estimated Long-Term Differential Settlement of Adjacent Footings:	≤ ½-inch

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C. The Ground Improvement elements shall be designed and installed to completely penetrate existing fills where encountered and designs shall consider stresses imposed by adjacent footings, as applicable.

D. The Ground Improvement elements shall be designed using a Ground Improvement stiffness modulus (to be verified by the results of the modulus test described in Section 5.02 of these specifications) or other method(s) approved by the Designer .

3.02 Design Submittal

The Installer shall submit detailed design calculations, construction drawings, and shop drawings, (the Design Submittal), for approval at least 2 week(s) prior to the beginning of construction. A detailed explanation of the design parameters for settlement calculations and uplift resistance shall be included in the Design Submittal. Additionally, the quality control test program for Ground Improvement system, meeting these design requirements, shall be submitted. All computer-generated calculations and drawings shall be prepared and sealed by a Professional Engineer, licensed in the State or Province where the piers are to be built. Submittals will be submitted electronically only unless otherwise required by specific submittal instructions.

PART 4: EXECUTION

4.01 Approved Installation Procedures

The following sections provide general criteria for the construction of the Ground Improvement elements. Unless otherwise approved by the Designer, the installation method used for Ground Improvement construction shall be that as used in the construction of the successful modulus test.

A. Augered Ground Improvement systems –

1. Augered Ground Improvement system shall be pre-augered using mechanical drilling or excavation equipment.

2. If cave-ins exceeding 10% of the lift volume occur during excavation such that the sidewalls of the hole are deemed to be unstable, steel casing shall be used to stabilize the cavity, or a displacement Ground Improvement system may be used.

3. Aggregate shall be placed in the augered cavity in lift thicknesses as determined by the Ground Improvement Designer.

4. A specially designed beveled tamper and high-energy impact densification apparatus shall be employed to densify lifts of aggregate during installation. The apparatus shall apply direct **downward** impact energy to each lift of aggregate. Compaction equipment that induces horizontal vibratory energy (such as Vibroflot equipment) is not permitted.

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B. Displacement Ground Improvement systems –

1. Displacement Ground Improvement systems shall be constructed by advancing a specially designed mandrel with a minimum 15-ton static force augmented by dynamic vertical ramming energy to the full design depth. The hollow-shaft mandrel, filled with aggregate, is incrementally raised, permitting the aggregate to be released into the cavity, and then lowered by vertically advancing and/or ramming to densify the aggregate and force it laterally into the adjacent soil. The cycle of raising and lowering the mandrel is repeated to the top of pier elevation. The cycle distance shall be determined by the Ground Improvement designer.
2. Special high-energy impact densification apparatus shall be employed to vertically densify the Ground Improvement elements during installation of each constructed lift of aggregate.
3. Densification shall be performed using a mandrel/tamper. The mandrel/tamper foot is required to adequately increase the lateral earth pressure in the matrix soil during installation. Compaction equipment that induces horizontal vibratory energy (such as Vibroflot equipment) is not permitted.
4. Downward crowd pressure shall be applied to the mandrel during installation.

4.02 Plan Location and Elevation of Ground Improvement Elements

The as-built center of each pier shall be within 6 inches of the locations indicated on the plans. Piers installed outside of the above tolerances and deemed not acceptable by the Designer shall be rebuilt at no additional expense to the Owner.

4.03 Rejected Ground Improvement Elements

Ground Improvement elements installed beyond the maximum allowable tolerances shall be abandoned and replaced with new piers unless the Designer approves the condition or provides other remedial measures. All material and labor required to replace rejected piers shall be provided at no additional cost to the Owner unless the cause of rejection is due to an obstruction or mislocation.

PART 5: QUALITY CONTROL

5.01 Control Technician

The Installer shall have a full-time, on-site Control Technician to verify and report all installation procedures. The Installer shall immediately report any unusual conditions encountered during installation to the Ground Improvement Designer, the General Contractor, and to the Testing Agency.

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5.02 Ground Improvement Modulus Test

As required by the designer, a Ground Improvement Modulus Test(s) will be performed at location(s) agreed upon by the Ground Improvement Designer to verify or modify Ground Improvement designs. Modulus Test Procedures shall utilize appropriate portions of ASTM D 1143 and ASTM D 1194, as outlined in the Ground Improvement design submittal. RAP modulus test shall be performed as outlined in Technical Bulletin No. 12 (Wissmann and Carter, 2015). The test element shall be tested to a load equal to the element area times at least 150 percent of the RAP element's maximum design stress (not allowable bearing pressure for footings) to demonstrate that the element exhibits safe response during service loading. Single-element modulus tests that are proposed to be loaded as a function of allowable bearing pressure are not considered standard practice and will not be accepted since the allowable bearing pressure is often only a fraction of the RAP element's maximum design stress.

5.04 Bottom Stabilization Testing (BSTs) / Crowd Stabilization Testing (CSTs)

Bottom stabilization testing (BSTs) or Crowd stabilization testing (CSTs) shall be performed by the Control Technician during the installation of the modulus test pier. Additional testing as required by the Ground Improvement Designer shall be performed on selected production Ground Improvement elements to compare results with the modulus test pier.

PART 6: QUALITY ASSURANCE

6.01 Independent Engineering Testing Agency (Owner's Quality Assurance)

The Ground Improvement Installer shall provide full-time Quality Control monitoring of Ground Improvement construction activities. The Owner or General Contractor is responsible for retaining an independent engineering testing firm to provide Quality Assurance services.

6.02 Responsibilities of Independent Engineering Testing Agency

A. The Testing Agency shall monitor the modulus test pier installation and testing. The Installer shall provide and install all dial indicators and other measuring devices.

B. The Testing Agency shall monitor the installation of Ground Improvement elements to verify that the production installation practices are similar to those used during the installation of the modulus test elements.

C. The Testing Agency shall report any discrepancies to the Installer and General Contractor immediately.

D. The Testing Agency shall observe the excavation, compaction and placement of the foundations as described in Section 7.05. Dynamic Cone Penetration testing or other approved testing methods may be performed to evaluate the footing bottom condition as determined by the Testing Agency.

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PART 7: RESPONSIBILITIES OF THE GENERAL CONTRACTOR

7.01 Site Preparation and Protection

A. The General Contractor shall locate and protect underground and aboveground utilities and other structures from damage during installation of the Ground Improvement elements.

B. Site grades for Ground Improvement installation shall be within 1 foot of the top of footing elevation or finished grade elevation to minimize Ground Improvement installation depths. Ground elevations and bottom of footing elevations shall be provided to the Ground Improvement Installer in sufficient detail to estimate installation depth elevations to within 3 inches.

C. The General Contractor will provide site access to the Installer, after earthwork in the area has been completed. A working surface shall be established and maintained by the General Contractor to provide wet weather protection of the subgrade and to provide access for efficient operation of the Ground Improvement installation.

D. Prior to, during and following Ground Improvement installation, the General Contractor shall provide positive drainage to protect the site from wet weather and surface ponding of water.

E. If spoils are generated by Ground Improvement installation, spoil removal from the Ground Improvement work area in a timely manner to prevent interruption of Ground Improvement installation is required.

7.02 Ground Improvement Layout

The location of Ground Improvement-supported foundations for this project, including layout of individual Ground Improvement elements, shall be marked in the field using survey stakes or other means approved by the Installer at locations shown on the drawings.

7.03 Contractor's / Owner's Independent Testing Agency (Owner's Quality Assurance)

General Contractor is responsible for acquiring an Independent Testing Agency (Quality Assurance) as required. Testing Agency roles are as described in Part 6 of this specification. TheGround Improvement Installer will provide Quality Control services as described in Part 5 of this specification.

7.04 Excavations of Obstructions

A. Should any obstruction be encountered during Ground Improvement installation, the General Contractor shall be responsible for promptly removing such obstruction, or the pier shall be relocated or abandoned. Obstructions include, but are not limited to, boulders, timbers, concrete, bricks, utility lines, etc., which shall prevent installing the piers to the required depth or shall cause the pier to drift from the required location.

B. Dense natural rock or weathered rock layers shall not be deemed obstructions,

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and piers may be terminated short of design lengths on such materials.

7.05 Utility Excavations

The General Contractor shall coordinate all excavations made subsequent to Ground Improvement installations so that excavations do not encroach on the piers as shown in the Ground Improvement construction drawings. Protection of completed Ground Improvement elements is the responsibility of the General Contractor. In the event that utility excavations are required in close proximity to the installed Ground Improvement elements, the General Contractor shall contact the Ground Improvement Designer immediately to develop construction solutions to minimize impacts on the installedGround Improvement elements.

7.06 Footing Bottoms

A. Excavation and surface compaction of all footings shall be the responsibility of the General Contractor.

B. Foundation excavations to expose the tops of Ground Improvement elements shall be made in a workman-like manner, and shall be protected until concrete placement, with procedures and equipment best suited to (1) avoid exposure to water, (2) prevent softening of the matrix soil between and around the Ground Improvement elements before pouring structural concrete, and
(3) achieve direct and firm contact between the dense, undisturbed Ground Improvement elements and the concrete footing.

C. All excavations for footing bottoms supported by Ground Improvement foundations shall be prepared in the following manner by the General Contractor. Recommended procedures for achieving these goals are to:

1. Limit over-excavation below the bottom of the footing to 3-inches (including disturbance from the teeth of the excavation equipment).
2. Compaction of surface soil and top of Ground Improvement elements shall be prepared using a motorized impact compactor (“Wacker Packer,” “Jumping Jack,” or similar). Sled- type tamping devices shall only be used in granular soils and when approved by the designer. Loose or soft surficial soil over the entire footing bottom shall be recompacted or removed, respectively. The surface of the Ground Improvement shall be recompacted prior to completing footing bottom preparation.
3. Place footing concrete immediately after footing excavation is made and approved, preferably the same day as the excavation. Footing concrete must be placed on the same day if the footing is bearing on moisture-sensitive soils. If same day placement of footing concrete is not possible, open excavations shall be protected from surface water accumulation. A lean concrete mud-mat may be used to accomplish this. Other methods must be pre-approved by the Designer.

D. The following criteria shall apply, and a written inspection report sealed by the project Testing Agency shall be furnished to the Installer to confirm:

1. That water (which may soften the unconfined matrix soil between and around the Ground Improvement elements and may have detrimental effects on the

NOT FOR BIDDING

supporting capability of the Ground Improvement reinforced subgrade) has not been allowed to pond in the footing excavation at any time.

2. That all Ground Improvement elements designed for each footing have been exposed in the footing excavation.

3. That immediately before footing construction, the tops of Ground Improvement elements exposed in each footing excavation have been inspected and recompacted as necessary with mechanical compaction equipment.

4. That no excavations or drilled shafts (elevator, etc) have been made after installation ofGround Improvement elements within the excavation limits described in the Ground Improvement construction drawings, without the written approval of the Installer or Designer.

E. Failure to provide the above inspection and certification by the Testing Agency, which is beyond the responsibility of the Ground Improvement Installer, may void any written or implied warranty on the performance of the Ground Improvement system.

PART 8: PAYMENT

8.01 Method of Measurement

A. Measurement of the Ground Improvement is on a lump sum basis.

B. Payment shall cover design, supply, and installation of the Ground Improvement foundation system. Excavation of unsuitable materials, delays, re-engineering, and remobilization as documented and approved by the Owner or Owner's Engineer, shall be paid for under separate pay items.

8.02 Basis of Payment

A. The accepted quantities of piers will be paid per approval, in-place aggregate-pier. Payment will be made under:

Pay Item:	Pay Unit:
Preparation of plans and specifications and installation of Ground Improvement elements	$___ Lump Sum

B. Unit prices shall be provided to account for:

Additional Installed Piers (w/o remobilization)	$___ Each
Add for Casing Holes	$___/Linear Foot
Additional Mobilizations	$___ Each
Additional Modulus	$___ Each

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Legislative Hall Parking Garage
Martin Luther King Jr Blvd South & East Water Street
Dover, DE 19901
OMB / DFM Contract #MJ1002000071

BID FORM

For Bids Due: _____ **To:** State of Delaware OMB / DFM
Haslet Armory
122 Martin Luther King Jr Blvd S, 2nd Floor
Dover, DE 19901

Name of Bidder: _____

Delaware Business License No.: _____ **Taxpayer ID No.:** _____

(Other License Nos.): _____

Phone No.: ( ) _____ - _____ **Fax No.: ( ) _____ - _____**

The undersigned, representing that he has read and understands the Bidding Documents and that this bid is made in accordance therewith, that he has visited the site and has familiarized himself with the local conditions under which the Work is to be performed, and that his bid is based upon the materials, systems and equipment described in the Bidding Documents without exception, hereby proposes and agrees to provide all labor, materials, plant, equipment, supplies, transport and other facilities required to execute the work described by the aforesaid documents for the lump sum itemized below:

$_____
($)

ALLOWANCES

Allowances conform to applicable project specification section. Refer to the specifications for a complete description of the following Allowances:

ALLOWANCE No. 1: Include an allowance entitled "General Owner's Allowance" in the amount of $750,000.00. This allowance will be utilized by the Owner for Owner-elected changes to the work. Any or all unused allowance monies shall be returned to the Owner via a credit change order at the end of the project. This allowance shall be carried as an individual line item on the Application for Payment.

Acknowledge / Initial: _____

ALTERNATES

Alternate prices conform to applicable project specification section. Refer to specifications for a complete description of the following Alternates. An "ADD" or "DEDUCT" amount is indicated by the crossed-out part that does not apply.

ALTERNATE No. 1: Provide lightning protection system as indicated in the Bid Documents.

Add / Deduct: $_____
($)

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ALTERNATE No. 2: Provide Solar Panel system and associated equipment as noted in the Bid Documents.

Add / Deduct: $_____

($)

ALTERNATE No. 3: Provide Synthetic Slate Shingle roof in lieu of Concrete Tile as indicated in the Bid Documents.

Add / Deduct: $_____

($)

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Legislative Hall Parking Garage
Martin Luther King Jr Blvd South & East Water Street
Dover, DE 19901
OMB / DFM Contract #MJ1002000071

BID FORM

I/We acknowledge Addendums numbered _____ and the price(s) submitted include any cost/schedule impact they may have.

This bid shall remain valid and cannot be withdrawn for thirty (30) days from the date of opening of bids (60 days for School Districts and Department of Education), and the undersigned shall abide by the Bid Security forfeiture provisions. Bid Security is attached to this Bid.

The Owner shall have the right to reject any or all bids, and to waive any informality or irregularity in any bid received.

This bid is based upon work being accomplished by the Sub-Contractors named on the list attached to this bid.

Should I/We be awarded this contract, I/We pledge to achieve substantial completion of all the work within _____calendar days of the Notice to Proceed.

The undersigned represents and warrants that he has complied and shall comply with all requirements of local, state, and national laws; that no legal requirement has been or shall be violated in making or accepting this bid, in awarding the contract to him or in the prosecution of the work required; that the bid is legal and firm; that he has not, directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken action in restraint of free competitive bidding.

Upon receipt of written notice of the acceptance of this Bid, the Bidder shall, within twenty (20) calendar days, execute the agreement in the required form and deliver the Contract Bonds, and Insurance Certificates, required by the Contract Documents.

I am / We are an Individual / a Partnership / a Corporation

By _____ Trading as _____
(Individual's / General Partner's / Corporate Name)

_____
(State of Corporation)

Business Address: _____
_____
_____
_____

Witness: _____ **By:** _____
(Authorized Signature)

(SEAL)

_____
(Title)

Date: _____

ATTACHMENTS

Sub-Contractor List
Non-Collusion Statement
Affidavit of Employee Drug Testing Program
Affidavit of Contractor Qualifications
Bid Security
(Others as Required by Project Manuals)

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Legislative Hall Parking Garage
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BID FORM

SUBCONTRACTOR LIST

In accordance with Title 29, Chapter 69, Section 6962(d)(10)b of the Delaware Code, the following subcontractor listing must accompany any bid submittal. The bidder must list **in each category** the full name and address (City & State) of the sub-contractor that the bidder will be using to perform the work and provide material for that subcontractor category. Should the bidder's listed subcontractor intend to provide any of their subcontractor category of work through a third-tier contractor, the bidder shall list that third-tier contractor's full name and address (City & State). **If the bidder intends to perform any category of work itself, it must list its full name and address.** For clarification, if the bidder intends to perform the work themselves, the bidder **may not** insert "not applicable", "N/A", "self" or anything other than its own full name and address (City & State). To do so shall cause the bid to be rejected. In addition, the failure to produce a completed subcontractor list with the bid submittal shall cause the bid to be rejected. If you have more than three (3) third-tier contractors to report in any subcontractor category, print out additional page(s) containing the appropriate category, complete the rest of your list of third-tier contractors for that category, notate the addition in parentheses as (CONTINUATION) next to the subcontractor category and an asterisk (*) next to any additional third-tier contractors, and submit it with your bid.

Subcontractor Category	Subcontractor	Address (City & State)	Subcontractors tax-payer ID # or Delaware Business license #
1.			
A.			
B.			
C.			
2.			
A.			
B.			
C.			

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Legislative Hall Parking Garage
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Dover, DE 19901
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BID FORM (Continued)

3.				
	A.			
	B.			
	C.			
4.				
	A.			
	B.			
	C.			
5.				
	A.			
	B.			
	C.			

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Legislative Hall Parking Garage
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BID FORM

NON-COLLUSION STATEMENT

This is to certify that the undersigned bidder has neither directly nor indirectly, entered into any agreement, participated in any collusion or otherwise taken any action in restraint of free competitive bidding in connection with this proposal submitted this date *(to the Office of Management and Budget, Division of Facilities Management)*.

All the terms and conditions of *OMB/DFM Contract #MJ1002000071* have been thoroughly examined and are understood.

NAME OF BIDDER: _____

AUTHORIZED REPRESENTATIVE (TYPED): _____

AUTHORIZED REPRESENTATIVE (SIGNATURE): _____

TITLE: _____

ADDRESS OF BIDDER: _____

_____

_____

E-MAIL: _____

PHONE NUMBER: _____

Sworn to and Subscribed before me this _____ day of _____ 20____.

My Commission expires _____. NOTARY PUBLIC _____.

THIS PAGE MUST BE SIGNED AND NOTARIZED FOR YOUR BID TO BE CONSIDERED.

NOT FOR BIDDING

AFFIDAVIT
OF
EMPLOYEE DRUG TESTING PROGRAM

4104 Regulations for the Drug Testing of Contractor and Subcontractor Employees Working on Large Public Works Projects requires that Contractors and Subcontractors implement a program of mandatory drug testing for Employees who work on Large Public Works Contracts funded all or in part with public funds.

We hereby certify that we have in place or will implement during the entire term of the contract a Mandatory Drug Testing Program for our employees on the jobsite, including subcontractors, that complies with this regulation:

Contractor/Subcontractor Name: _____

Contractor/Subcontractor Address: _____

_____

_____

Authorized Representative (typed or printed): _____

Authorized Representative (signature): _____

Title: _____

Sworn to and Subscribed before me this _____ day of _____ 20____.

My Commission expires _____. NOTARY PUBLIC _____.

NOT FOR BIDDING

THIS PAGE MUST BE SIGNED AND NOTARIZED FOR YOUR BID TO BE CONSIDERED.

Legislative Hall Parking Garage
Martin Luther King Jr Blvd South & East Water Street
Dover, DE 19901
OMB / DFM Contract #MJ1002000071

AFFIDAVIT OF CONTRACTOR QUALIFICATIONS

We hereby certify that we will abide by the contractor's qualifications outlined in the construction bid specifications for the duration of the contract term.

In accordance with Title 29, Chapter 69, Section 6962(d)(10)b.3 of the Delaware Code, after a contract has been awarded the successful bidder shall not substitute another subcontractor whose name was submitted on the Subcontractor Form except for the reasons in the statute and not without written consent from the awarding agency. Failure to utilize the subcontractors on the list will subject the successful bidder to penalties as outlined in the General Requirements Section 5.2 of the contract.

Contractor Name: _____

Contractor Address: _____

_____

_____

Authorized Representative (typed or printed): _____

Authorized Representative (signature): _____

Title: _____

Sworn to and Subscribed before me this _____day of _____ 20____.

My Commission expires _____. NOTARY PUBLIC _____.

THIS PAGE MUST BE SIGNED AND NOTARIZED FOR YOUR BID TO BE CONSIDERED.

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STATE OF DELAWARE
OFFICE OF MANAGEMENT AND BUDGET

BID BOND

TO ACCOMPANY PROPOSAL
(Not necessary if security is used)

KNOW ALL MEN BY THESE PRESENTS That: _____ _____of _____ in the County of _____and State of ___ _____as **Principal**, and _____ of _____ _____ in the County of _____ and State of _____ as **Surety**, legally authorized to do business in the State of Delaware ("**State**"), are held and firmly unto the **State** in the sum of _____ _____ Dollars ($_____), or _____ percent not to exceed _____ _____ Dollars ($_____) of amount of bid on **Contract No. MJ1002000071**, to be paid to the **State** for the use and benefit of **OMB/Division of Facilities Management** for which payment well and truly to be made, we do bind ourselves, our and each of our heirs, executors, administrators, and successors, jointly and severally for and in the whole firmly by these presents.

NOW THE CONDITION OF THIS OBLIGATION IS SUCH That if the above bonded **Principal** who has submitted to the **OMB/Division of Facilities Management** a certain proposal to enter into this contract for the furnishing of certain material and/or services within the **State**, shall be awarded this Contract, and if said **Principal** shall well and truly enter into and execute this Contract as may be required by the terms of this Contract and approved by the **OMB/Division of Facilities Management** this Contract to be entered into within twenty days after the date of official notice of the award thereof in accordance with the terms of said proposal, then this obligation shall be void or else to be and remain in full force and virtue.

Sealed with _____ seal and dated this _____day of _____ in the year of our Lord two thousand and _____ (20___).

SEALED, AND DELIVERED IN THE
Presence of

_____
Name of Bidder (Organization)

Corporate Seal

By: _____
Authorized Signature

Attest _____

_____
Title

_____
Name of Surety

Witness:_____

By: _____

_____
Title

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SECTION 00 52 13

STANDARD FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR A101-2017

The contract to be utilized on this project shall be the "Standard Form of Agreement Between Owner and Contractor" AIA Document A101-2017, including AIA Document A101 – 2017 Exhibit A, as well as Supplements to A101-2017 and Exhibit A and the State of Delaware's General Requirements.

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AIA® Document A101® – 2017

Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum

AGREEMENT made as of the day of in the year
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

and the Contractor:
(Name, legal status, address and other information)

for the following Project:
(Name, location and detailed description)

The Architect:
(Name, legal status, address and other information)

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

The parties should complete A101®–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201®–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

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TABLE OF ARTICLES

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EXHIBIT A INSURANCE AND BONDS

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:
(Check one of the following boxes.)

[ ] The date of this Agreement.

[X] A date set forth in a notice to proceed issued by the Owner.

[ ] Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:
(Check one of the following boxes and complete the necessary information.)

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[X] Not later than ( ) calendar days from the date of commencement of the Work.

[ ] By the following date:

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date
N/A	

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be ($), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item	Price

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance
N/A		

§ 4.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item	Price

§ 4.4 Unit prices, if any:
(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit ($0.00)
None		

§ 4.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any.)

N/A

§ 4.6 Other:
(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)

N/A

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ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

N/A

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the last day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the last day of the following month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than Thirty (30) days after the Owner receives the valid Application for Payment.
(Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

- **.1** That portion of the Contract Sum properly allocable to completed Work;
- **.2** That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and
- **.3** That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

- **.1** The aggregate of any amounts previously paid by the Owner;
- **.2** The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;
- **.3** Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;
- **.4** For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and
- **.5** Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:
(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

Five Percent (5%)

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§ 5.1.7.1.1 The following items are not subject to retainage:
(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

N/A

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

N/A

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:
(Insert any other conditions for release of retainage upon Substantial Completion.)

N/A

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and

.2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

Per Bid Documents

§ 5.3 Interest

Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
(Insert rate of interest agreed upon, if any.)

One percent (1%) per month not to exceed twelve percent (12%) annum beginning thirty days after the owner receives the valid application for payment.

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.
(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

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§ 6.2 Binding Dispute Resolution
For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

[ ] Arbitration pursuant to Section 15.4 of AIA Document A201–2017

[ ] Litigation in a court of competent jurisdiction

[X] Other *(Specify)*

Remedies at Law or In Equity

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

ARTICLE 7 TERMINATION OR SUSPENSION
§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

§ 7.1.1 If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:
(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)

N/A

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

ARTICLE 8 MISCELLANEOUS PROVISIONS
§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:
(Name, address, email address, and other information)

§ 8.3 The Contractor's representative:
(Name, address, email address, and other information)

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§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™–2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:
(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

N/A

§ 8.7 Other provisions:

Per Specifications and all applicable Addendums.

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor

.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds

.3 AIA Document A201™–2017, General Conditions of the Contract for Construction

.4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013 incorporated into this Agreement.)

N/A

.5 Drawings

Number	Title	Date
See EXHIBIT B	List of Drawings	

.6 Specifications

Section	Title	Date	Pages
See EXHIBIT C	Table of Contents		

.7 Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

.8 Other Exhibits:
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

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[ ] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017 incorporated into this Agreement.)

[ ] The Sustainability Plan:

Title	Date	Pages

[X] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

Bid Form submitted by Contractor on _____

This Agreement entered into as of the day and year first written above.

OWNER *(Signature)*	**CONTRACTOR** *(Signature)*
(Printed name and title)	*(Printed name and title)*

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SECTION 00 54 13

SUPPLEMENT TO AGREEMENT BETWEEN OWNER AND CONTRACTOR A101-2017

The following supplements modify the "Standard Form of Agreement Between Owner and Contractor," AIA Document A101-2017. Where a portion of the Standard Form of Agreement is modified or deleted by the following, the unaltered portions of the Standard Form of Agreement shall remain in effect.

ARTICLE 3: DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

3.1 Delete paragraph 3.1 in its entirety and replace with the following:

"The date of Commencement of the Work shall be a date set forth in a notice to proceed issued by the Owner."

ARTICLE 5: PAYMENTS

5.1 PROGRESS PAYMENTS

5.1.3 Delete paragraph 5.1.3 in its entirety and replace with the following:

"Provided that a valid Application for Payment is received by the Architect that meets all requirements of the Contract, payment shall be made by the Owner not later than 30 days after the Owner receives the valid Application for Payment."

5.3 Insert the interest rate of "1% per month not to exceed 12% per annum."

ARTICLE 6: DISPUTE RESOLUTION

6.2 BINDING DISPUTE RESOLUTION

Check the box "Other" – and add the following sentence:

"Any remedies available in law or in equity."

ARTICLE 7: TERMINATION or SUSPENSION

7.1.1.1 Delete paragraph 7.1.1.1 in its entirety.

ARTICLE 8: MISCELLANEOUS PROVISIONS

8.4 Delete paragraph 8.4 in its entirety and replace with the following:

"The Contractor's representative shall not be changed without ten days written notice to the Owner."

END OF SECTION

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THIS PAGE INTENTIONALLY LEFT BLANK

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AIA® Document A101™ – 2017 Exhibit A

Insurance and Bonds

This Insurance and Bonds Exhibit is part of the Agreement, between the Owner and the Contractor, dated the day of in the year
(In words, indicate day, month and year.)

for the following **PROJECT**:
(Name and location or address)

THE OWNER:
(Name, legal status and address)

THE CONTRACTOR:
(Name, legal status and address)

TABLE OF ARTICLES

A.1 GENERAL

A.2 OWNER'S INSURANCE

A.3 CONTRACTOR'S INSURANCE AND BONDS

A.4 SPECIAL TERMS AND CONDITIONS

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

This document is intended to be used in conjunction with AIA Document A201™–2017, General Conditions of the Contract for Construction. Article 11 of A201™–2017 contains additional insurance provisions.

ARTICLE A.1 GENERAL

The Owner and Contractor shall purchase and maintain insurance, and provide bonds, as set forth in this Exhibit. As used in this Exhibit, the term General Conditions refers to AIA Document A201™–2017, General Conditions of the Contract for Construction.

ARTICLE A.2 OWNER'S INSURANCE

§ A.2.1 General

Prior to commencement of the Work, the Owner shall secure the insurance, and provide evidence of the coverage, required under this Article A.2 and, upon the Contractor's request, provide a copy of the property insurance policy or policies required by Section A.2.3. The copy of the policy or policies provided shall contain all applicable conditions, definitions, exclusions, and endorsements.

§ A.2.2 Liability Insurance

The Owner shall be responsible for purchasing and maintaining the Owner's usual general liability insurance.

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§ A.2.3 Required Property Insurance

§ A.2.3.1 Unless this obligation is placed on the Contractor pursuant to Section A.3.3.2.1, the Owner shall purchase and maintain, from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located, property insurance written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis. The Owner's property insurance coverage shall be no less than the amount of the initial Contract Sum, plus the value of subsequent Modifications and labor performed and materials or equipment supplied by others. The property insurance shall be maintained until Substantial Completion and thereafter as provided in Section A.2.3.1.3, unless otherwise provided in the Contract Documents or otherwise agreed in writing by the parties to this Agreement. This insurance shall include the interests of the Owner, Contractor, Subcontractors, and Sub-subcontractors in the Project as insureds. This insurance shall include the interests of mortgagees as loss payees.

§ A.2.3.1.1 Causes of Loss. The insurance required by this Section A.2.3.1 shall provide coverage for direct physical loss or damage, and shall not exclude the risks of fire, explosion, theft, vandalism, malicious mischief, collapse, earthquake, flood, or windstorm. The insurance shall also provide coverage for ensuing loss or resulting damage from error, omission, or deficiency in construction methods, design, specifications, workmanship, or materials. Sub-limits, if any, are as follows:
(Indicate below the cause of loss and any applicable sub-limit.)

Causes of Loss	Sub-Limit

§ A.2.3.1.2 Specific Required Coverages. The insurance required by this Section A.2.3.1 shall provide coverage for loss or damage to falsework and other temporary structures, and to building systems from testing and startup. The insurance shall also cover debris removal, including demolition occasioned by enforcement of any applicable legal requirements, and reasonable compensation for the Architect's and Contractor's services and expenses required as a result of such insured loss, including claim preparation expenses. Sub-limits, if any, are as follows:
(Indicate below type of coverage and any applicable sub-limit for specific required coverages.)

Coverage	Sub-Limit

§ A.2.3.1.3 Unless the parties agree otherwise, upon Substantial Completion, the Owner shall continue the insurance required by Section A.2.3.1 or, if necessary, replace the insurance policy required under Section A.2.3.1 with property insurance written for the total value of the Project that shall remain in effect until expiration of the period for correction of the Work set forth in Section 12.2.2 of the General Conditions.

§ A.2.3.1.4 Deductibles and Self-Insured Retentions. If the insurance required by this Section A.2.3 is subject to deductibles or self-insured retentions, the Owner shall be responsible for all loss not covered because of such deductibles or retentions.

§ A.2.3.2 Occupancy or Use Prior to Substantial Completion. The Owner's occupancy or use of any completed or partially completed portion of the Work prior to Substantial Completion shall not commence until the insurance company or companies providing the insurance under Section A.2.3.1 have consented in writing to the continuance of coverage. The Owner and the Contractor shall take no action with respect to partial occupancy or use that would cause cancellation, lapse, or reduction of insurance, unless they agree otherwise in writing.

§ A.2.3.3 Insurance for Existing Structures

If the Work involves remodeling an existing structure or constructing an addition to an existing structure, the Owner shall purchase and maintain, until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, "all-risks" property insurance, on a replacement cost basis, protecting the existing structure against direct physical loss or damage from the causes of loss identified in Section A.2.3.1, notwithstanding the undertaking of the Work. The Owner shall be responsible for all co-insurance penalties.

§ A.2.4 Optional Extended Property Insurance.

The Owner shall purchase and maintain the insurance selected and described below.

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(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. For each type of insurance selected, indicate applicable limits of coverage or other conditions in the fill point below the selected item.)

[ ] **§ A.2.4.1 Loss of Use, Business Interruption, and Delay in Completion Insurance**, to reimburse the Owner for loss of use of the Owner's property, or the inability to conduct normal operations due to a covered cause of loss.

[ ] **§ A.2.4.2 Ordinance or Law Insurance**, for the reasonable and necessary costs to satisfy the minimum requirements of the enforcement of any law or ordinance regulating the demolition, construction, repair, replacement or use of the Project.

[ ] **§ A.2.4.3 Expediting Cost Insurance**, for the reasonable and necessary costs for the temporary repair of damage to insured property, and to expedite the permanent repair or replacement of the damaged property.

[ ] **§ A.2.4.4 Extra Expense Insurance**, to provide reimbursement of the reasonable and necessary excess costs incurred during the period of restoration or repair of the damaged property that are over and above the total costs that would normally have been incurred during the same period of time had no loss or damage occurred.

[ ] **§ A.2.4.5 Civil Authority Insurance**, for losses or costs arising from an order of a civil authority prohibiting access to the Project, provided such order is the direct result of physical damage covered under the required property insurance.

[ ] **§ A.2.4.6 Ingress/Egress Insurance**, for loss due to the necessary interruption of the insured's business due to physical prevention of ingress to, or egress from, the Project as a direct result of physical damage.

[ ] **§ A.2.4.7 Soft Costs Insurance**, to reimburse the Owner for costs due to the delay of completion of the Work, arising out of physical loss or damage covered by the required property insurance: including construction loan fees; leasing and marketing expenses; additional fees, including those of architects, engineers, consultants, attorneys and accountants, needed for the completion of the construction, repairs, or reconstruction; and carrying costs such as property taxes, building permits, additional interest on loans, realty taxes, and insurance premiums over and above normal expenses.

§ A.2.5 Other Optional Insurance.

The Owner shall purchase and maintain the insurance selected below.

(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance.)

[ ] **§ A.2.5.1 Cyber Security Insurance** for loss to the Owner due to data security and privacy breach,

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including costs of investigating a potential or actual breach of confidential or private information.
(Indicate applicable limits of coverage or other conditions in the fill point below.)

[ ] **§ A.2.5.2 Other Insurance**
(List below any other insurance coverage to be provided by the Owner and any applicable limits.)

Coverage	Limits

ARTICLE A.3 CONTRACTOR'S INSURANCE AND BONDS

§ A.3.1 General

§ A.3.1.1 Certificates of Insurance. The Contractor shall provide certificates of insurance acceptable to the Owner evidencing compliance with the requirements in this Article A.3 at the following times: (1) prior to commencement of the Work; (2) upon renewal or replacement of each required policy of insurance; and (3) upon the Owner's written request. An additional certificate evidencing continuation of commercial liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment and thereafter upon renewal or replacement of such coverage until the expiration of the periods required by Section A.3.2.1 and Section A.3.3.1. The certificates will show the Owner as an additional insured on the Contractor's Commercial General Liability and excess or umbrella liability policy or policies.

§ A.3.1.2 Deductibles and Self-Insured Retentions. The Contractor shall disclose to the Owner any deductible or self-insured retentions applicable to any insurance required to be provided by the Contractor.

§ A.3.1.3 Additional Insured Obligations. To the fullest extent permitted by law, the Contractor shall cause the commercial general liability coverage to include (1) the Owner, the Architect, and the Architect's consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions for which loss occurs during completed operations. The additional insured coverage shall be primary and non-contributory to any of the Owner's general liability insurance policies and shall apply to both ongoing and completed operations. To the extent commercially available, the additional insured coverage shall be no less than that provided by Insurance Services Office, Inc. (ISO) forms CG 20 10 07 04, CG 20 37 07 04, and, with respect to the Architect and the Architect's consultants, CG 20 32 07 04.

§ A.3.2 Contractor's Required Insurance Coverage

§ A.3.2.1 The Contractor shall purchase and maintain the following types and limits of insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:
(If the Contractor is required to maintain insurance for a duration other than the expiration of the period for correction of Work, state the duration.)

§ A.3.2.2 Commercial General Liability

§ A.3.2.2.1 Commercial General Liability insurance for the Project written on an occurrence form with policy limits of not less than ($) each occurrence, ($) general aggregate, and ($) aggregate for products-completed operations hazard, providing coverage for claims including

.1 damages because of bodily injury, sickness or disease, including occupational sickness or disease, and death of any person;
.2 personal injury and advertising injury;
.3 damages because of physical damage to or destruction of tangible property, including the loss of use of such property;
.4 bodily injury or property damage arising out of completed operations; and
.5 the Contractor's indemnity obligations under Section 3.18 of the General Conditions.

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§ A.3.2.2.2 The Contractor's Commercial General Liability policy under this Section A.3.2.2 shall not contain an exclusion or restriction of coverage for the following:

.1 Claims by one insured against another insured, if the exclusion or restriction is based solely on the fact that the claimant is an insured, and there would otherwise be coverage for the claim.

.2 Claims for property damage to the Contractor's Work arising out of the products-completed operations hazard where the damaged Work or the Work out of which the damage arises was performed by a Subcontractor.

.3 Claims for bodily injury other than to employees of the insured.

.4 Claims for indemnity under Section 3.18 of the General Conditions arising out of injury to employees of the insured.

.5 Claims or loss excluded under a prior work endorsement or other similar exclusionary language.

.6 Claims or loss due to physical damage under a prior injury endorsement or similar exclusionary language.

.7 Claims related to residential, multi-family, or other habitational projects, if the Work is to be performed on such a project.

.8 Claims related to roofing, if the Work involves roofing.

.9 Claims related to exterior insulation finish systems (EIFS), synthetic stucco or similar exterior coatings or surfaces, if the Work involves such coatings or surfaces.

.10 Claims related to earth subsidence or movement, where the Work involves such hazards.

.11 Claims related to explosion, collapse and underground hazards, where the Work involves such hazards.

§ A.3.2.3 Automobile Liability covering vehicles owned, and non-owned vehicles used, by the Contractor, with policy limits of not less than ($) per accident, for bodily injury, death of any person, and property damage arising out of the ownership, maintenance and use of those motor vehicles along with any other statutorily required automobile coverage.

§ A.3.2.4 The Contractor may achieve the required limits and coverage for Commercial General Liability and Automobile Liability through a combination of primary and excess or umbrella liability insurance, provided such primary and excess or umbrella insurance policies result in the same or greater coverage as the coverages required under Section A.3.2.2 and A.3.2.3, and in no event shall any excess or umbrella liability insurance provide narrower coverage than the primary policy. The excess policy shall not require the exhaustion of the underlying limits only through the actual payment by the underlying insurers.

§ A.3.2.5 Workers' Compensation at statutory limits.

§ A.3.2.6 Employers' Liability with policy limits not less than ($) each accident, ($) each employee, and ($) policy limit.

§ A.3.2.7 Jones Act, and the Longshore & Harbor Workers' Compensation Act, as required, if the Work involves hazards arising from work on or near navigable waterways, including vessels and docks

§ A.3.2.8 If the Contractor is required to furnish professional services as part of the Work, the Contractor shall procure Professional Liability insurance covering performance of the professional services, with policy limits of not less than ($) per claim and ($) in the aggregate.

§ A.3.2.9 If the Work involves the transport, dissemination, use, or release of pollutants, the Contractor shall procure Pollution Liability insurance, with policy limits of not less than ($) per claim and ($) in the aggregate.

§ A.3.2.10 Coverage under Sections A.3.2.8 and A.3.2.9 may be procured through a Combined Professional Liability and Pollution Liability insurance policy, with combined policy limits of not less than ($) per claim and ($) in the aggregate.

§ A.3.2.11 Insurance for maritime liability risks associated with the operation of a vessel, if the Work requires such activities, with policy limits of not less than ($) per claim and ($) in the aggregate.

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§ A.3.2.12 Insurance for the use or operation of manned or unmanned aircraft, if the Work requires such activities, with policy limits of not less than ($) per claim and ($) in the aggregate.

§ A.3.3 Contractor's Other Insurance Coverage

§ A.3.3.1 Insurance selected and described in this Section A.3.3 shall be purchased from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:
(If the Contractor is required to maintain any of the types of insurance selected below for a duration other than the expiration of the period for correction of Work, state the duration.)

§ A.3.3.2 The Contractor shall purchase and maintain the following types and limits of insurance in accordance with Section A.3.3.1.
(Select the types of insurance the Contractor is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. Where policy limits are provided, include the policy limit in the appropriate fill point.)

[ ] **§ A.3.3.2.1** Property insurance of the same type and scope satisfying the requirements identified in Section A.2.3, which, if selected in this section A.3.3.2.1, relieves the Owner of the responsibility to purchase and maintain such insurance except insurance required by Section A.2.3.1.3 and Section A.2.3.3. The Contractor shall comply with all obligations of the Owner under Section A.2.3 except to the extent provided below. The Contractor shall disclose to the Owner the amount of any deductible, and the Owner shall be responsible for losses within the deductible. Upon request, the Contractor shall provide the Owner with a copy of the property insurance policy or policies required. The Owner shall adjust and settle the loss with the insurer and be the trustee of the proceeds of the property insurance in accordance with Article 11 of the General Conditions unless otherwise set forth below:
(Where the Contractor's obligation to provide property insurance differs from the Owner's obligations as described under Section A.2.3, indicate such differences in the space below. Additionally, if a party other than the Owner will be responsible for adjusting and settling a loss with the insurer and acting as the trustee of the proceeds of property insurance in accordance with Article 11 of the General Conditions, indicate the responsible party below.)

[ ] **§ A.3.3.2.2 Railroad Protective Liability Insurance**, with policy limits of not less than ($) per claim and ($) in the aggregate, for Work within fifty (50) feet of railroad property.

[ ] **§ A.3.3.2.3 Asbestos Abatement Liability Insurance**, with policy limits of not less than ($) per claim and ($) in the aggregate, for liability arising from the encapsulation, removal, handling, storage, transportation, and disposal of asbestos-containing materials.

[ ] **§ A.3.3.2.4** Insurance for physical damage to property while it is in storage and in transit to the construction site on an "all-risks" completed value form.

[ ] **§ A.3.3.2.5** Property insurance on an "all-risks" completed value form, covering property owned by the Contractor and used on the Project, including scaffolding and other equipment.

[ ] **§ A.3.3.2.6 Other Insurance**
(List below any other insurance coverage to be provided by the Contractor and any applicable limits.)

Coverage	Limits

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§ A.3.4 Performance Bond and Payment Bond

The Contractor shall provide surety bonds, from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located, as follows:
(Specify type and penal sum of bonds.)

Type	Penal Sum ($0.00)
Payment Bond	
Performance Bond	

Payment and Performance Bonds shall be AIA Document A312™, Payment Bond and Performance Bond, or contain provisions identical to AIA Document A312™, current as of the date of this Agreement.

ARTICLE A.4 SPECIAL TERMS AND CONDITIONS

Special terms and conditions that modify this Insurance and Bonds Exhibit, if any, are as follows:

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SECTION 00 54 14

SUPPLEMENT TO A101-2017 – EXHIBIT A – INSURANCE AND BONDS

The following supplements modify the "Standard Form of Agreement Between Owner and Contractor," AIA Document A101-2017 Exhibit A Insurance and Bonds. Where a portion of the Standard Form of Agreement is modified or deleted by the following, the unaltered portions of the Standard Form of Agreement shall remain in effect.

ARTICLE A.2 OWNER'S INSURANCE

A.2.1 General

Delete paragraph A.2.1 in its entirety.

A.2.2 Liability Insurance

Delete paragraph A.2.2 in its entirety, except in the case of school projects this paragraph shall remain.

A.2.3 Required Property Insurance

Delete paragraph A.2.3 in its entirety.

A.2.4 Optional Extended Property Insurance

Delete paragraph A.2.4 in its entirety.

A.2.5 Other Optional Insurance

Delete paragraph A.2.5 in its entirety.

ARTICLE A.3 CONTRACTORS INSURANCE AND BONDS

A.3.1.1 Strike the last sentence of the paragraph.

A.3.1.3 Additional Insured Obligations

In the first sentence after "coverage to include (1)" delete "(1) the Owner,".

Strike the remainder of the first sentence beginning at the semicolon "; and (2) the Owner" through the end of the sentence.

Delete the second sentence in its entirety.

A.3.2.2.1 Insert "$1,000,000.00" in the blank for each occurrence.
Insert "$3,000,000.00" in the blank for general aggregate.
Insert "$3,000,000.00" in the blank for aggregate for products-completed operations hazard.

A.3.2.3 Insert "$1,000,000.00" in the blank for per accident.

A.3.2.6 Insert "$500,000.00" in the blank for each accident.
Insert "$500,000.00" in the blank for each employee.

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Insert “$500,000.00” in the blank for policy limit.

A.3.2.8 Insert “$1,000,000.00” in the blank for per claim.
Insert “$3,000,000.00” in the blank for in the aggregate.

A.3.2.9 Insert “$1,000,000.00” in the blank for per claim.
Insert “$3,000,000.00” in the blank for in the aggregate.

A.3.2.10 Insert “$2,000,000.00” in the blank for per claim.
Insert “$4,000,000.00” in the blank for in the aggregate.

A.3.2.11 Strike in its entirety.

A.3.2.12 Strike in its entirety.

A.3.3.2.1 Delete paragraph 3.3.2.1 in its entirety

A.3.3.2.2 Strike in its entirety.

A.3.3.2.3 Insert “$1,000,000.00” in the blanks for per claim.
Insert “$3,000,000.00” in the blanks for in the aggregate.

A.3.4 Insert the actual contract price in both the Payment Bond and the Performance Bond Penal Sum blanks. It must be 100% of the contract price.

Strike the last sentence in this section and replace with “Payment and Performance Bonds shall be in the standard form issued by the Delaware Office of Management and Budget.”

END OF SECTION

NOT FOR BIDDING

STATE OF DELAWARE
OFFICE OF MANAGEMENT AND BUDGET

PERFORMANCE BOND

Bond Number: _____

KNOW ALL PERSONS BY THESE PRESENTS, that we, _____, as principal ("**Principal**"), and _____, a _____ corporation, legally authorized to do business in the State of Delaware, as surety ("**Surety**"), are held and firmly bound unto the **State of Delaware Office of Management & Budget** ("**Owner**"), in the amount of _____ ($_____), to be paid to **Owner**, for which payment well and truly to be made, we do bind ourselves, our and each and every of our heirs, executors, administrations, successors and assigns, jointly and severally, for and in the whole, firmly by these presents.

Sealed with our seals and dated this _____ day of _____, 20__.

NOW THE CONDITION OF THIS OBLIGATION IS SUCH, that if **Principal**, who has been awarded by **Owner** that certain contract known as **Contract No. MJ1002000071** dated the _____ day of _____, 20__ (the "Contract"), which Contract is incorporated herein by reference, shall well and truly provide and furnish all materials, appliances and tools and perform all the work required under and pursuant to the terms and conditions of the Contract and the Contract Documents (as defined in the Contract) or any changes or modifications thereto made as therein provided, shall make good and reimburse **Owner** sufficient funds to pay the costs of completing the Contract that **Owner** may sustain by reason of any failure or default on the part of **Principal**, and shall also indemnify and save harmless **Owner** from all costs, damages and expenses arising out of or by reason of the performance of the Contract and for as long as provided by the Contract; then this obligation shall be void, otherwise to be and remain in full force and effect.

Surety, for value received, hereby stipulates and agrees, if requested to do so by **Owner**, to fully perform and complete the work to be performed under the Contract pursuant to the terms, conditions and covenants thereof, if for any cause **Principal** fails or neglects to so fully perform and complete such work.

Surety, for value received, for itself and its successors and assigns, hereby stipulates and agrees that the obligation of **Surety** and its bond shall be in no way impaired or affected by any extension of time, modification, omission, addition or change in or to the Contract or the work to be performed thereunder, or by any payment thereunder before the time required therein, or by any waiver of any provisions thereof, or by any assignment, subletting or other transfer thereof or of any work to be performed or any monies due or to become due thereunder; and **Surety** hereby waives notice of any and all such extensions, modifications, omissions, additions, changes, payments, waivers, assignments, subcontracts and transfers and hereby expressly stipulates and agrees that any and all things done and omitted to be done by and in relation to assignees, subcontractors, and other transferees shall have the same effect as to **Surety** as though done or omitted to be done by or in relation to **Principal**.

NOT FOR BIDDING

Surety hereby stipulates and agrees that no modifications, omissions or additions in or to the terms of the Contract shall in any way whatsoever affect the obligation of **Surety** and its bond.

Any proceeding, legal or equitable, under this Bond may be brought in any court of competent jurisdiction in the State of Delaware. Notices to **Surety** or Contractor may be mailed or delivered to them at their respective addresses shown below.

IN WITNESS WHEREOF, **Principal** and **Surety** have hereunto set their hand and seals, and such of them as are corporations have caused their corporate seal to be hereto affixed and these presents to be signed by their duly authorized officers, the day and year first above written.

PRINCIPAL

Name: _____

Witness or Attest: Address: _____

_____ By: _____(SEAL)
Name: Name:
Title:

(Corporate Seal)

SURETY

Name: _____

Witness or Attest: Address: _____

_____ By: _____ (SEAL)
Name: Name:
Title:

(Corporate Seal)

NOT FOR BIDDING

STATE OF DELAWARE
OFFICE OF MANAGEMENT AND BUDGET

PAYMENT BOND

Bond Number: _____

KNOW ALL PERSONS BY THESE PRESENTS, that we, _____, as principal ("**Principal**"), and _____, a _____ corporation, legally authorized to do business in the State of Delaware, as surety ("**Surety**"), are held and firmly bound unto the **State of Delaware Office of Management & Budget** ("**Owner**"), in the amount of _____ ($_____), to be paid to **Owner**, for which payment well and truly to be made, we do bind ourselves, our and each and every of our heirs, executors, administrations, successors and assigns, jointly and severally, for and in the whole firmly by these presents.

Sealed with our seals and dated this _____ day of_____, 20__.

NOW THE CONDITION OF THIS OBLIGATION IS SUCH, that if **Principal**, who has been awarded by **Owner** that certain contract known as **Contract No. MJ1002000071** dated the _____ day of _____, 20__ (the "Contract"), which Contract is incorporated herein by reference, shall well and truly pay all and every person furnishing materials or performing labor or service in and about the performance of the work under the Contract, all and every sums of money due him, her, them or any of them, for all such materials, labor and service for which **Principal** is liable, shall make good and reimburse **Owner** sufficient funds to pay such costs in the completion of the Contract as **Owner** may sustain by reason of any failure or default on the part of **Principal**, and shall also indemnify and save harmless **Owner** from all costs, damages and expenses arising out of or by reason of the performance of the Contract and for as long as provided by the Contract; then this obligation shall be void, otherwise to be and remain in full force and effect.

Surety, for value received, for itself and its successors and assigns, hereby stipulates and agrees that the obligation of **Surety** and its bond shall be in no way impaired or affected by any extension of time, modification, omission, addition or change in or to the Contract or the work to be performed thereunder, or by any payment thereunder before the time required therein, or by any waiver of any provisions thereof, or by any assignment, subletting or other transfer thereof or of any work to be performed or any monies due or to become due thereunder; and **Surety** hereby waives notice of any and all such extensions, modifications, omissions, additions, changes, payments, waivers, assignments, subcontracts and transfers and hereby expressly stipulates and agrees that any and all things done and omitted to be done by and in relation to assignees, subcontractors, and other transferees shall have the same effect as to **Surety** as though done or omitted to be done by or in relation to **Principal**.

Surety hereby stipulates and agrees that no modifications, omission or additions in or to the terms of the Contract shall in any way whatsoever affect the obligation of **Surety** and its bond.

NOT FOR BIDDING

Any proceeding, legal or equitable, under this Bond may be brought in any court of competent jurisdiction in the State of Delaware. Notices to **Surety** or Contractor may be mailed or delivered to them at their respective addresses shown below.

IN WITNESS WHEREOF, **Principal** and **Surety** have hereunto set their hand and seals, and such of them as are corporations have caused their corporate seal to be hereto affixed and these presents to be signed by their duly authorized officers, the day and year first above written.

PRINCIPAL

Name: _____

Witness or Attest: Address: _____

_____ By: _____(SEAL)
Name: Name:
Title:

(Corporate Seal)

SURETY

Name: _____

Witness or Attest: Address: _____

_____ By: _____(SEAL)
Name: Name:
Title:

(Corporate Seal)

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APPLICATION AND CERTIFICATE FOR PAYMENT FORMS

The Application and Certificate for Payment are as stated in the American Institute of Architects Document AIA G702 & AIA G703 (1992 version) entitled Application and Certificate for Payment and is part of this project manual as if herein written in full. A draft sample has been included for reference.

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AIA® Document G702™ – 1992

Application and Certificate for Payment

NOT FOR BIDDING

TO OWNER:

PROJECT: sample

APPLICATION NO: 001
PERIOD TO:
CONTRACT FOR: General Construction
CONTRACT DATE:
PROJECT NOS: / /

Distribution to:
OWNER: ☐
ARCHITECT: ☐
CONTRACTOR: ☐
FIELD: ☐
OTHER: ☐

FROM
CONTRACTOR:

VIA
ARCHITECT:

CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract.
Continuation Sheet, AIA Document G703, is attached.

1. ORIGINAL CONTRACT SUM		$ 0.00
2. Net change by Change Orders		$ 0.00
3. CONTRACT SUM TO DATE (Line 1 ± 2)		$ 0.00
4. TOTAL COMPLETED & STORED TO DATE (Column G on G703)		$ 0.00
5. RETAINAGE:		
a. 0 % of Completed Work (Column D + E on G703)	$ 0.00	
b. 0 % of Stored Material (Column F on G703)	$ 0.00	
Total Retainage (Lines 5a + 5b or Total in Column I of G703)		$ 0.00
6. TOTAL EARNED LESS RETAINAGE (Line 4 Less Line 5 Total)		$ 0.00
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT (Line 6 from prior Certificate)		$ 0.00
8. CURRENT PAYMENT DUE		$ 0.00
9. BALANCE TO FINISH, INCLUDING RETAINAGE (Line 3 less Line 6)	$ 0.00	

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner	$ 0.00	$ 0.00
Total approved this Month	$ 0.00	$ 0.00
TOTALS	$ 0.00	$ 0.00
NET CHANGES by Change Order	$ 0.00	

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

CONTRACTOR:

By: _____ Date: _____

State of:

County of:

Subscribed and sworn to before me this day of

Notary Public:

My Commission expires:

ARCHITECT'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based on on-site observations and the data comprising this application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED ..... $ 0.00

(Attach explanation if amount certified differs from the amount applied. Initial all figures on this Application and on the Continuation Sheet that are changed to conform with the amount certified.)

ARCHITECT:

By: _____ Date: _____

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract

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AIA® Document G703™ – 1992

Continuation Sheet

AIA Document G702, APPLICATION AND CERTIFICATION FOR PAYMENT, containing Contractor's signed certification is attached.
In tabulations below, amounts are stated to the nearest dollar.
Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NO: 001
APPLICATION DATE:
PERIOD TO:
ARCHITECT'S PROJECT NO:

A	B	C	D	E	F	G		H	I
ITEM NO.	DESCRIPTION OF WORK	SCHEDULED VALUE	WORK COMPLETED FROM PREVIOUS APPLICATION (D + E)	WORK COMPLETED THIS PERIOD	MATERIALS PRESENTLY STORED (NOT IN D OR E)	TOTAL COMPLETED AND STORED TO DATE (D+E+F)	% (G ÷ C)	BALANCE TO FINISH (C - G)	RETAINAGE (IF VARIABLE RATE)
	GRAND TOTAL	$ 0.00	$ 0.00	$ 0.00	$ 0.00	$ 0.00	0.00 %	$ 0.00	$ 0.00

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(875520561)
User Notes:

SECTION 00 65 01

CLOSEOUT DOCUMENT CHECKLIST

THIS SECTION LISTS THE DOCUMENTS REQUIRED PRIOR TO ISSUANCE OF FINAL PAYMENT, AS APPLICABLE.

1.01 CHECKLIST ITEMS:

A. 2 original Form G704 Substantial Completion
B. 2 original Form G706 Affidavit of Payment of Debts and Claims
C. 2 original Form 706A Release of Liens Contractor / Subcontractor
D. 2 original Form 707 Consent of Surety Company
E. 3 original Final Payment App
F. Meeting Minutes
G. General Correspondence
H. Certificate of Occupancy
I. Environmental Certificates
J. 2 original of Warranties (Letter of Guarantee and Warranty Info)
K. 2 O&M Manuals
L. 2 Hard Copy of As-Built Drawings
M. 2 sets of drawing discs. Updated CAD files
N. Occupancy Permits
O. Test & Balancing Reports
P. Field Reports/Inspection Reports
Q. Pest Control Final Inspection Report & Warranty (Slabs over 400SF)
R. 2 original Substantial Completion Form
S. 2 sets of Record Shop Drawings and submittals
T. Affidavit of Discharge of State Tax Liability
U. Copy of completed final punch list signed off on by Owner's Rep
V. Punch list Closeout Letter.

END OF SECTION

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SECTION 00 72 13

GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION
A201-2017

The General Conditions of this Contract are as stated in the American Institute of Architects Document AIA A201 (2017 Edition) entitled General Conditions of the Contract for Construction as revised by the Supplementary General Conditions and is part of this project manual as if herein written in full.

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AIA® Document A201™ – 2017

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

Sample

THE OWNER:
(Name, legal status and address)

THE ARCHITECT:
(Name, legal status and address)

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

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§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document

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G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

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§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

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§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

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§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

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§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- **.1** allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- **.2** Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- **.3** whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and

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delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely

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upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

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§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

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§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

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ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- **.1** assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
- **.2** assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

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When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

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§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

.1 The change in the Work;
.2 The amount of the adjustment, if any, in the Contract Sum; and
.3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
.2 Unit prices stated in the Contract Documents or subsequently agreed upon;
.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
.4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

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.1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;

.2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;

.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and

.5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

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§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

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§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- **.1** defective Work not remedied;
- **.2** third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- **.3** failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;

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.4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
.5 damage to the Owner or a Separate Contractor;
.6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
.7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

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§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

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§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- **.1** liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- **.2** failure of the Work to comply with the requirements of the Contract Documents;
- **.3** terms of special warranties required by the Contract Documents; or
- **.4** audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

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.1 employees on the Work and other persons who may be affected thereby;

.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and

.3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will

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promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or

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expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

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§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during

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that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

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§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

.1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;

.2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;

.3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or

.4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

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§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- **.1** repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- **.2** fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- **.3** repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- **.4** otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- **.1** Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- **.2** Accept assignment of subcontracts pursuant to Section 5.4; and
- **.3** Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- **.1** that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- **.2** that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- **.1** cease operations as directed by the Owner in the notice;

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.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract 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. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

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§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

.1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

.2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

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§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

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§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

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SUPPLEMENTARY GENERAL CONDITIONS A201-2017

The following supplements modify the "General Conditions of the Contract for Construction," AIA Document A201-2017. Where a portion of the General Conditions is modified or deleted by the Supplementary Conditions, the unaltered portions of the General Conditions shall remain in effect.

TABLE OF ARTICLES

1. GENERAL PROVISIONS
2. OWNER
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15. CLAIMS AND DISPUTES

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ARTICLE 1: GENERAL PROVISIONS

1.1 BASIC DEFINITIONS

1.1.1 THE CONTRACT DOCUMENTS

Strike the last sentence of Section 1.1.1 in its entirety and replace with the following:

"The Contract Documents also include Advertisement for Bid, Instructions to Bidder, sample forms, the Bid Form, the Contractor's completed Bid and the Award Letter."

Add the following Section:

"1.1.1.1 In the event of conflict or discrepancies among the Contract Documents, the Documents prepared by the State of Delaware, Division of Facilities Management shall take precedence over all other documents."

1.1.8 INITIAL DECISION MAKER

Strike the last sentence of Section 1.1.8 in its entirety and add the following to the end of the remaining sentence:

" and certify termination of the Agreement under Section14.2.2."

1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

1.2.1.1 Insert "if possible" at the end of the second sentence.

Add the following Sections:

"1.2.4 In the case of an inconsistency between the Drawings and the Specifications, or within either document not clarified by addendum, the better quality or greater quantity of work shall be provided in accordance with the Architect's interpretation."

"1.2.5 The word "PROVIDE" as used in the Contract Documents shall mean "FURNISH AND INSTALL" and shall include, without limitation, all labor, materials, equipment, transportation, services and other items required to complete the Work."

"1.2.6 The word "PRODUCT" as used in the Contract Documents means all materials, systems and equipment."

1.5 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE

Strike Section 1.5.1 in its entirety and replace with the following:

"All pre-design studies, drawings, specifications and other documents, including those in electronic form, prepared by the Architect under this Agreement are, and shall remain, the property of the Owner whether the Project for which they are made is executed or not. Such documents may be used by the Owner to construct one or more like Projects without the approval of, or additional compensation to, the Architect. The Contractor, Subcontractors, Sub-subcontractors, and Material or Equipment Suppliers are authorized to use and reproduce applicable portions of the Drawings, Specifications and other

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documents prepared by the Architect and the Architect's consultants appropriate to and for use in the execution of their Work under the Contract Documents. They are not to be used by the Contractor or any Subcontractor, Sub-subcontractor or Material and Equipment Supplier on other Projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and Architect's consultants.

The Architect shall not be liable for injury or damage resulting from the re-use of drawings and specifications if the Architect is not involved in the re-use Project. Prior to re-use of construction documents for a Project in which the Architect is not also involved, the Owner will remove from such documents all identification of the original Architect, including name, address and professional seal or stamp."

Strike Section 1.5.2 in its entirety.

1.7 DIGITAL DATA USE AND TRANSMISSION

Strike Section 1.7 in its entirety and replace with the following:

"The parties shall agree upon protocols governing transmission and use of Instruments of Service or any other information or documentation in digital form."

1.8 BUILDING INFORMATION MODELS USE AND RELIANCE

Strike Section 1.8 in its entirety.

ARTICLE 2: OWNER

2.2 EVIDENCE OF THE OWNERS FINANCIAL ARRANGEMENTS

Strike Section 2.2 in its entirety.

2.3 INFORMATION AND SERVICES REQUIRED OF THE OWNER

2.3.3 Strike 2.3.3 in its entirety.

2.3.4 Add the following sentence at the end of the paragraph:

"The Contractor, at their expense shall bear the costs to accurately identify the location of all underground utilities in the area of their excavation and shall bear all cost for any repairs required, out of failure to accurately identify said utilities."

Strike Section 2.3.6 in its entirety and replace with the following:

"2.3.6 The Contractor shall be furnished free of charge (1) electronic set of the Drawings and Project Manuals. Additional sets will be furnished at the cost of reproduction, postage and handling."

2.5 OWNER'S RIGHT TO CARRY OUT THE WORK

Add ", except as outlined in Section 3.15" after the reference to "Article 15" at the end of the last sentence of the Section.

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ARTICLE 3: CONTRACTOR

3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

3.2.2 Add “and Owner” after “report to the Architect” in the second sentence.

3.2.4 Strike “subject to Section 15.1.7” in the second sentence.

3.2.4 Strike the third sentence.

3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

Add the following Sections:

“3.3.2.1 The Contractor shall immediately remove from the Work, whenever requested to do so by the Owner, any person who is considered by the Owner or Architect to be incompetent or disposed to be so disorderly, or who for any reason is not satisfactory to the Owner, and that person shall not again be employed on the Work without the consent of the Owner or the Architect.”

“3.3.4 The Contractor must provide suitable storage facilities at the Site for the proper protection and safe storage of their materials, or as otherwise identified by the specifications. Consult the Owner and the Architect before storing any materials.”

“3.3.5 When any room is used as a shop, storeroom, office, etc., by the Contractor or Subcontractor(s) during the construction of the Work, the Contractor making use of these areas will be held responsible for any repairs, patching or cleaning arising from such use.”

3.4 LABOR AND MATERIALS

Add the Following Sections:

“3.4.4 Before starting the Work, each Contractor shall carefully examine all preparatory Work that has been executed to receive their Work. Check carefully, by whatever means are required, to insure that its Work and adjacent, related Work, will finish to proper contours, planes and levels. Promptly notify the Architect & Owner of any defects or imperfections in preparatory Work which will in any way affect satisfactory completion of its Work. Absence of such notification will be construed as an acceptance of preparatory Work and later claims of defects will not be recognized.”

“3.4.5 Under no circumstances shall the Contractor’s Work proceed prior to preparatory Work having been completely cured, dried and/or otherwise made satisfactory to receive this Work. Responsibility for timely installation of all materials rests solely with the Contractor responsible for that Work, who shall maintain coordination at all times.”

3.5 WARRANTY

Add the following Sections:

“3.5.3 The Contractor will guarantee all materials and workmanship against original defects, except injury from proper and usual wear when used for the purpose intended,

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for two years after Acceptance by the Owner, and will maintain all items in perfect condition during the period of warranty."

"3.5.4 Defects appearing during the period of warranty will be made good by the Contractor at his expense upon demand of the Owner, it being required that all work will be in perfect condition when the period of warranty will have elapsed."

"3.5.5 Upon notification by the Owner of a defect covered by the Contractor's warranty, the Contractor shall respond within 4 hours of the notification."

"3.5.6 In addition to the General Warranty there are other warranties required for certain items for different periods of time than the two years as above, and are particularly so stated in that part of the specifications referring to same. The said warranties will commence at the same time as the General Warranty."

"3.5.7 If the Contractor fails to remedy any failure, defect or damage within a reasonable time after receipt of notice, the Owner will have the right to replace, repair, or otherwise remedy the failure, defect or damage at the Contractor's expense."

3.8 ALLOWANCES

Add the following Section:

"3.8.1.1 For costs to be covered under a project allowance, (included in the schedule of values) the Contractor shall submit a summary of those costs anticipated and an Allowance Access Authorization Form to the Architect and Owner, reflecting the projected costs. The Allowance Access Authorization Form must be signed by the Owner prior to initiating any work associated with the allowance."

3.10 CONTRACTOR'S CONSTRUCTION AND SUBMITTAL SCHEDULES

3.10.1 Add "estimated" after "and the" and before "date of" in the second sentence.

3.10.2 Strike "and thereafter as necessary to maintain a current submittal schedule" in the first sentence.

3.11 DOCUMENTS AND SAMPLES AT THE SITE

Add the following Sections:

"3.11.1 During the course of the Work, the Contractor shall maintain a record set of drawings on which the Contractor shall mark the actual physical location of all piping, valves, equipment, conduit, outlets, access panels, controls, actuators, including all appurtenances that will be concealed once construction is complete, etc., including all invert elevations."

"3.11.2 At the completion of the project, the Contractor shall obtain a set of the conformed contract drawings from the Architect, and neatly transfer all information outlined in 3.11.1 to provide a complete record of the as-built conditions."

"3.11.3 Upon completion of the work noted in 3.11.2 the contractor shall schedule a meeting with the Architect/Engineer and Owner to review the final record drawings and closeout documents prior to submission. After this meeting the Contractor shall make adjustments per the review, and submit one (1) original markup and (2) copies of the red

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line drawings (as-built conditions, to the Owner and one (1) print to the Architect. In addition, attach one complete set of the as-built documents to each of the Operating and Maintenance Instructions/Manuals. The Contractor will include (2) USB drives, each containing all "red line drawings (as-built) and Closeout Documents properly tabbed in accordance with closeout requirements as defined elsewhere in the contract documents."

3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

3.12.10.2 Strike "If the Contract Documents require" from the beginning of the sentence.

3.12.10.2 Strike "to" between "professional" and certify" and replace with "shall".

3.17 Insert "indemnify and" between "shall" and "hold" in the second sentence.

ARTICLE 4: ADMINISTRATION OF THE CONTRACT

4.2 ADMINISTRATION OF THE CONTRACT

4.2.7 Strike the first sentence and replace with the following:

"The Architect will review and approve or take other appropriate action upon the Contractor's submittals such as Shop Drawings, Product Data and Samples for the purpose of checking for conformance with the Contract Documents."

4.2.7 Strike the second sentence and replace with the following:

"The Architect's action will be taken with such reasonable promptness as to cause no delay in the Work in the activities of the Owner, Contractor or separate Contractors, while allowing sufficient time in the Owner's professional judgment to permit adequate review."

Add the following Section:

"4.2.10.1 There will be no full-time Project Representative provided by the Owner or Architect on this project."

"4.2.13 Add "and in compliance with all local requirements." to the end of the sentence."

ARTICLE 5: SUBCONTRACTORS

5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

5.2.3 Strike Section 5.2.3 in its entirety and replace with the following:

"If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection, subject to the statutory requirements of 29 Delaware Code § 6962(d)(10)b.3 and 4."

5.2.4 Strike Section 5.2.4 in its entirety and replace with the following:

"The Contractor may not substitute any Subcontractor listed in its Bid unless the Contractor complies with the requirements of 29 Delaware Code § 6962(d)(10)b.3 and 4.

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Failure to comply with this requirement shall subject the Contractor to a penalty as outlined in Section 5.2 of the Owner's General Requirements."

Add the following Section:

"5.2.5 The Contractor shall comply and shall ensure all Subcontractors comply with all requirements for drug testing as set forth in TITLE 19 LABOR DELAWARE ADMINISTRATIVE CODE 4000 Office of Management and Budget 4100 Division of Facilities Management **4104 Regulations for the Drug Testing of Contractor and Subcontractor Employees Working on Large Public Works Projects."**

ARTICLE 6: CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

6.1.1 Strike "and waiver of subrogation" from the end of the second sentence.

6.1.4 Strike Section 6.1.4 in its entirety.

6.2 MUTUAL RESPONSIBILITY

6.2.3 Strike "shall" and replace with "may" in the second sentence.

ARTICLE 7: CHANGES IN THE WORK

(SEE ARTICLE 7: CHANGES IN WORK IN THE STATE OF DELAWARE DIVISION OF FACILITIES MANAGEMENT GENERAL REQUIREMENTS)

7.2 CHANGE ORDERS

Add the following Sections:

"7.2.2 In addition to the above:

7.2.2.1 The General Contractor is allowed a fifteen percent (15%) markup for overhead and profit for additional work performed by the General Contractor's own forces.

7.2.2.2 For additional subcontractor work, the Subcontractor is allowed a fifteen (15) percent overhead and profit on change order work above and beyond the direct costs stated previously. To this amount, the General Contractor will be allowed a mark-up not exceeding seven- and one-half percent (7.5%) on the subcontractor's work.

7.2.2.3 Where the Third Tier Contractor is going to be completing the additional work, the Third-Tier contractor will be allowed a markup of fifteen percent (15%) overhead and profit on changes order work above and beyond the direct costs stated previously. To this amount, the Subcontractor will be allowed a markup not to exceed seven and one-half percent (7.5%) on the Third-Tier Contractor's work and the

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General Contractor will be allowed a markup not to exceed seven and one-half percent (7.5%) of the amount of the Subcontractor's markup.

7.2.2.4 No additional costs shall be allowed for changes related to the Contractor's onsite superintendent/staff, or project manager, unless a change in the work changes the project duration and is identified by the CPM schedule. There will be no other costs associated with the change order.

7.2.2.5 These markups shall include all costs including, but not limited to: overhead, profit, bonds, insurance, supervision, etc."

7.3.4.1 Strike "and other employee costs approved by the Architect" after "worker's compensation insurance,"

7.3.4.4 Add "work attributable to the" before "change" at the end of the sentence.

7.4 MINOR CHANGES IN THE WORK
Add "unless such changes are approved" at the end of the third sentence.

ARTICLE 8: TIME

8.2 PROGRESS AND COMPLETION

8.2.1 Add the following Section:

"8.2.1.1 Refer to Project Specifications Section SUMMARY OF WORK for Contract time requirements."

8.2.2 After "by the Contractor" strike "and" and insert "to".

8.2.4 Add the following Section:

"8.2.4 If the Work falls behind the Progress Schedule as submitted by the Contractor, the Contractor shall employ additional labor and/or equipment necessary to bring the Work into compliance with the Progress Schedule at no additional cost to the Owner."

8.3 DELAYS AND EXTENSION OF TIME

8.3.1 Strike "binding dispute resolution" and insert "any and all remedies at law or in equity".

Add the following Section:

"8.3.2.1 The Contractor shall update the status of the suspension, delay, or interruption of the Work with each Application for Payment. (The Contractor shall report the termination of such cause immediately upon the termination thereof.) Failure to comply with this procedure shall constitute a waiver for any claim for adjustment of time or price based upon said cause."

Strike Section 8.3.3 in its entirety and replace with the following:

8.3.3 "Except in the case of a suspension of the Work directed by the Owner, an extension of time under the provisions of Section 8.3.1 shall be the Contractor's sole remedy in the progress of the Work and there shall be no payment or compensation to the Contractor for any expense or damage resulting from the delay."

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Add the following Section:

"8.3.4 By permitting the Contractor to work after the expired time for completion of the project, the Owner does not waive their rights under the Contract."

ARTICLE 9: PAYMENTS AND COMPLETION

9.2 SCHEDULE OF VALUES

Add the following Sections:

"9.2.1 The Schedule of Values shall be submitted using AIA Document G703, Continuation Sheet to G702."

"9.2.2 The Schedule of Values is to include a line item for Project Closeout Document Submittal. The value of this item is to be no less than 1.5% of the initial contract amount."

9.3 APPLICATIONS FOR PAYMENT

9.3.1 Strike Section 9.3.1 in its entirety and replace with the following:

"At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values for completed portions of the Work. The application shall be notarized, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage."

Add the following Sections:

"9.3.1.3 Application for Payment shall be submitted on AIA Document G702 "Application and Certificate for Payment", supported by AIA Document G703 "Continuation Sheet". Said Applications shall be fully executed and notarized."

"9.3.4 Until Closeout Documents have been received and outstanding items completed the Owner will pay 95% (ninety-five percent) of the amount due the Contractor on account of progress payments."

"9.3.5 The Contractor shall provide a current and updated Progress Schedule to the Architect with each Application for Payment. Failure to provide Schedule will be just cause for rejection of Application for Payment."

9.5 DECISIONS TO WITHHOLD CERTIFICATION

Add the following Subsections to 9.5.1:

.8 failure to provide a current Progress Schedule;
.9 a lien or attachment is filed;
.10 failure to comply with mandatory requirements for maintaining Record Documents.

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9.6 PROGRESS PAYMENTS

9.6.1 Strike Section 9.6.1 in its entirety and replace with the following:

"9.6.1 After the Architect has approved and issued a Certificate for Payment, payment shall be made by the Owner within 30 days after Owner's receipt of the Certificate for Payment."

9.6.8 Strike "Provided the Owner has fulfilled its payment obligations under the Contract Documents," in the first sentence.

9.7 FAILURE OF PAYMENT

Strike Section 9.7 in its entirety and replace with the following:

"If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within fourteen days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within thirty days after the date established in the Contract Documents, the amount certified by the Architect, then the Contractor may, upon thirty additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents."

9.8 SUBSTANTIAL COMPLETION

9.8.3 At the end of Section 9.8.3, add the following sentence:

"If the Architect is required to make more than 2 inspections of the same portion of work, the Contractor shall be responsible for all costs associated with subsequent inspections including but not limited to any Architect's fees."

9.8.5 Strike "shall" and insert "may" in the second sentence.

9.8.5 Insert "1/2 of the" after "make payment of" in the second sentence.

9.9 PARTIAL OCCUPANCY OR USE

9.9.1 Strike the the first sentence and replace with the following (the remainder of the Section remains as written):
"The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use authorized by public authorities having jurisdiction over the Project."

9.10.2 Strike "to remain in force after final payment is currently in effect" after "required by the Contract Documents" and replace with "shall remain in force until final payment is completed" in the first sentence.

9.10.4.4 Strike "if permitted by the Contract Documents,"

ARTICLE 10: PROTECTION OF PERSONS AND PROPERTY

10.1 SAFETY PRECAUTIONS AND PROGRAMS

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Add the following Sections:

10.1.1 Each Contractor shall develop a safety program in accordance with the Occupational Safety and Health Act of 1970. A copy of said plan shall be furnished to the Owner and Architect prior to the commencement of that Contractor's Work.

10.1.2 Each Contractor shall appoint a Safety Representative. Safety Representatives shall be someone who is on site on a full time basis. If deemed necessary by the Owner or Architect, Contractor Safety meetings will be scheduled. The attendance of all Safety Representatives will be required. Minutes will be recorded of said meetings by the Contractor and will be distributed to all parties as well as posted in all job offices/trailers etc.

10.2 SAFETY OF PERSONS AND PROPERTY

Add the following Section:

10.2.4.1 As required in the Hazardous Chemical Act of June 1984, all vendors supplying any material that may be defined as hazardous must provide Material Safety Data Sheets for those products. Any chemical product should be considered hazardous if it has a caution warning on the label relating to a potential physical or health hazard, if it is known to be present in the work place, and if employees may be exposed under normal conditions or in foreseeable emergency situations. Material Safety Data Sheets shall be provided directly to the Owner, along with the shipping slips that include those products.

10.2.5 Strike the second sentence in its entirety.

10.3 HAZARDOUS MATERIALS AND SUBSTANCES

10.3.3 Strike Section 10.3.3 in its entirety.

10.3.4 Insert "hazardous" in the last sentence after "handling of such" .

10.3.6 Strike Section 10.3.6 in its entirety.

ARTICLE 11: INSURANCE AND BONDS

11.1 CONTRACTOR'S INSURANCE AND BONDS

11.1.1 Strike "Owner" from the third sentence.

11.2 OWNER'S LIABILITY INSURANCE

Strike 11.2 in its entirety, except that in the case of school projects in which case Section 11.2 shall remain.

11.3 WAIVERS OF SUBROGATION

Delete Section 11.3 in its entirety

11.4 LOSS OF USE, BUSINESS INTERRUPTION, AND DELAY IN COMPLETION INSURANCE

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Delete Section 11.4 in its entirety

ARTICLE 12: UNCOVERING AND CORRECTION OF WORK

12.2.2 AFTER SUBSTANTIAL COMPLETION

Add the following Section:

"12.2.2.1.1 At any time during the progress of the Work, or in any case where the nature of the defects will be such that it is not expedient to have corrected, the Owner, at its option, will have the right to deduct such sum, or sums, of money from the amount of the Contract as it considers justified to adjust the difference in value between the non-conforming work and that required under contract including any damage to the structure."

12.2.2.1 Strike all references to "one year" or "one-year" and replace with "two years".

12.2.2.2 Strike "one-year" and replace with "two years".

12.2.2.3 Strike "one-year" and replace with "two years".

12.2.5 Strike "one-year" and replaced with "two years".

ARTICLE 13: MISCELLANEOUS PROVISIONS

13.1 GOVERNING LAW

Strike the last sentence.

13.4 TESTS AND INSPECTIONS

13.4.1 Strike the last sentence and replace with the following:

"The Owner shall pay for tests, inspections, or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor."

13.5 INTEREST

Strike "the date payment is due at such rate as the parties may agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located" and replace with "30 days of presentment of the authorized Certificate of Payment at the annual rate of 12% or 1% per month."

Insert the following Section:

"13.6 CONFLICTS WITH FEDERAL STATUTES OR REGULATIONS

13.6.1 If any provision, specifications or requirement of the Contract Documents conflict or is inconsistent with any statute, law or regulation of the government of the United State of America, the Contractor shall notify the Architect and Owner immediately upon discovery."

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ARTICLE 14: TERMINATION OR SUSPENSION OF THE CONTRACT

14.1 TERMINATION BY THE CONTRACTOR

14.1.1.4 Insert ", upon the Contractors' request," after "furnish to the Contractor".

14.1.3 Strike "and profit on Work not executed, and" after "as well as reasonable overhead" and replace with ", profit, and reasonable"

14.3 SUSPENSION BY OWNER FOR CONVENIENCE

14.3.2 Strike "Adjustment of the Contract Sum shall include profit".

14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

14.4.3 Strike Section 14.4.3 in its entirety and replace with the following:

"In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and reasonable costs incurred by reason of such termination along with reasonable overhead."

ARTICLE 15: CLAIMS AND DISPUTES

15.1 CLAIMS

15.1.2 TIME LIMITS ON CLAIMS

Strike the last sentence.

15.1.3 NOTICE OF CLAIM

Strike all references to "21" and replace with "45".

15.1.5 CLAIMS FOR ADDITIONAL COSTS

Strike the first sentence and replace with the following:

"Contractor shall not proceed to execute any portion of the Work that is subject to the Claim without prior approval of the costs or method of payment for the costs associated with the Claim as determined by the Architect and approved by the Owner."

15.1.7 WAIVER OF CLAIMS FOR CONSEQUENTIAL DAMAGES

Strike Section 15.1.7 in its entirety.

15.2 INITIAL DECISION

15.2.1 Strike "and binding dispute resolution" in the fourth sentence and replace with "or any and all remedies at law or in equity".

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15.2.5 Strike Section 15.2.5 in its entirety and replace with the following:

"The Architect will approve or reject Claims by written decision, which shall state the reasons therefore and shall notify the parties of any change in the Contract Sum or Contract Time or both. The approval or rejection of a Claim by the Architect shall be subject to mediation and any or all remedies at law or in equity."

15.2.6 Strike Section 15.2.6 and its sub-Sections in their entirety.

15.3 MEDIATION

15.3.1 Strike "binding dispute resolution" and replace with "any or all remedies at law or in equity".

15.3.2 Strike ", shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedure in effect on the date of the Agreement," in the first sentence.

15.3.2 Strike all references to "binding dispute resolution" and replace with "any or all remedies at law and in equity".

15.3.3 Strike Section 15.3.3 in its entirety.

15.4 ARBITRATION

Strike Section 15.4 and its Subsections in their entirety.

END OF SECTION

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WAGE RATE DETERMINATION SCHEDULE

The Delaware Department of Labor Division of Industrial Affairs has established the category and associated prevailing wage rate for this project. The project approved prevailing wage rate determination schedule follows.

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STATE OF DELAWARE
DEPARTMENT OF LABOR
DIVISION OF INDUSTRIAL AFFAIRS
OFFICE OF LABOR LAW ENFORCEMENT
PHONE: (302) 318-2769

Mailing Address:
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Newark, DE 19702

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Suite 210
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PREVAILING WAGES FOR **BUILDING CONSTRUCTION** EFFECTIVE MARCH 14, 2025

CLASSIFICATION	NEW CASTLE	KENT	SUSSEX
ASBESTOS WORKERS	29.89	36.79	53.56
BOILERMAKERS	89.46	45.39	66.72
BRICKLAYERS	66.79	66.79	66.79
CARPENTERS	62.56	62.56	50.80
CEMENT FINISHERS	94.36	67.11	52.04
ELECTRICAL LINE WORKERS	59.42	50.96	38.85
ELECTRICIANS	83.92	83.92	83.92
ELEVATOR CONSTRUCTORS	117.63	84.30	100.06
GLAZIERS	85.50	85.50	74.04
INSULATORS	69.12	69.12	69.12
IRON WORKERS	77.73	77.73	77.73
LABORERS	57.65	57.65	57.65
MILLWRIGHTS	88.35	88.35	70.97
PAINTERS	59.63	59.63	59.63
PILEDRIVERS	91.12	51.44	41.60
PLASTERERS	39.01	39.01	28.91
PLUMBERS/PIPEFITTERS/STEAMFITTERS	79.55	82.95	73.71
POWER EQUIPMENT OPERATORS	83.29	83.29	83.29
ROOFERS-COMPOSITION	32.40	30.53	32.76
ROOFERS-SHINGLE/SLATE/TILE	24.03	28.59	22.47
SHEET METAL WORKERS	86.84	86.84	86.84
SOFT FLOOR LAYERS	61.68	61.68	47.74
SPRINKLER FITTERS	73.13	73.13	73.13
TERRAZZO/MARBLE/TILE FNRS	70.79	70.79	81.89
TERRAZZO/MARBLE/TILE STRS	78.73	78.73	90.82
TRUCK DRIVERS	56.88	35.86	27.91

CERTIFIED: 3/17/2025

BY: for Fran Chudzik
ADMINISTRATOR, OFFICE OF LABOR LAW ENFORCEMENT

NOTE: THESE RATES ARE PROMULGATED AND ENFORCED PURSUANT TO THE PREVAILING WAGE REGULATIONS ADOPTED BY THE DEPARTMENT OF LABOR ON APRIL 3, 1992.

CLASSIFICATIONS OF WORKERS ARE DETERMINED BY THE DEPARTMENT OF LABOR. FOR ASSISTANCE IN CLASSIFYING WORKERS, OR FOR A COPY OF THE REGULATIONS CLASSIFICATIONS, PHONE (302) 318-2769.

NON-REGISTERED APPRENTICES MUST BE PAID THE MECHANIC'S RATE.

PROJECT: MJ1002000071 Legislative Hall Parking Garage , Kent County

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SECTION 00 81 13

GENERAL REQUIREMENTS

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2. OWNER
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ARTICLE 1: GENERAL

1.1 CONTRACT DOCUMENTS

1.1.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary and what is required by one shall be as binding as if required by all. Performance by the Contractor shall be required to an extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the intended results.

1.1.2 Work including material purchases shall not begin until the Contractor is in receipt of a bonafide State of Delaware Purchase Order. Any work performed or material purchases prior to the issuance of the Purchase Order is done at the Contractor's own risk and cost.

1.2 EQUALITY OF EMPLOYMENT OPPORTUNITY ON PUBLIC WORKS

1.2.1 For Public Works Projects financed in whole or in part by state appropriation the Contractor agrees that during the performance of this contract:

1. The Contractor will not discriminate against any employee or applicant for employment because of race, creed, sex, color, sexual orientation, gender identity or national origin. The Contractor will take positive steps to ensure that applicants are employed and that employees are treated during employment without regard to their race, creed, sex, color, sexual orientation, gender identity or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places available to employees and applicants for employment notices to be provided by the contracting agency setting forth this nondiscrimination clause.

2. The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, creed, sex, color, sexual orientation, gender identity or national origin."

ARTICLE 2: OWNER

(NO ADDITIONAL GENERAL REQUIREMENTS – SEE SUPPLEMENTARY GENERAL CONDITIONS)

ARTICLE 3: CONTRACTOR

3.1 Schedule of Values: The successful Bidder shall within twenty (20) days after receiving notice to proceed with the work, furnish to the Owner a complete schedule of values on the various items comprising the work.

3.2 Subcontracts: Upon approval of Subcontractors, the Contractor shall award their Subcontracts as soon as possible after the signing of their own contract and see that all material, their own and those of their Subcontractors, are promptly ordered so that the work will not be delayed by failure of materials to arrive on time.

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3.3 Before commencing any work or construction, the General Contractor is to consult with the Owner as to matters in connection with access to the site and the allocation of Ground Areas for the various features of hauling, storage, etc.

3.4 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions.

3.5 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Contract. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them.

3.6 The Contractor warrants to the Owner that materials and equipment furnished will be new and of good quality, unless otherwise permitted, and that the work will be free from defects and in conformance with the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved, may be considered defective. If required by the Owner, the Contractor shall furnish evidence as to the kind and quality of materials and equipment provided.

3.7 Unless otherwise provided, the Contractor shall pay all sales, consumer, use and other similar taxes, and shall secure and pay for required permits, fees, licenses, and inspections necessary for proper execution of the Work.

3.8 The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations, and lawful orders of public authorities bearing on performance of the Work. The Contractor shall promptly notify the Owner if the Drawings and Specifications are observed to be at variance therewith.

3.9 The Contractor shall be responsible to the Owner for the acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons performing portions of the Work under contract with the Contractor.

3.10 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work the Contractor shall remove from and about the Project all waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials. The Contractor shall be responsible for returning all damaged areas to their original conditions.

3.11 STATE LICENSE AND TAX REQUIREMENTS

3.11.1 Each Contractor and Subcontractor shall be licensed to do business in the State of Delaware and shall pay all fees and taxes due under State laws. In conformance with Section 2503, Chapter 25, Title 30, Delaware Code, "the Contractor shall furnish the Delaware Department of Finance within ten (10) days after entering into any contract with a contractor or subcontractor not a resident of this State, a statement of total value of such contract or contracts together with the names and addresses of the contracting parties."

3.12 The Contractor shall comply with all requirements set forth in Section 6962, Chapter 69, Title 29 of the Delaware Code.

3.13 During the contract Work, the Contractor and each Subcontractor, shall implement an Employee Drug Testing Program in accordance with OMB Regulation 4104 - "Regulations for the Drug Testing of Contractor and Subcontractor Employees Working

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on “Large Public Works Projects”. “Large Public Works” is based upon the current threshold required for bidding Public Works as set by the Purchasing and Contracting Advisory Council.

ARTICLE 4: ADMINISTRATION OF THE CONTRACT

4.1 CONTRACT SURETY

4.1.1 PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND

4.1.2 All bonds will be required as follows unless specifically waived elsewhere in the Bidding Documents.

4.1.3 Contents of Performance Bonds – The bond shall be in the form approved by the Office of Management and Budget. The bond shall be conditioned upon the faithful compliance and performance by the successful bidder of each and every term and condition of the contract and the proposal, plans, specifications, and bid documents thereof. Each term and condition shall be met at the time and in the manner prescribed by the Contract, Bid documents and the specifications, including the payment in full to every person furnishing materiel or performing labor in the performance of the Contract, of all sums of money due the person for such labor and materiel. (The bond shall also contain the successful bidder’s guarantee to indemnify and save harmless the State and the agency from all costs, damages and expenses growing out of or by reason of the Contract in accordance with the Contract.)

4.1.4 Invoking a Performance Bond – The agency may, when it considers that the interest of the State so requires, cause judgement to be confessed upon the bond.

4.1.5 Within twenty (20) days after the date of notice of award of contract, the Bidder to whom the award is made shall furnish a Performance Bond and Labor and Material Payment Bond, each equal to the full amount of the Contract price to guarantee the faithful performance of all terms, covenants and conditions of the same. The bonds are to be issued by an acceptable Bonding Company licensed to do business in the State of Delaware and shall be issued in duplicate.

4.1.6 Performance and Payment Bonds shall be maintained in full force (warranty bond) for a period of two (2) years after the date of the Certificate for Final Payment. The Performance Bond shall guarantee the satisfactory completion of the Project and that the Contractor will make good any faults or defects in his work which may develop during the period of said guarantees as a result of improper or defective workmanship, material or apparatus, whether furnished by themselves or their Sub-Contractors. The Payment Bond shall guarantee that the Contractor shall pay in full all persons, firms or corporations who furnish labor or material or both labor and material for, or on account of, the work included herein. The bonds shall be paid for by this Contractor. The Owner shall have the right to demand that the proof parties signing the bonds are duly authorized to do so.

4.2 FAILURE TO COMPLY WITH CONTRACT

4.2.1 If any firm entering into a contract with the State, or Agency that neglects or refuses to perform or fails to comply with the terms thereof, the Agency which signed the Contract may terminate the Contract and proceed to award a new contract in accordance with this Chapter 69, Title 29 of the Delaware Code or may require the Surety on the Performance Bond to complete the Contract in accordance with the terms of the Performance Bond. Nothing herein shall preclude the Agency from pursing additional remedies as otherwise provided by law.

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4.3 CONTRACT INSURANCE AND CONTRACT LIABILITY

4.3.1 In addition to the bond requirements stated in the Bid Documents, each successful Bidder shall purchase adequate insurance for the performance of the Contract and, by submission of a Bid, agrees to indemnify and save harmless and to defend all legal or equitable actions brought against the State, any Agency, officer and/or employee of the State, for and from all claims of liability which is or may be the result of the successful Bidder's actions during the performance of the Contract.

4.3.2 The purchase or nonpurchase of such insurance or the involvement of the successful Bidder in any legal or equitable defense of any action brought against the successful Bidder based upon work performed pursuant to the Contract will not waive any defense which the State, its agencies and their respective officers, employees and agents might otherwise have against such claims, specifically including the defense of sovereign immunity, where applicable, and by the terms of this section, the State and all agencies, officers and employees thereof shall not be financially responsible for the consequences of work performed, pursuant to said contract.

4.4 RIGHT TO AUDIT RECORDS

4.4.1 The Owner shall have the right to audit the books and records of a Contractor or any Subcontractor under any Contract or Subcontract to the extent that the books and records relate to the performance of the Contract or Subcontract.

4.4.2 Said books and records shall be maintained by the Contractor for a period of seven (7) years from the date of final payment under the Prime Contract and by the Subcontractor for a period of seven (7) years from the date of final payment under the Subcontract.

ARTICLE 5: SUBCONTRACTORS

5.1 SUBCONTRACTING REQUIREMENTS

5.1.1 All contracts for the construction, reconstruction, alteration or repair of any public building (not a road, street or highway) shall be subject to the following provisions:

1. A contract shall be awarded only to a Bidder whose Bid is accompanied by a statement containing, for each Subcontractor category, the name and address (city or town and State only – street number and P.O. Box addresses not required) of the subcontractor whose services the Bidder intends to use in performing the Work and providing the material for such Subcontractor category.

2. A Bid will not be accepted nor will an award of any Contract be made to any Bidder which, as the Prime Contractor, has listed itself as the Subcontractor for any Subcontractor unless:

   A. It has been established to the satisfaction of the awarding Agency that the Bidder has customarily performed the specialty work of such Subcontractor category by artisans regularly employed by the Bidder's firm;

   B. That the Bidder is duly licensed by the State to engage in such specialty work, if the State requires licenses; and

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C. That the Bidder is recognized in the industry as a bona fide Subcontractor or Contractor in such specialty work and Subcontractor category.

5.1.2 The decision of the awarding Agency as to whether a Bidder who list itself as the Subcontractor for a Subcontractor category shall be final and binding upon all Bidders, and no action of any nature shall lie against any awarding agency or its employees or officers because of its decision in this regard.

5.1.3 After such a Contract has been awarded, the successful Bidder shall not substitute another Subcontractor for any Subcontractor whose name was set forth in the statement which accompanied the Bid without the written consent of the awarding Agency.

5.1.4 No Agency shall consent to any substitution of Subcontractors unless the Agency is satisfied that the Subcontractor whose name is on the Bidders accompanying statement:

A. Is unqualified to perform the work required;

B. Has failed to execute a timely reasonable Subcontract;

C. Has defaulted in the performance on the portion of the work covered by the Subcontract; or

D. Is no longer engaged in such business.

5.1.5 Should a Bidder be awarded a contract, such successful Bidder shall provide to the agency the taxpayer identification license numbers of such subcontractors. Such numbers shall be provided on the later of the date on which such subcontractor is required to be identified or the time the contract is executed. The successful Bidder shall provide to the agency to which it is contracting, within 30 days of entering into such public works contract, copies of all Delaware Business licenses of subcontractors and/or independent contractors that will perform work for such public works contract. However, if a subcontractor or independent contractor is hired or contracted more than 20 days after the Bidder entered the public works contract the Delaware Business license of such subcontractor or independent contractor shall be provided to the agency within 10 days of being contracted or hired.

5.1.6 The Contractor may employ additional Subcontractors on the jobsite only after submitting a copy of the Subcontractor's Employee Drug Testing Program to the Owner for approval. A Contractor or Subcontractor shall not commence work until the Owner has concluded its review and determined that the submitted Employee Drug Testing Program complies with OMB Regulation 4104.

5.2 PENALTY FOR SUBSTITUTION OF SUBCONTRACTORS

5.2.1 Should the Contractor fail to utilize any or all of the Subcontractors in the Contractor's Bid statement in the performance of the Work on the public bidding, the Contractor shall be penalized in the amount of (project specific amount*). The Agency may determine to deduct payments of the penalty from the Contractor or have the amount paid directly to the Agency. Any penalty amount assessed against the Contractor may be remitted or refunded, in whole or in part, by the Agency awarding the Contract, only if it is established to the satisfaction of the Agency that the Subcontractor in question has defaulted or is no longer engaged in such business. No claim for the remission or refund of any penalty shall be granted unless an application is filed within one year after the liability of the successful Bidder accrues. All

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penalty amounts assessed and not refunded or remitted to the contractor shall be reverted to the State.

*one (1) percent of contract amount not to exceed $10,000

5.3 ASBESTOS ABATEMENT

5.3.1 The selection of any Contractor to perform asbestos abatement for State-funded projects shall be approved by the Office of Management and Budget, Division of Facilities Management pursuant to Chapter 78 of Title 16.

5.4 STANDARDS OF CONSTRUCTION FOR THE PROTECTION OF THE PHYSICALLY HANDICAPPED

5.4.1 All Contracts shall conform with the standard established by the Delaware Architectural Accessibility Board unless otherwise exempted by the Board.

5.5 CONTRACT PERFORMANCE

5.5.1 Any firm entering into a Public Works Contract that neglects or refuses to perform or fails to comply with its terms, the Agency may terminate the Contract and proceed to award a new Contract or may require the Surety on the Performance Bond to complete the Contract in accordance with the terms of the Performance Bond.

ARTICLE 6: CONSTRUCTION BY OWNER OR SEPARATE CONTRACTORS

6.1 The Owner reserves the right to simultaneously perform other construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other Projects at the same site.

6.2 The Contractor shall afford the Owner and other Contractors reasonable opportunity for access and storage of materials and equipment, and for the performance of their activities, and shall connect and coordinate their activities with other forces as required by the Contract Documents.

ARTICLE 7: CHANGES IN THE WORK

7.1 The Owner, without invalidating the Contract, may order changes in the Work consisting of Additions, Deletions, Modifications or Substitutions, with the Contract Sum and Contract completion date being adjusted accordingly. Such changes in the Work shall be authorized by written Change Order signed by the Professional, as the duly authorized agent, the Contractor and the Owner.

7.2 The Contract Sum and Contract Completion Date shall be adjusted only by a fully executed Change Order.

7.3 The additional cost, or credit to the Owner resulting from a change in the Work shall be by mutual agreement of the Owner, Contractor and the Architect. In all cases, this cost or credit shall be based on the ‘DPE’ wages required and the “invoice price” of the materials/equipment needed.

7.3.1 “DPE” shall be defined to mean “direct personnel expense”. Direct payroll expense includes prevailing wage rates plus a maximum multiplier of 1.35 times DPE. For example, if the prevailing wage rate is $50/hour, the DPE would be $67.50/hour (50 x 1.35).

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7.3.2 "Invoice price" of materials/equipment shall be defined to mean the actual cost of materials and/or equipment that is paid by the Contractor, (or subcontractor), to a material distributor, direct factory vendor, store, material provider, or equipment leasing entity. Rates for equipment that is leased and/or owned by the Contractor or subcontractor(s) shall not exceed those listed in the latest version of the "Means Building Construction Cost Data" publication.

7.3.3 In addition to the above:

7.3.3.1 The General Contractor is allowed a fifteen percent (15%) markup for overhead and profit for additional work performed by the General Contractor's own forces.

7.3.3.2 For additional subcontractor work, the Subcontractor is allowed a fifteen (15) percent overhead and profit on change order work above and beyond the direct costs stated previously. To this amount, the General Contractor will be allowed a mark-up not exceeding seven- and one-half percent (7.5%) on the subcontractor's work.

7.3.3.3 Where the Third Tier Contractor is going to be completing the additional work, the Third-Tier contractor will be allowed a markup of fifteen percent (15%) overhead and profit on changes order work above and beyond the direct costs stated previously. To this amount, the Subcontractor will be allowed a markup not to exceed seven and one-half percent (7.5%) on the Third-Tier Contractor's work and the General Contractor will be allowed a markup not to exceed seven and one-half percent (7.5%) of the amount of the Subcontractor's markup.

7.3.3.4 No additional costs shall be allowed for changes related to the Contractor's onsite superintendent/staff, or project manager, unless a change in the work changes the project duration and is identified by the CPM schedule. There will be no other costs associated with the change order.

7.3.3.5 These markups shall include all costs including, but not limited to: overhead, profit, bonds, insurance, supervision, etc.

ARTICLE 8: TIME

8.1 Time limits, if any, are as stated in the Project Manual. By executing the Agreement, the Contractor confirms that the stipulated limits are reasonable, and that the Work will be completed within the anticipated time frame.

8.2 If progress of the Work is delayed at any time by changes ordered by the Owner, by labor disputes, fire, unusual delay in deliveries, abnormal adverse weather conditions, unavoidable casualties or other causes beyond the Contractor's control, the Contract Time shall be extended for such reasonable time as the Owner may determine.

8.3 Any extension of time beyond the date fixed for completion of the construction and acceptance of any part of the Work called for by the Contract, or the occupancy of the building by the Owner, in whole or in part, previous to the completion shall not be deemed a waiver by the Owner of his right to annul or terminate the Contract for abandonment or delay in the matter provided for, nor relieve the Contractor of full responsibility

8.4 SUSPENSION AND DEBARMENT

8.4.1 Per Section 6962(d)(14), Title 29, Delaware Code, "Any Contractor who fails to perform a public works contract or complete a public works project within the time schedule

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established by the Agency in the Invitation To Bid, may be subject to Suspension or Debarment for one or more of the following reasons: a) failure to supply the adequate labor supply ratio for the project; b) inadequate financial resources; or, c) poor performance on the Project."

8.4.2 "Upon such failure for any of the above stated reasons, the Agency that contracted for the public works project may petition the Director of the Office of Management and Budget for Suspension or Debarment of the Contractor. The Agency shall send a copy of the petition to the Contractor within three (3) working days of filing with the Director. If the Director concludes that the petition has merit, the Director shall schedule and hold a hearing to determine whether to suspend the Contractor, debar the Contractor or deny the petition. The Agency shall have the burden of proving, by a preponderance of the evidence, that the Contractor failed to perform or complete the public works project within the time schedule established by the Agency and failed to do so for one or more of the following reasons: a) failure to supply the adequate labor supply ratio for the project; b) inadequate financial resources; or, c) poor performance on the project. Upon a finding in favor of the Agency, the Director may suspend a Contractor from Bidding on any project funded, in whole or in part, with public funds for up to 1 year for a first offense, up to 3 years for a second offense and permanently debar the Contractor for a third offense. The Director shall issue a written decision and shall send a copy to the Contractor and the Agency. Such decision may be appealed to the Superior Court within thirty (30) days for a review on the record."

8.5 RETAINAGE

8.5.1 Per Section 6962(d)(5) a.3, Title 29, Delaware Code: The Agency may at the beginning of each public works project establish a time schedule for the completion of the project. If the project is delayed beyond the completion date due to the Contractor's failure to meet their responsibilities, the Agency may forfeit, at its discretion, all or part of the Contractor's retainage.

8.5.2 This forfeiture of retainage also applies to the timely completion of the punchlist. A punchlist will only be prepared upon the mutual agreement of the Owner, Architect and Contractor. Once the punchlist is prepared, all three parties will by mutual agreement, establish a schedule for its completion. Should completion of the punchlist be delayed beyond the established date due to the Contractor's failure to meet their responsibilities, the Agency may hold permanently, at its discretion, all or part of the Contractor's retainage.

ARTICLE 9: PAYMENTS AND COMPLETION

9.1 APPLICATION FOR PAYMENT

9.1.1 Applications for payment shall be made upon AIA Document G702. There will be a five percent (5%) retainage on all Contractor's monthly invoices until completion of the project. This retainage may become payable upon receipt of all required closeout documentation, provided all other requirements of the Contract Documents have been met.

9.1.2 A date will be fixed for the taking of the monthly account of work done. Upon receipt of Contractor's itemized application for payment, such application will be audited, modified, if found necessary, and approved for the amount. Statement shall be submitted to the Owner.

9.1.3 Section 6516, Title 29 of the Delaware Code annualized interest is not to exceed 12% per annum beginning thirty (30) days after the "presentment" (as opposed to the date) of the invoice.

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9.2 PARTIAL PAYMENTS

9.2.1 Any public works Contract executed by any Agency may provide for partial payments at the option of the Owner with respect to materials placed along or upon the sites or stored at secured locations, which are suitable for use in the performance of the contract.

9.2.2 When approved by the agency, partial payment may include the values of tested and acceptable materials of a nonperishable or noncontaminative nature which have been produced or furnished for incorporation as a permanent part of the work yet to be completed, provided acceptable provisions have been made for storage.

9.2.2.1 Any allowance made for materials on hand will not exceed the delivered cost of the materials as verified by invoices furnished by the Contractor, nor will it exceed the contract bid price for the material complete in place.

9.2.3 If requested by the Agency, receipted bills from all Contractors, Subcontractors, and material, men, etc., for the previous payment must accompany each application for payment. Following such a request, no payment will be made until these receipted bills have been received by the Owner.

9.3 SUBSTANTIAL COMPLETION

9.3.1 When the building has been made suitable for occupancy, but still requires small items of miscellaneous work, the Owner will determine the date when the project has been substantially completed.

9.3.2 If, after the Work has been substantially completed, full completion thereof is materially delayed through no fault of the Contractor, and without terminating the Contract, the Owner may make payment of the balance due for the portion of the Work fully completed and accepted. Such payment shall be made under the terms and conditions governing final payment that it shall not constitute a waiver of claims.

9.3.3 On projects where commissioning is included, the commissioning work as defined in the specifications must be complete prior to the issuance of substantial completion.

9.4 FINAL PAYMENT

9.4.1 Final payment, including the five percent (5%) retainage if determined appropriate, shall be made within thirty (30) days after the Work is fully completed and the Contract fully performed and provided that the Contractor has submitted the following closeout documentation (in addition to any other documentation required elsewhere in the Contract Documents):

9.4.1.1 Evidence satisfactory to the Owner that all payrolls, material bills, and other indebtedness connected with the work have been paid,

9.4.1.2 An acceptable RELEASE OF LIENS,

9.4.1.3 Copies of all applicable warranties,

9.4.1.4 As-built drawings,

9.4.1.5 Operations and Maintenance Manuals,

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9.4.1.6 Instruction Manuals,

9.4.1.7 Consent of Surety to final payment.

9.4.1.8 The Owner reserves the right to retain payments, or parts thereof, for its protection until the foregoing conditions have been complied with, defective work corrected and all unsatisfactory conditions remedied.

ARTICLE 10: PROTECTION OF PERSONS AND PROPERTY

10.1 The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract. The Contractor shall take all reasonable precautions to prevent damage, injury or loss to: workers, persons nearby who may be affected, the Work, materials and equipment to be incorporated, and existing property at the site or adjacent thereto. The Contractor shall give notices and comply with applicable laws ordinances, rules regulations, and lawful orders of public authorities bearing on the safety of persons and property and their protection from injury, damage, or loss. The Contractor shall promptly remedy damage and loss to property at the site caused in whole or in part by the Contractor, a Subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable.

10.2 The Contractor shall notify the Owner in the event any previously unknown hazardous material such as PCBs, asbestos, etc. is encountered on the project. The Owner will arrange with a qualified specialist for the identification, testing, removal, handling and protection against exposure or environmental pollution, to comply with applicable regulation laws and ordinances. The Contractor and Architect will not be required to participate in or to perform this operation. Upon completion of this work, the Owner will notify the Contractor and Architect in writing the area has been cleared and approved by the authorities in order for the work to proceed. The Contractor shall attach documentation from the authorities of said approval to the closeout documents to be submitted at the end of the project.

10.2.1 Any activities with the potential to disturb lead-based materials should be performed by the Contractor in accordance with OSHA regulations pertaining to Lead in Construction, 29 CFR 1926.62, Lead.

10.2.1.1 The Contractor shall notify the Owner in the event they encounter previously unknown material that they suspect may contain “lead”. The Owner will arrange with a qualified specialist for identification and testing and advise the Contractor of the results. In the case that testing identifies potential lead based materials, the contractor shall continue performance of the work that has the potential to disturb associated in accordance with OSHA regulations pertaining to Lead in Construction, 29 CFR 1926.62, Lead.

10.3 As required in the Hazardous Chemical Information Act of June 1984, all vendors supplying any materials that may be defined as hazardous, must provide Material Safety Data Sheets for those products. Any chemical product should be considered hazardous if it has a warning caution on the label relating to a potential physical or health hazard, if it is known to be present in the work place, and if employees may be exposed under normal conditions or in any foreseeable emergency situation. Material Safety Data Sheets must be provided directly to the Owner along with the shipping slips that include those products.

10.4 The Contractor shall certify to the Owner that materials incorporated into the Work are free of all asbestos. This certification may be in the form of Material Safety Data Sheet (MSDS) provided by the product manufacturer for the materials used in construction, as specified or as provided by the Contractor.

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ARTICLE 11: INSURANCE AND BONDS

11.1 The Contractor shall carry all insurance required by law, such as Unemployment Insurance, etc. The Contractor shall carry such insurance coverage as they desire on their own property such as a field office, storage sheds or other structures erected upon the project site that belong to them and for their own use. The Subcontractors involved with this project shall carry whatever insurance protection they consider necessary to cover the loss of any of their personal property, etc.

11.2 Upon being awarded the Contract, the Contractor shall obtain a minimum of two (2) copies of all required insurance certificates called for herein, and submit one (1) copy of each certificate, to the Owner, within 20 days of contract award.

11.3 Bodily Injury Liability and Property Damage Liability Insurance shall, in addition to the coverage included herein, include coverage for injury to or destruction of any property arising out of the collapse of or structural injury to any building or structure due to demolition work and evidence of these coverages shall be filed with and approved by the Owner.

11.4 The Contractor's Property Damage Liability Insurance shall, in addition to the coverage noted herein, include coverage on all real and personal property in their care, custody and control damaged in any way by the Contractor or their Subcontractors during the entire construction period on this project.

11.5 Builders Risk (including Standard Extended Coverage Insurance) on the existing building during the entire construction period, may be provided by the Contractor under this contract. The Owner shall insure the existing building and all of its contents and all this new alteration work under this contract during entire construction period for the full insurable value of the entire work at the site. Note, however, that the Contractor and their Subcontractors shall be responsible for insuring building materials (installed and stored) and their tools and equipment whenever in use on the project, against fire damage, theft, vandalism, etc.

11.6 Certificates of the insurance company or companies stating the amount and type of coverage, terms of policies, etc., shall be furnished to the Owner, within 20 days of contract award.

11.7 The Contractor shall, at their own expense, (in addition to the above) carry the following forms of insurance:

11.7.1 <u>Contractor's Contractual Liability Insurance</u>

Minimum coverage to be:

Bodily Injury		
	$1,000,000	for each occurrence
	$3,000,000	aggregate
Property Damage	$1,000,000	for each occurrence
	$3,000,000	aggregate

11.7.2 <u>Contractor's Protective Liability Insurance</u>

Minimum coverage to be:

Bodily Injury		
	$1,000,000	for each occurrence

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	$3,000,000	aggregate
Property Damage	$1,000,000	for each occurrence
	$3,000,000	aggregate

11.7.3 Automobile Liability Insurance

Minimum coverage to be:

Bodily Injury	$1,000,000	for each person
	$1,000,000	for each occurrence
Property Damage	$500,000	per accident

11.7.4 Prime Contractor's and Subcontractors' policies shall include contingent and contractual liability coverage in the same minimum amounts as 11.7.1 above.

11.7.5 Workmen's Compensation (including Employer's Liability):

11.7.5.1 Minimum Limit on employer's liability to be as required by law.

11.7.5.2 Minimum Limit for all employees working at one site.

11.7.6 Certificates of Insurance must be filed with the Owner guaranteeing fifteen (15) days prior notice of cancellation, non-renewal, or any change in coverages and limits of liability shown as included on certificates.

11.7.7 Social Security Liability

11.7.7.1 With respect to all persons at any time employed by or on the payroll of the Contractor or performing any work for or on their behalf, or in connection with or arising out of the Contractor's business, the Contractor shall accept full and exclusive liability for the payment of any and all contributions or taxes or unemployment insurance, or old age retirement benefits, pensions or annuities now or hereafter imposed by the Government of the United States and the State or political subdivision thereof, whether the same be measured by wages, salaries or other remuneration paid to such persons or otherwise.

11.7.7.2 Upon request, the Contractor shall furnish Owner such information on payrolls or employment records as may be necessary to enable it to fully comply with the law imposing the aforesaid contributions or taxes.

11.7.7.3 If the Owner is required by law to and does pay any and/or all of the aforesaid contributions or taxes, the Contractor shall forthwith reimburse the Owner for the entire amount so paid by the Owner.

ARTICLE 12: UNCOVERING AND CORRECTION OF WORK

12.1 The Contractor shall promptly correct Work rejected by the Owner or failing to conform to the requirements of the Contract Documents, whether observed before or after Substantial Completion and whether or not fabricated, installed or completed, and shall correct any Work found to be not in accordance with the requirements of the Contract Documents within a period of two years from the date of Substantial Completion, or by terms of an applicable special warranty required by the Contract Documents. The provisions of this Article apply to work done by Subcontractors as well as to Work done by direct employees of the Contractor.

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12.2 At any time during the progress of the work, or in any case where the nature of the defects shall be such that it is not expedient to have them corrected, the Owner, at their option, shall have the right to deduct such sum, or sums, of money from the amount of the contract as they consider justified to adjust the difference in value between the defective work and that required under contract including any damage to the structure.

ARTICLE 13: MISCELLANEOUS PROVISIONS

13.1 CUTTING AND PATCHING

13.1.1 The Contractor shall be responsible for all cutting and patching. The Contractor shall coordinate the work of the various trades involved.

13.2 DIMENSIONS

13.2.1 All dimensions shown shall be verified by the Contractor by actual measurements at the project site. Any discrepancies between the drawings and specifications and the existing conditions shall be referred to the Owner for adjustment before any work affected thereby has been performed.

13.3 LABORATORY TESTS

13.3.1 Any specified laboratory tests of material and finished articles to be incorporated in the work shall be made by bureaus, laboratories or agencies approved by the Owner and reports of such tests shall be submitted to the Owner. The cost of the testing shall be paid for by the Contractor.

13.3.2 The Contractor shall furnish all sample materials required for these tests and shall deliver same without charge to the testing laboratory or other designated agency when and where directed by the Owner.

13.4 ARCHAEOLOGICAL EVIDENCE

13.4.1 Whenever, in the course of construction, any archaeological evidence is encountered on the surface or below the surface of the ground, the Contractor shall notify the authorities of the State Historic Preservation Office and suspend work in the immediate area for a reasonable time to permit those authorities, or persons designated by them, to examine the area and ensure the proper removal of the archaeological evidence for suitable preservation by the Division of Historical and Cultural Affairs.

13.5 GLASS REPLACEMENT AND CLEANING

13.5.1 The General Contractor shall replace without expense to the Owner all glass broken during the construction of the project. If job conditions warrant, at completion of the job the General Contractor shall have all glass cleaned and polished.

13.6 WARRANTY

13.6.1 For a period of two (2) years from the date of substantial completion, as evidenced by the date of final acceptance of the work, the contractor warrants that work performed under this contract conforms to the contract requirements and is free of any defect of equipment, material or workmanship performed by the contractor or any of his subcontractors or suppliers. However, manufacturer's warranties and guarantees, if for a period longer than two (2) years, shall take precedence over the above warranties. The contractor shall

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remedy, at his own expense, any such failure to conform or any such defect. The protection of this warranty shall be included in the Contractor's Performance Bond.

ARTICLE 14: TERMINATION OR SUSPENSION OF THE CONTRACT

14.1 If the Contractor defaults or persistently fails or neglects to carry out the Work in accordance with the Contract Documents or fails to perform a provision of the Contract, the Owner, after seven days written notice to the Contractor, may make good such deficiencies and may deduct the cost thereof from the payment then or thereafter due the Contractor. Alternatively, at the Owner's option, and the Owner may terminate the Contract and take possession of the site and of all materials, equipment, tools, and machinery thereon owned by the Contractor and may finish the Work by whatever method the Owner may deem expedient. If the costs of finishing the Work exceed any unpaid compensation due the Contractor, the Contractor shall pay the difference to the Owner.

14.2 “If the continuation of this Agreement is contingent upon the appropriation of adequate state, or federal funds, this Agreement may be terminated on the date beginning on the first fiscal year for which funds are not appropriated or at the exhaustion of the appropriation. The Owner may terminate this Agreement by providing written notice to the parties of such non-appropriation. All payment obligations of the Owner will cease upon the date of termination. Notwithstanding the foregoing, the Owner agrees that it will use its best efforts to obtain approval of necessary funds to continue the Agreement by taking appropriate action to request adequate funds to continue the Agreement.”

END OF SECTION

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EMPLOYEE DRUG TESTING REPORT FORM
Period Ending:_____

4104 Regulations for the Drug Testing of Contractor and Subcontractor Employees Working on Large Public Works Projects requires that Contractors and Subcontractors who work on Large Public Works Contracts funded all or in part with public funds maintain testing data that includes but is not limited to the data elements below.

Project Number: _____

Project Name: _____

Contractor/Subcontractor Name: _____

Contractor/Subcontractor Address: _____
_____
_____

Number of employees who worked on the jobsite during the report period:_____

Number of employees subject to random testing during the report period:_____

Number of Negative Results _____ Number of Positive Results _____

Action taken on employee(s) in response to a failed or positive random test:
_____
_____
_____

Date: _____

This form is not required to be submitted to the Owner. Included as a reference to show information required to be maintained by the Contractor. The Owner shall have the right to periodically audit all Contractor and Subcontractor test results at the Contractor's or Subcontractor's offices (or by other means to make the data available for inspection by the Owner).

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EMPLOYEE DRUG TESTING
REPORT OF POSITIVE RESULTS

4104 Regulations for the Drug Testing of Contractor and Subcontractor Employees Working on Large Public Works Projects requires that Contractors and Subcontractors who work on Large Public Works Contracts funded all or in part with public funds to notify the Owner in writing of a positive random drug test.

Project Number: _____

Project Name: _____

Contractor/Subcontractor Name: _____

Contractor/Subcontractor Address: _____
_____
_____

Name of employee with positive test result: _____

Last 4 digits of employee SSN: _____

Date test results received: _____

Action taken on employee in response to a positive test result:
_____
_____
_____

Authorized Representative of Contractor/Subcontractor: _____
(typed or printed)

Authorized Representative of Contractor/Subcontractor: _____
(signature)

Date: _____

This form shall be sent by mail to the Owner within 24 hours of receipt of test results.

Enclose this test results form in a sealed envelope with the notation "Drug Testing Form – DO NOT OPEN" on the face thereof and place in a separate mailing envelope.

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Legislative Hall Parking Garage
411 Legislative Ave, Dover, DE 19901
OMB / DFM Contract #MJ1002000071

AFFIDAVIT OF CRAFT TRAINING COMPLIANCE

We, the contractor, hereby certify that we and all applicable subcontractors will abide by the contractor and subcontractor craft training requirements outlined below for the duration of the contract. Craft training must be provided by a contractor and/or subcontractor for each craft on a project for which there are Delaware Department of Labor approved and registered training programs or, if the contractor and/or subcontractor meets the requirements under Title 29, Chapter 69, Section 6960A.(b)(1)c.1.-3., payment may be made in accordance with Title 29, Chapter 69, Section 6960A.(b)(1)d. A list of crafts for which there are approved and registered training programs is maintained by the Delaware Department of Labor and can be found at: https://laborfiles.delaware.gov/main/det/apprenticeship/DE%20Craft%20Training%20Occupation%20List%20Effective%20March%201%202022.pdf. If you have questions regarding craft training programs, please submit all questions in writing to the Delaware Department of Labor at: apprenticeship@delaware.gov. ***This Affidavit of Craft Training Compliance must be submitted prior to contract execution***.

In accordance with Title 29, Chapter 69, Section 6960A.(a)(1), a contract relating to a public works project under § 6962 of Title 29 must include a craft training program for each craft in the project if at the time the contractor executes a public works contract, all of the following apply:

a. A project meets the prevailing wage requirement under Section 6960 of Title 29.
b. The contractor employs 10 or more total employees.
c. The project is not a federal highway project, except for the project under Section 6962(c)(11) of Title 29.
d. There is an apprenticeship program for a craft in the project on the list of crafts under Section 204(b)(2) of Title 19.

Pursuant to Title 29, Chapter 69, Section 6960A.(a)(2), ***a contractor must commit that all subcontractors provide craft training*** if paragraph (a)(1) of this section applies to the subcontractor. Failure to provide required craft training or payment on the project may subject the successful contractor and/or subcontractor(s) to penalties as outlined in Title 29, Chapter 69, Section 6960A.(d)(1)-(3).

Craft(s): _____

Contractor Name: _____

Contractor Address: _____

_____

_____

Contractor Program Registration Number(s) _____
On this line also indicate whether DE, Other State (identify) or US Registration Number

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Or

☐ **A payment has been made in the amount established under Section 204(b)(2)b.2. of Title 19, for the craft into the Delaware Department of Labor's Apprenticeship and Training Fund.**

Or

☐ **Craft Training requirements are not applicable because:**

_____

Authorized Representative (typed or printed): _____

Authorized Representative (signature): _____

Title: _____

State of Delaware)
) ss:
County of _____)

Before me, a notary public, in and for said county and state, personally appeared, _____, who acknowledged to me that she/he did execute the foregoing instrument on behalf of _____.

IN TESTIMONY WHEREOF, I have subscribed my name and affixed my official seal this ____ day of _____ 20___.

_____
Notary Public
Commission Expires _____

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THIS PAGE MUST BE SIGNED AND NOTARIZED TO BE CONSIDERED.

SECTION 01 10 00
SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: Legislative Hall - Legislative Hall Parking Garage.

B. Owner's Name: State of Delaware.

C. Architect's Name: StudioJAED.

D. The Project consists of the construction of a new 3-story, 124,800 SF parking garage at Legislative Hall.

E. The parking garage has 344 parking spots (97 restricted access parking for legislators and 248 public parking spots)

F. There is (1) public passenger elevator to levels 2 and 3. There is a hoistway and provisions to install (1) future restricted access passenger elevator from ground level to tunnel for future tunnel access to Legislative Hall.

G. The exterior walls are thin brick on precast concrete panels. There is a steep-slope roof structure with synthetic shake shingles and dormers. The remainder of roof is open to above.

H. Demolition scope includes the removal of the existing parking lot and removal / relocation of undergound utilities as required to perform the new work.

I. Civil scope of work includes preparing site for new foundation walls and slab, providing finish grading for building, stormwater management, paved areas around the building, and plantings.

J. Structural scope of work includes a concrete foundation system to support pre-cast concrete walls, slab on grade, and diaphragms, with precast, prestressed concrete frame, and structural steel framing for the roofing system.

K. Electrical scope of work new electrical to support the parking garage, including but not limited to new electrical service, panels, light fixtures, generator, fire alarm system and devices.

L. Installation of the generator, fuel tank, and automatic transfer switch sized to support the Parking Garage.

M. Mechanical scope of work includes HVAC to condition the elevator hoistways as well as occupied spaces. A new BAS is to be provided for remote monitoring and control.

N. Plumbing scope of work includes new domestic water service from the City of Dover as well as a new backflow preventor and water meter. There will be a new sanitary main connected to the City of Dover sanitary sewer system.

O. The Parking Garage shall be fully sprinklered with a dry-pipe system.

P. Construction of masonry wall as an exterior generator enclosure.

1.02 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a Stipulated Price.

1.03 WORK BY OWNER

A. Owner will supply and install the following:
   1. Low voltage wiring and systems.
   2. Security and access control devices.

1.04 FUTURE WORK

A. Provide hoist way and other components as indicated for future installation of a 2-stop MRL elevator.

1.05 OWNER OCCUPANCY

A. Owner intends to occupy the Project upon Substantial Completion.

B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

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C. Schedule the Work to accommodate Owner occupancy.

1.06 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.
   1. Work hours are between 8:00 am to 4:30pm, Monday through Friday. Alternate hours will be considered on a special-need basis.
   2. Laydown space limited to area of work and coordinated with the Owner.
   3. Contractor shall be responsable for securing the project site and all construction materials.
   4. Contractor shall provide temporary toilet facilities.

B. Provide access to and from site as required by law and by Owner:
   1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
   2. Do not obstruct roadways, sidewalks, or other public ways without permit.

C. Existing building spaces may not be used for storage.

D. Utility Outages and Shutdown:
   1. Coordinate any interruption and/ or shutdown of utilities with the State of Delaware at least 14 days in advanced of anticipated interruption and/ or shutdown. Limit any interruptions/ shutdowns to the absolute minimum amount of time.
   2. Coordinate any access outside area of work with the State of Delaware at least 7 days in advanced of anticipated need for access. This is to provide ample time for notification to the occupants of the building.
   3. Owner reserves the right to reschedule constructions shutdowns with minimal warning to the contractor as required to respond to emergencies.
   4. Limit disruption of utility services to hours the building is unoccupied.
   5. Prevent accidental disruption of utility services to other facilities.

E. Owner Occupancy
   1. The Owner will occupy the adjacent buildings throughout construction.

1.07 SCHEDULE

A. Pre-construction activities (i.e. submittals, shop drawings) to begin immediately after award.

B. Biweekly progress meetings to begin after award.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 20 00
PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

B. Change procedures.

1.02 RELATED REQUIREMENTS

A. Section 00 72 13 - General Conditions of the Contract for Construction A201-2017

B. Section 00 73 13 - Supplementary General Conditions A201-2017

C. Section 00 81 13 - General Requirements

1.03 SCHEDULE OF VALUES

A. Use Schedule of Values Form: AIA G703, edition stipulated in the Agreement.

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. Revise schedule to list approved Change Orders, with each Application For Payment.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Submit for work completed prior to issuing the Application for progress payment only..

B. Use Form AIA G702 and Form AIA G703, edition stipulated in the Agreement.

C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.

D. Forms filled out by hand will not be accepted.

E. Execute certification by signature of authorized officer.

F. Submit three copies of each Application for Payment.

1.05 MODIFICATION PROCEDURES

A. For minor changes not involving an adjustment to the Contract Price or Contract Time, Architect will issue instructions directly to Contractor.

B. 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 Price or Contract Time.
2. Promptly execute the change.

C. 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, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 5 days.

D. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.

E. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 21 00

ALLOWANCES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Contingency allowance.

1.02 RELATED REQUIREMENTS

A. Section 01 20 00 - Price and Payment Procedures: Additional payment and modification procedures.

1.03 CONTINGENCY ALLOWANCE

A. Contractor's costs for products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, overhead and profit will be included in Change Orders authorizing expenditure of funds from this Contingency Allowance.

B. Funds will be drawn from the Contingency Allowance only by 01 21 16 - Allowance Authorization Form.

C. At closeout of Contract, funds remaining in Contingency Allowance will be credited to Owner by Change Order.

1.04 ALLOWANCES SCHEDULE

A. The following allowance is set aside for unpredicted scope on the project, to be verified and billed as the project conditions dictate:

1. Allowance #1: Include the stipulated sum/price of $750,000.00 for use upon Owner's instructions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 21 16

ALLOWANCE AUTHORIZATION

Project: Legislative Hall Parking Garage

Architect: StudioJAED Architects & Engineers **Project No.** #MJ1002000071

Contractor:

AAA No.: **Initiation Date:**

The Allowance is allocated as follows:

Total original Contract Allowance was: $
Amount of Contract Allowance Access previously authorized: $
Adjusted Contract Allowance prior to this authorization is: $
The amount of available Allowance will Decrease by this Access Authorization: $
The remaining Contract Allowance, after this Access Authorization will be: $

Recommended by:
Architect

By (Signature): _____

Date: _____

Accepted by:
Contractor

By (Signature): _____
_____

Date: _____

Approved by:
Owner

By (Signature):

Date: _____

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SECTION 01 23 00
ALTERNATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Description of Alternates.

B. Documentation of changes to Contract Price and Contract Time.

1.02 RELATED REQUIREMENTS

A. Document 00 21 13 - Instructions to Bidders: Instructions for preparation of pricing for Alternates.

B. Section 00 41 13 - Bid Form

1.03 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.

1.04 SCHEDULE OF ALTERNATES

A. Alternate No. 1 - Provide Lightning Protection System as indicated in the Bid Documents.:

B. Alternate No. 2 - Provide Solar Panel system and associated equipment as noted in the Bid Documents.:

C. Alternate No. 3 - Provide Synthetic Slate Shingle roof in lieu of Concrete Tile as indicated in the Bid Documents.:

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 25 00
SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

A. Section 00 21 13 - Instructions to Bidders: Restrictions on timing of substitution requests.

B. Section 01 30 00 - Administrative Requirements: Submittal procedures, coordination.

C. Section 01 60 00 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

D. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions: Restrictions on emissions of indoor substitute products.

1.03 DEFINITIONS

A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.

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 coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.

C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
   1. No specific form is required. Contractor's Substitution Request documentation must include the following:
      a. Project Information:
         1) Official project name and number, and any additional required identifiers established in Contract Documents.
      b. Substitution Request Information:
         1) Discrete and consecutive Substitution Request number, and descriptive subject/title.
         2) Indication of reason for the substitution.
         3) Issue date.
         4) Reference to particular Contract Document(s) specification section number, title, and article/paragraph(s).
         5) Description of Substitution.
         6) Reason why the specified item cannot be provided.
         7) Differences between proposed substitution and specified item.
         8) Description of how proposed substitution affects other parts of work.
      c. Attached Comparative Data: Provide point-by-point, side-by-side comparison addressing essential attributes specified, as appropriate and relevant for the item:

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1) Physical characteristics.
2) In-service performance.
3) Expected durability.
4) Visual effect.
5) Sustainable design features.
6) Warranties.
7) Other salient features and requirements.

d. Impact of Substitution:
1) Savings to Owner for accepting substitution.
2) Change to Contract Time due to accepting substitution.

D. Limit each request to a single proposed substitution item.

3.02 SUBSTITUTION PROCEDURES DURING PROCUREMENT

A. Instructions to Bidders specifies time restrictions for submitting requests for substitutions during the bidding period, and the documents required.

3.03 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

A. Submit request for Substitution for Convenience immediately upon discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule. Substitutions for Convenience may be considered if the substitution provides advantage to the Owner and may be considered at the Owner's discretion.
1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
3. Bear the costs engendered by proposed substitution of:
a. Owner's compensation to the Architect for any required redesign, time spent processing and evaluating the request.

B. 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.

3.04 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.

3.05 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.

END OF SECTION

NOT FOR BIDDING

SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.
B. Preconstruction meeting.
C. Progress meetings.
D. Progress photographs.
E. Submittals for review, information, and project closeout.
F. Number of copies of submittals.
G. Requests for Interpretation (RFI) procedures.
H. Submittal procedures.

1.02 RELATED REQUIREMENTS

A. Section 01 60 00 - Product Requirements: General product requirements.

1.03 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 01 70 00 - 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. Coordination drawings.
   10. Correction Punch List and Final Correction Punch List for Substantial Completion.
   11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

A. Owner will schedule a meeting after Notice of Award.
B. Attendance Required:
   1. Owner.
   2. Architect.
   3. Contractor.
C. Agenda:
   1. Execution of Owner-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.
   4. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
   5. Designation of personnel representing the parties to Contract, OMB and Architect.
   6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   7. Scheduling.

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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.

3.02 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the Work at maximum bi-weekly (every other week) intervals.

B. Attendance Required: Job superintendent, major Subcontractors and suppliers, Owner, and Architect, as appropriate to agenda topics for each meeting.

C. 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. Maintenance of progress schedule.
   7. Corrective measures to regain projected schedules.
   8. Planned progress during succeeding work period.
   9. Maintenance of quality and work standards.
   10. Effect of proposed changes on progress schedule and coordination.
   11. Other business relating to Work.

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 CONSTRUCTION PROGRESS SCHEDULE

A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.

B. 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 schedule.

C. Submit updated schedule with each Application for Payment.
   1. Submit updated schedule at more frequent intervals as required to document significant changes between Applications for Payments.

3.04 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. Provide photographs of site and construction throughout progress of work produced by an experienced photographer, acceptable to Architect.

D. In addition to periodic, recurring views, take photographs of each of the following events:
   1. Excavations in progress.

E. 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.

F. 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 email.

NOT FOR BIDDING

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 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.

3.05 REQUESTS FOR INTERPRETATION (RFI)

A. 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.

B. 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. Combine RFI and its attachments into a single electronic file. PDF format is preferred.

C. 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 - 01 60 00 - 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).

D. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
   1. Official Project name and number, and any additional required identifiers established in Contract Documents.
   2. Owner's, Architect's, and Contractor's names.
   3. Discrete and consecutive RFI number, and descriptive subject/title.
   4. Issue date, and requested reply date.
   5. 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).
   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.

E. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

F. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.

G. Review Time: Architect will respond and return RFIs to Contractor within seven 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.

NOT FOR BIDDING

H. 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.

3.06 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.
   1. Coordinate with Contractor's construction schedule and schedule of values.
   2. Format schedule to allow tracking of status of submittals throughout duration of construction.
   3. 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, and role and name of subcontractor.
   4. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.

3.07 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 conformance with information given and the design concept expressed in the contract documents.

C. Samples will be reviewed only 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 01 78 00 - Closeout Submittals.

3.08 SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:
   1. Design data.
   2. Test reports.
   3. Inspection reports.
   4. Manufacturer's instructions.
   5. Manufacturer's field reports.
   6. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner. No action will be taken.

3.09 SUBMITTALS FOR PROJECT CLOSEOUT

A. When the following are specified in individual sections, submit them at project closeout:
   1. Project record documents.
   2. Operation and maintenance data.
   3. Warranties.

NOT FOR BIDDING

4. Bonds.
5. Other types as indicated.

3.10 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. Extra Copies at Project Closeout: See Section 01 78 00.

C. 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.

3.11 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.
   3. Identify each item by specification section with sequential suffix.
   4. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
   5. 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.
      a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
   6. Schedule submittals to expedite the Project, and coordinate submission of related items.
      a. For each submittal for review, allow 15 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 7 days.
   7. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
   8. Provide space for Contractor and Architect review stamps.
   9. When revised for resubmission, identify all changes made since previous submission.
   10. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
   11. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.

B. Product Data Procedures:
   1. Submit only information required by individual specification sections.
   2. Collect required information into a single submittal.
   3. Do not submit (Material) Safety Data Sheets for materials or products.

C. Shop Drawing Procedures:
   1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting the Contract Documents and coordinating related work.
   2. Do not reproduce Contract Documents to create shop drawings.
   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.

E. Transmit each submittal with approved form.

NOT FOR BIDDING

F. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.

G. Identify Project, Contractor, Subcontractor or supplier; pertinent drawing and detail number, and specification section number, as appropriate on each copy.

H. 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.

I. Schedule submittals to expedite the Project, and coordinate submission of related items.

J. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.

K. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.

L. Provide space for Contractor and Architect review stamps.

M. When revised for resubmission, identify all changes made since previous submission.

N. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.

O. Submittals not requested will not be recognized or processed.

END OF SECTION

NOT FOR BIDDING

SECTION 01 31 00
PROJECT MANAGEMENT AND COORDINATION

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. This Section includes administrative provisions for coordinating construction operations on the project including, but not limited to, the following:
   1. General project coordination procedures.
   2. Coordination Drawings.
   3. Administrative and supervisory personnel.
   4. Project meetings.

B. Related Sections
   1. Division 01 Section "Closeout Procedures" for coordinating Contract closeout.

C. Each contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific contractor.

1.03 DEFINITIONS

A. RFI: Request from Owner, Architect, or Contractor seeking information from each other during construction.

1.04 COORDINATION

A. Coordination: Coordinate construction operations included in various Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.

B. If necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
   1. Prepare similar memoranda for the Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of the Contractor's Construction Schedule.
   2. Preparation of the Schedule of Values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.
   5. Progress meetings.
   6. Pre-installation conferences.
   7. Project closeout activities.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

NOT FOR BIDDING

1.05 REQUESTS FOR INFORMATION (RFIS)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
   1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
   2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
   1. Project name
   2. Project number
   3. Date
   4. Name of Contractor
   5. Name of Architect
   6. RFI number, numbered sequentially
   7. RFI subject
   8. Specification Section number and title and related paragraphs, as appropriate
   9. Drawing number and detail references, as appropriate
   10. Field dimensions and conditions, as appropriate
   11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI
   12. Contractor's signature
   13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
      a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within [10] ten days of receipt of the RFI response

C. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.

D. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log bi-weekly.

E. SUBMITTALS
   1. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
      a. Indicate relationship of components shown on separate Shop Drawings.
      b. Indicate required installation sequences.
      c. Refer to Division 15 Section "Basic Mechanical Materials and Methods" and Division 16 Section "Basic Electrical Materials and Methods" for specific Coordination Drawing requirements for mechanical and electrical installations.

F. Staff Names: Within 15 days of starting construction operations, submit a list of principal staff
   1. assignments, including superintendent and other personnel in attendance at the Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to the Project.
   2. Post copies of list in the Project meeting room, in temporary field office, and by each temporary telephone.

NOT FOR BIDDING

1.06 PROJECT MEETINGS

A. General: Meetings shall be schedule by the Owner and shall be conducted at the Project site, unless otherwise indicated.
   1. Attendees: Architect shall inform participants and others involved, and individuals whose presence is required, of date and time of each meeting.
   2. Agenda: Architect shall prepare the meeting agenda and distribute the agenda to all invited attendees.
   3. Minutes: Architect shall record significant discussions and agreements achieved and distribute the meeting minutes to everyone concerned within 5 days of the meeting.

B. Preconstruction Conference: Owner shall schedule a preconstruction conference before starting Construction. Conference shall be held at the conference at the Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
   1. Attendees: Authorized representatives of the Owner, the Architect and their consultants, the Contractor and its superintendent, and other concerned parties shall attend the conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.
   2. Agenda: Discuss items of significance that could affect progress, including the following:
      a. Tentative construction schedule
      b. Phasing
      c. Critical work sequencing
      d. Designation of responsible personnel
      e. Procedures for processing field decisions and Change Orders
      f. Procedures for processing Applications for Payment
      g. Distribution of the Contract Documents
      h. Submittal procedures
      i. Preparation of Record Documents
      j. Use of the premises
      k. Responsibility for temporary facilities and controls
      l. Parking availability
      m. Office, work, and storage areas
      n. Equipment deliveries and priorities
      o. First aid
      p. Security
      q. Progress cleaning
      r. Working hours

C. Progress Meetings:Owner shall schedule the Progress Meetings at bi-weekly intervals.
   1. Agenda:
      a. Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of the Project.
      b. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to the Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
         1) Contractor shall issue a three-week look ahead schedule in advance of each Progress Meeting.
         2) Contractor shall revised the Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. At a minimum, the updated Construction Schedule shall be issued with each Application for Payment.
      c. Review present and future needs of each entity present, including the following:
         1) Interface requirements

NOT FOR BIDDING

2) Sequence of operations
3) Status of submittals
4) Deliveries
5) Off-site fabrication
6) Access
7) Site utilization
8) Temporary facilities and controls
9) Work hours
10) Hazards and risks
11) Progress cleaning
12) Quality and work standard
13) Change Orders
14) Documentation of information for payment requests

2. Reporting: Architect shall distribute minutes of the meeting to each party present and to parties who should have been present.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

NOT FOR BIDDING

SECTION 01 32 00

CONSTRUCTION PROGRESS DOCUMENTATION

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. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Preliminary Construction Schedule.
   2. Contractor's Construction Schedule.
   3. Submittals Schedule.
   4. Field condition reports.
   5. Construction photographs.

B. Related Sections include the following:
   1. Division 01 Section "Payment Procedures" for submitting the Schedule of Values.
   2. Division 01 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
   3. Division 01 Section "Submittal Procedures" for submitting schedules and reports.
   4. Division 01 Section "Closeout Procedures" for submitting construction photographs as Project Record Documents at Project closeout.

1.03 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
   1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
   2. Predecessor activity is an activity that must be completed before a given activity can be started.

B. Critical Path: The longest continuous chain of activities through the network schedule that establishes the minimum overall Project duration and contains no float.

C. Event: The starting or ending point of an activity.

D. Float: The measure of leeway in starting and completing an activity.
   1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
   2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the following activity.
   3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

E. Major Area: A story of construction, a separate building, or a similar significant construction element.

F. Milestone: A key or critical point in time for reference or measurement.

G. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.

H. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

NOT FOR BIDDING

1.04 SUBMITTALS

A. Qualification Data: For firms and persons specified in "Quality Assurance" Article and in-house scheduling personnel to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

B. Submittals Schedule: Submit three copies of schedule. Arrange the following information in a tubular format:
   1. Scheduled date for first submittal.
   2. Specification Section number and title.
   3. Submittal category (action or informational).
   4. Name of subcontractor.
   5. Description of the Work covered.

C. Contractor's Construction Schedule: Submit three printed copies of initial schedule, one a reproducible print and one a blue- or black-line print, large enough to show entire schedule for entire construction period.

D. Photographic Documentation:
   1. Preconstruction Photographs: Before commencement of demolition, take color, digital photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
   2. Periodic Construction Photographs: Take 12,coclor, digital photographs monthly with timing each month adjust to coinside with the cutoff date associated with each Application for Payment. Select vantage points to show stataus of construction and progress since last photgraphs were taken.

1.05 QUALITY ASSURANCE

A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting.

1.06 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
   1. Secure time commitments for performing critical elements of the Work from parties involved.
   2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.01 SUBMITTALS SCHEDULE

A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.
   1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
   2. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

2.02 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. CPM Schedule: Prepare Contractor's Construction Schedule using a CPM network analysis diagram.
   1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 15 days after date established for the Notice to Proceed..

NOT FOR BIDDING

2. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
3. Use "one workday" as the unit of time.

B. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths. Using the preliminary network diagram, prepare a skeleton network to identify probable critical paths.
   1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in realtion to other activities. Include estimated time frames for the following activities:
      a. Preparation and processing of submittals
      b. Mobilization and demobilization
      c. Purchase of materials
      d. Delivery
      e. Fabrication
      f. Utility interruptions
      g. Installation
      h. Work by Owner that may affect or be affected by Contractor's activities
      i. Testing
   2. Processing: Process data to produce output data or a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
   3. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
      a. Subnetworks on separate sheets are permissible for activities clearly off the critical
      b. path.

C. Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting. Include the following:
   1. Identification of activities that have changed.
   2. Changes in early and late start dates.
   3. Changes in early and late finish dates.
   4. Changes in activity durations in workdays.
   5. Changes in the critical path.
   6. Changes in total float or slack time.
   7. Changes in the Contract Time
      a. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 32 16
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, bar chart type.

1.02 RELATED SECTIONS

A. Section 01 10 00 - Summary: Work sequence.

1.03 REFERENCES

A. AGC (CPSM) - Construction Planning and Scheduling Manual; 2004.

1.04 SUBMITTALS

A. 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.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 10 days after joint review, submit complete schedule.

D. Submit updated schedule with each Application for Payment.

E. Submit the number of opaque reproductions that Contractor requires, plus two copies that will be retained by Architect.

F. Submit under transmittal letter form specified in Section 01 30 00.

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 or width required.

C. Sheet Size: Multiples of 8-1/2 x 11 inches.

D. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart, following the critical path method.

3.02 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 stages and other logically grouped activities.

D. Provide sub-schedules for each stage of Work identified in Section 01 10 00.

E. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

NOT FOR BIDDING

F. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.

G. Indicate delivery dates for owner-furnished products.

H. Coordinate content with schedule of values specified in Section 01 20 00.

I. Provide legend for symbols and abbreviations used.

3.03 BAR CHARTS

A. Include a separate bar for each major portion of Work or operation.

B. Identify the first work day of each week.

3.04 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.

3.05 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 including the effects of changes on schedules of separate contractors.

3.06 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 shown in schedules.

END OF SECTION

NOT FOR BIDDING

SECTION 01 33 00

SUBMITTAL PROCEDURES

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 requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
   1. Process designated submittals for the Project electronically through designated email system.

1.03 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's and responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

C. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

D. Email System: A method to transmit certain electronic submittals between the Contractor, Architect, and Owner, via email.
   1. For consistency, the standard file format will be PDF. Convert paper originals and other file formats to PDF prior to submission.
   2. In the event of system malfunction, submittals shall be processed in accordance with the Architect's instructions, until the system malfunction has been corrected.
   3. For this Project, process the following submittal types through the designated email system:
      a. Product Data.
      b. Shop Drawings.
      c. Product Schedules.
      d. Qualification Data.
      e. Certificates (Welding, Installer, Manufacturer, Product, and Material, as applicable).
      f. Test Reports (Material, Product, Preconstruction, Compatibility, and Field, as applicable).
      g. Research Reports.
      h. Warranty (sample).
      i. Design Data, including calculations.
      j. Coordination Drawings.
      k. Delegated-Design Services Certifications.
   4. For Samples, provide electronic submittal of Sample cover sheet, identifying location and actual delivery date of Samples. Deliver Samples to location (Architect's office, Project site, etc.) as directed by the Architect.
      a. Architect will identify delivery location(s) after receipt and review of Contractor's Submittal Schedule.

1.04 SUBMITTAL SCHEDULE

A. Submittal Schedule: Submit a schedule of submittals indicating scheduled date for each submission. Factor time required for review, ordering, manufacturing, fabrication, and delivery when establishing submission dates. Include additional time required for making corrections or

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revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1. Submit concurrently with the first complete submittal of Contractor's construction schedule.
2. Format: Arrange the following information in a tabular format:
    a. Specification Section number and title.
    b. A/E Number.
        1) Architect will furnish Contractor with unique "A/E Number" designation for each required submittal.
    c. Submittal category: Action; informal.
    d. Submittal type: Product Data, Shop Drawings, Samples, etc.
    e. Description of the Work covered.
    f. Scheduled date for first submittal.

1.05 COLOR SCHEDULE

A. Color Schedule: Within 30 days after date of Notice of Award, submit a complete list of proposed manufacturers and complete product designations (i.e. model, grade, series, product line, etc.) for each item requiring color selection by Architect.

1.06 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
    1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
    2. Where indicated, submit all submittal items required for each Specification Section concurrently.
    3. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
        a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

B. Processing Time: Allow sufficient time for submittal review, including time for resubmittals. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

C. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
    1. Include a cover sheet on each submittal item for identification. Do not combine different submittals under same cover sheet; only one submittal is to be provided per email.
        a. Cover Sheet: Use PDF version of sample form included in Project Manual. Complete each item on form, sign and date. Architect will furnish PDF version of sample form.
    2. Name submittal file as directed by Architect.
    3. Transmit each submittal via email using subject line as directed by Architect.

D. Resubmittals: Make resubmittals in same form and, for non-electronic submittals, in the same number of copies as initial submittal.
    1. Note date and content of revision in label or title block and clearly indicate extent of revision.
    2. Resubmit submittals until they are marked with approval notation from Architect.
    3. Refer to Supplementary Conditions for provisions allowing Owner to obtain reimbursement from the Contractor for amounts paid to the Architect for evaluation of certain resubmittals.

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities.

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect.

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PART 2 - PRODUCTS

2.01 SUBMITTAL PROCEDURES, GENERAL

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

2.02 ELECTRONIC SUBMITTAL PROCEDURES

A. Use the designated email system for submittals in this Article.
   1. Submit electronic submittals via email as PDF electronic files.
      a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
   1. Mark submittal to show which products and options are applicable.
   2. Include the following information, as applicable:
      a. Manufacturer's catalog cuts.
      b. Statement of compliance with specified referenced standards.
      c. Testing by recognized testing agency.
   3. For equipment, include the following in addition to the above, as applicable:
      a. Printed performance curves.
      b. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Architect's digital data drawing files is otherwise permitted.
   1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
      a. Identification of products.
      b. Schedules.
      c. Compliance with specified standards.
      d. Notation of dimensions established by field measurement.
      e. Relationship and attachment to adjoining construction clearly indicated.
      f. Seal and signature of professional engineer if specified.

D. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

E. Certificates:
   1. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
   2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
   3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
   4. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
   5. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

F. Test Reports:

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1. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
2. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
3. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
4. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
5. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

G. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.

H. Warranty: Submit sample warranties as required in individual Specification Sections.

I. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

J. Coordination Drawing Submittals: Comply with requirements specified in Division 01 Section "Project Management and Coordination."

K. Delegated-Design Services Certification: Submit certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.
2. In addition, for a project in New Jersey, provide three paper copies of certificate, signed and sealed (with raised seal) by the responsible design professional.

2.03 NON-ELECTRONIC SUBMITTAL PROCEDURES

A. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:
   a. Generic description of Sample.
   b. Product name and name of manufacturer.
   c. Sample source.
   d. Number and title of applicable Specification Section.
3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available. Number of Samples: Submit three full sets of available choices where color, pattern, texture, or

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similar characteristics are required to be selected from manufacturer's product line. Architect will return one submittal with options selected.

5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
    a. Number of Samples: Submit three sets of Samples. Architect will return one set.
        1) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

B. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
    1. Name, address, and telephone number of entity performing subcontract or supplying products
    2. Number and title of related Specification Section(s) covered by subcontract.
    3. Submit subcontract list in the following format:
        a. Number of Copies: Four paper copies of subcontractor list, unless otherwise indicated. Architect will return one copy.

C. Key Personnel Names: No later than 15 days after date of Notice of Award, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site.
    1. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including emergency, office, and cellular telephone numbers and email addresses.
        a. Number of Copies: Four paper copies of key personnel list, unless otherwise indicated.

D. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."

E. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

2.04 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

B. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

PART 3 - EXECUTION

3.01 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Identify any deviations from Contract Document requirements. Mark cover sheet with approval before submitting to Architect.
    1. Sign and date statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.02 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval and will return them without action.

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B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will mark submittal appropriately to indicate action, as follows:
   1. Final Unrestricted Release: Where the submittal is marked "Approved," the Work covered by the submittal may proceed provided it complies with the Contract Documents. Final acceptance will depend on that compliance.
   2. Final-but-Restricted Release: Where the submittal is marked "Approved as Noted," the Work covered by the submittal may proceed provided it complies both with Architect's notations and corrections on the submittal and the Contract Documents. Final acceptance will depend on that compliance.
   3. Resubmit: Where the submittal is marked "Approved, Revise and Return Corrected Copies," the Work covered by the submittal may proceed provided it complies both with Architect's notations and corrections on the submittal and the Contract Documents. Revise submittal according to Architect's notations and corrections and return corrected copies. Final acceptance will depend on that compliance.
   4. Rejected: Where the submittal is marked "Rejected," do not proceed with the Work covered by the submittal. Prepare a new submittal for a product that complies with the Contract Documents.
   5. Incomplete - Resubmit: Where the submittal is marked "Incomplete, Submit Additional Information," do not proceed with the Work covered by the submittal. Prepare additional information requested, or required by the Contract Documents, that indicates compliance with requirements, and resubmit.

C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Limit information submitted to specific products indicated. Do not submit extraneous matter. Submittals containing excessive extraneous matter will be returned for resubmittal withou review.

F. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION

NOT FOR BIDDING

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. References and standards.

B. Testing and inspection agencies and services.

C. Control of installation.

D. Mock-ups.

E. Tolerances.

F. Defect Assessment.

1.02 REFERENCE STANDARDS

A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2014).

1.03 TESTING AND INSPECTION AGENCIES AND SERVICES

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. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

C. Architect will use accepted mock-ups as a comparison standard for the remaining Work.

D. 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.

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.

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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 DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

B. If, in the opinion of Architect, it is not practical to remove and replace the work, Architect will direct an appropriate remedy or adjust payment.

END OF SECTION

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SECTION 01 42 16

DEFINITIONS

PART 1 GENERAL

1.01 SUMMARY

A. Other definitions are included in individual specification sections.

1.02 DEFINITIONS

A. Furnish: To supply, deliver, unload, and inspect for damage.

B. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.

C. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.

D. Project Manual: The book-sized volume that includes the procurement requirements (if any), the contracting requirements, and the specifications.

E. Provide: To furnish and install.

F. Supply: Same as Furnish.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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SECTION 01 45 00

QUALITY CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control, including but not limited to the following:

1. Testing required of Contractors and Subcontractors.
2. General Contractor's quality control systems.
3. Manufacturer's field services.
4. Owner's Independent Testing Agency services.
5. General Contractor's Surveying Services.

1.2 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Mockups: Full size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on the project site, consisting of multiple products, assemblies and subassemblies.
2. Concrete Slab Mockup: Mockup of typical top of slab finish, see Specification 03 30 10.

D. Preconstruction Testing: Tests and inspections performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified in accordance with this Section to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

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H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

I. Installer/Applicator/Erector: Contractor, Subcontractor or another entity engaged by General Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade or trades.

J. Experienced: When used with an entity or individual, “experienced” means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.3 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.4 SUBMITTALS

A. Testing Agency Qualifications: (For testing agencies specified in Article 1.6 “Quality Assurance” to demonstrate their capabilities and experience.) Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.5 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.

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4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.6 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections may specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, complexity, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E329; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

1. Pre-Certified Testing Agencies: Continuing accreditation, in accordance with project requirements, as one of the following:

    a. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7 (United States Federal regulation/OSHA).
    b. NVLAP: A testing agency accredited according to National Institute of Standards and Technology's (NIST's) National Voluntary Laboratory Accreditation Program.

2. Certifications by Testing Agency:

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a. For each type of inspection and testing service to be performed, the Testing Agency shall submit certification, signed and sealed by the Agency's Professional Engineer, registered in the State where the testing service is to be performed, of compliance with all applicable requirements of the following:

1) ASTM E329, "Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction."

2) "Recommended Requirements for Independent Laboratory Qualifications" published by the American Council of Independent Laboratories.

b. The Testing Agency shall furnish evidence, satisfactory to the Architect and Structural Engineer, that all equipment to be used has been calibrated in accordance with applicable ASTM standards within the last year and is in proper working order.

c. Tests shall be made by an accredited testing agency with a minimum of 5 years experience in the specific type of testing to be performed. Except as otherwise provided, sampling and testing of all materials and the laboratory methods and testing equipment shall be in accordance with the latest standards and tentative methods of the American Society for Testing and Materials (ASTM).

G. Manufacturer’s Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer’s products that are similar in material, design, and extent to those indicated for this Project.

H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer’s products that are similar in material, design, and extent to those indicated for this Project.

I. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
2. Notify Architect fourteen (14) days in advance of dates and times when mockups will be constructed.
3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at the Project.
4. Demonstrate the proposed range of aesthetic effects and workmanship.
5. Obtain Architect’s approval of mockups before starting work, fabrication, or construction.

a. Allow seven (7) days for initial review and each re-review of each mockup.

6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
7. Demolish and remove mockups when directed, unless otherwise indicated.

J. Integrated Exterior Mockups: Construct integrated exterior mockup as indicated on Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.

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1.7 TESTING, GENERAL

A. The General Contractor shall provide such equipment and facilities as the Testing Agency may require for conducting field tests and for collecting and forwarding samples. The General Contractor shall not use any materials or equipment represented by samples until testing, if required, has been performed and the materials or equipment found to be acceptable. Any product which becomes unfit for use after acceptance shall not be incorporated into the work.

B. All materials or equipment proposed may be tested at any time during their preparation or use. The General Contractor shall furnish the required samples without charge and shall coordinate testing with the Architect, Engineer and Testing Agency to allow sufficient time for testing before placing orders or starting work. Products may be tested either prior to shipment or after being received at the Project site.

1.8 TESTING REQUIRED OF CONSTRUCTION TEAM

A. General Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are the General Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Unless otherwise indicated, provide quality-control services specified. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

    a. No member of the Construction Team shall employ the same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

B. Testing

1. General

    a. Material or Method Substitution: Any tests of basic material, fabrication equipment or method offered as a substitute for specified items or methods on which a test may be required in order to prove its compliance with the Specifications.
    b. Product Performance Verification: The Supplier of products specified based on performance criteria shall, at the request of the Architect, inspect the installed product and certify conformance of the product to specified criteria under the installed conditions.

2. See individual Sections for specific testing requirements.

3. Excavation Shoring Connections
    a. All welds shall be inspected as required herein.
    b. The Independent Testing Agency shall visually verify tieback stressing sequences and record value of initial and final stressing force.

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4. Masonry: Submit the following tests for each class of unit and type of masonry assemblage two weeks prior to start of construction. Prepare specimens and test in accordance with ACI 530.1/ASCE 6, Specification for Masonry Structures, latest edition, and standards cited therein.
   a. Current tests made on individual masonry units.
   b. Current mortar test including mortar proportions.
   c. Current grout test including grout proportions.
   d. Current prism test, if required by the Contract documents.
      1) Include mortar and grout proportions used in test specimens.
      2) Substantiate that each type of masonry assemblage meets or exceeds the required 28-day compressive strength (f'm).

C. Corrective measures: Corrective measures resulting from any test that fails shall be paid for by the installing contractor and shall be subject to the following conditions:

1. Quantity and nature of additional testing, if required, will be determined by the Architect/ Engineer.
2. All additional tests shall be taken in the presence of the Owner's representative.
3. Proof of noncompliance will make the installing contractor liable for any corrective action which the Architect/ Engineer feels is prudent, including complete removal and replacement of defective material.
4. Nothing contained herein is intended to imply that the installing contractor does not have the right to have tests performed on any material at any time for his own information and job control so long as the Owner does not assume responsibility for costs or for giving them consideration when appraising quality of materials.

1.9 CONTRACTOR'S QUALITY CONTROL SYSTEM

A. General: The General Contractor shall establish a quality control system and shall perform sufficient inspection and tests of all items of work, including that of his subcontractors, to ensure conformance to the Contract Documents for materials, workmanship, construction, finish, functional performance and identification. General Contractor's quality control system is the means by which he assures himself that his construction complies with the requirements of the Contract Documents. Controls shall be adequate to cover all construction operations.

B. Pre-Construction Conference

1. General Contractor shall schedule and conduct a pre-construction conference to review the items detailed below prior to commencement of the applicable portion of the work:

   a. Excavation bracing.
   b. Selective demolition.
   c. Foundations.
   d. Cast-in-place concrete.
   e. Precast Concrete.
   f. Masonry.
   g. Plumbing, HVAC and Electrical.
   h. Glazing.
   i. Elevators
   j. Roofing.
   k. Sitework.
   l. Painting.

2. The General Contractor shall require responsible representatives of each party concerned with that portion of the work to attend the conference, including but not limited

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to the following:
a. General Contractor's Superintendent and Project Manager
b. Materials supplier(s) or fabricator.
c. Installation Subcontractor(s).
d. Agency responsible for General Contractor-furnished testing.

3. Contractor shall have a copy of all approved Shop Drawings and Submittals applicable to the Work present at the pre-construction conference.
4. The Architect, responsible Engineer, Owner and Owner's Testing Agency shall be notified by the Contractor at least fifteen (15) working days prior to the scheduled date of each such conference. All conferences are to be scheduled in conjunction with the scheduled site visits being performed by the Architect/ Engineer or as approved by the Architect/ Engineer. Conferences shall be scheduled to accommodate multiple required pre-construction topics wherever possible and the proposed meetings to be scheduled on a given day are to be reviewed and approved by the Owner and the Architect.
5. Minutes of each conference shall be recorded by the General Contractor and shall be distributed by him in typed or printed form to each party in attendance within five (5) working days of the meeting. One copy of these minutes shall also be transmitted to the Owner and the Architect for information.

C. Records: General Contractor shall maintain accurate records of all inspections and tests performed, instructions received from the Architect, responsible Engineer or Testing Agency, and actions taken as a result of those instructions. These records shall include evidence that the required inspections or tests have been performed (including type and number of inspections or tests, nature of defects, causes for rejection, etc.), proposed or directed remedial action, and corrective action taken.

1.10 MANUFACTURER'S FIELD SERVICES

A. When specified in respective Specification Sections, Contractor shall require supplier or manufacturer to provide qualified personnel to observe field conditions, conditions of surfaces and installation, quality of workmanship, testing, and to make appropriate recommendations.

B. Manufacturer's representative shall submit written report to the Architect and responsible Engineer listing observations and recommendations.

1.11 OWNER'S INDEPENDENT TESTING AGENCY SERVICES

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish General Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to General Contractor.

B. General

1. The Owner will employ and pay for the services of an Independent Testing Agency to perform the following inspections, tests and other services. Services shall be performed in accordance with requirements of governing authorities and with specified standards.
   a. Contractor shall cooperate with Testing Agency personnel and shall furnish tools, samples of materials, design mixes, equipment, and assistance as requested.
   b. Contractor shall provide and maintain, for the sole use of the Testing Agency, adequate facilities for the safe storage and proper curing of concrete test cylinders

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on the project site for the first 24 hours after casting as required by ASTM C31, "Standard Practice for Making and Curing Concrete Test Specimens in the Field."

c. Contractor shall build and store masonry test prisms, as required, in a manner acceptable to the Testing Agency. Prisms to be tested shall remain at the job site until moved by Testing Agency personnel.

d. Contractor shall notify Testing Agency at least ten (10) working days in advance of any qualification testing for welding required herein.

e. Contractor shall notify Testing Agency at least 24 hours prior to expected time for operations requiring testing or inspection services.

f. Contractor shall make arrangements with the Testing Agency and pay for additional samples and tests made for the Contractor's convenience or for retesting of failed samples.

2. Retention of an independent Testing Agency by the Owner shall in no way relieve the Contractor of responsibility for performing all work in accordance with Contract requirements.

3. The Testing Agency inspector shall familiarize himself with all applicable portions of the Contract Documents pertaining to his area of investigation prior to performing his services.

4. Authorities and Duties of the Testing Agency

a. Attending Preconstruction Conferences: The Testing Agency shall obtain and review the Contract Drawings, Specifications, and approved shop drawings prior to the start of construction. The Testing Agency shall attend preconstruction conferences with the Architect, Engineer, Project Manager, General Contractor, and Material Suppliers as required to coordinate materials inspection and testing requirements with the planned construction schedule. The Testing Agency will participate in such conferences throughout the course of the project.

b. Cooperation with Design Team: The Testing Agency shall cooperate with the Architect, Engineer, and General Contractor and provide qualified personnel promptly on notice.

c. The Testing Agency shall perform the required inspections, sampling, and testing of materials as specified under each Section and observe methods of construction for compliance with the requirements of the Contract Documents.

d. Notification of Deficiencies in the Work: When deficiencies are discovered while on site, the Testing Agency shall notify the Contractor immediately of these deficiencies. The Testing Agency shall notify the Architect within 24 hours of discovery by telephone and then in writing of observed irregularities and deficiencies of the work and other conditions not in compliance with the requirements of the Contract Documents.

e. Reports

1) Paper Copies (if applicable): The Agency shall send certified copies of test and inspection reports to the following parties:
   a) 1 copy to the Owner
   b) 2 copies to the General Contractor
   c) 2 copies to the Architect/ Engineer
   d) 1 copy to the applicable Supplier or Subcontractor
   e) Other copies as directed

2) Electronic Copies: The Agency shall send certified copies of test and inspection reports to the following parties in electronic format (Word, Excel or pdf):
   a) 1 copy to the Owner
   b) 1 copy to the General Contractor
   c) 1 copy to the Architect/ Engineer
   d) 1 copy to the applicable Supplier or Subcontractor
   e) Other copies as directed

3) Handwritten field notes of all testing agencies representatives shall remain on file for a minimum of three years.

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f. Deficiency Log: The Testing Agency shall maintain a "Deficiency Log" listing each observed incident of non-compliant construction and non-compliant test results. This log shall indicate all steps taken to bring the construction to compliance with the Contract Documents or approvals given of non-compliant construction. No non-compliant construction incident shall be noted as closed until it has been made to comply with the Construction Documents or resolved by the Contractor to the satisfaction of the Architect.

g. Limitations of Authority: The Testing Agency is not authorized to revoke, alter, relax, enlarge upon, or release any requirements of the Specifications or to approve or accept any portion of the work or to perform any duties of the General Contractor and his Subcontractors.

C. Testing & Inspection

1. Drilled-In Inserts
   a. Self-Expanding Inserts: The Testing Agency shall inspect self-expanding, drilled-in inserts shown on the structural drawings as follows:
      1) Prior to installation, the Testing Agency shall determine that the installing contractor has the proper materials and equipment for drilling holes in the receiving surface of required diameter and length.
      2) All inserts shall be visually inspected during installation to ensure that they have been installed perpendicular to the receiving surface and to proper depth.
      3) Inspect 20% of all inserts at each structural level for a 'snug tight' condition. If at any time the number of rejectable inserts exceeds 10% of the number of inserts tested at that level, all inserts at that level shall be tested by the same method and this 100% testing rate shall be continued on all succeeding levels until 10% or less of the inserts tested at a level are found to be rejectable. Cost of additional testing required by this paragraph shall be borne by the installing contractor.
   b. Epoxy-Bonded Inserts: The Testing Agency shall inspect epoxy-bonded, drilled-in inserts as follows:
      1) The Testing Agency shall be present at the site to observe the installation of the first fifty (50) inserts placed. Such observation shall be to ensure that drilled holes are of required diameter and depth, holes are properly cleaned prior to installation of the insert, and that holes are completely filled with properly mixed epoxy after installation.
      2) All inserts shall be visually inspected after installation to ensure that the insert has been installed perpendicular to the receiving surface and to proper depth.
      3) Inspect 20% of all inserts at each structural level for a 'snug tight' condition. If at any time the number of rejectable inserts exceeds 10% of the number of inserts tested at that level, all inserts at that level shall be tested by the same method and this 100% testing rate shall be continued on all succeeding levels until 10% or less of the inserts tested at a level are found to be rejectable. Cost of additional testing required by this paragraph shall be borne by the installing contractor.

2. See individual Sections for specific testing and inspection requirements.
3. Soil Material and Soil Compaction
   a. The Testing Agency will prepare one optimum moisture-maximum density curve for each type of soil encountered in subgrades under paved areas or areas to receive compacted fill. Maximum densities are to be determined in accordance with ASTM D698 for all materials.
   b. Each type of borrow material will receive, as applicable:
      1) Mechanical analysis.

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2) Moisture-density curve determination.
3) Plasticity index determination.

c. Compacted fill and subgrades under compacted fill or paved areas shall be tested as follows:
1) The top 12 inches of subgrade resulting from excavation shall have the maximum density at optimum moisture specified under Section 31 20 01, Earthwork. Make at least one field density test of the subgrade for every 5000 sq. ft. of area, but in no case less than three (3) tests.
2) In each compacted fill layer, make one field density test for every overlaying 5000 sq. ft. of area, but in no case less than three (3) tests. Perform field density tests in accordance with ASTM D1556, ASTM D2167, or ASTM D2922.

4. Concrete Work
a. Concrete inspection and testing will be made in accordance with the governing building code requirements, and Contract Documents, and will include the following:
1) Inspection at the batching plant. Required only when no documentation exists of a similar inspection conducted by the appropriate agency of the state where work is to be performed or other authority having jurisdiction not earlier than 12 months prior to awarding the contract on the subject project.
2) Testing concrete for strength, slump, air content, temperature, and unit weight.
a) Testing for air content must be performed for every truckload of the structure concrete intended for above grade use or exposed to moisture and freeze-thaw cycles in service. (slab-on-grade and elevated field cast concrete structures).
3) Making and testing concrete cylinders and grout cubes, including furnishing cylinder containers for specimens.
4) Transporting and storing of all specimens involved in testing and inspection. Test concrete cylinders are to be initially cured and transported to laboratory in accordance with the requirements of ASTM C31. Follow ASTM C109 for curing and testing of grout cubes. Cube specimens shall be restrained from expansion as described in ASTM C942.
5) Inspection of mixing and placing of concrete at the site, including recording of: amount and location of concrete placement, truck number and amount of water added to each load of concrete tested, time batched, time of transit, time mixed on job, time placement was completed, method of placing concrete, concrete and air temperature at time of placement, and any other pertinent information.
6) Installing temperature sensors in cold weather as defined by ACI 306 and recording temperatures as maintained during the minimum required protection period. Provide a minimum of 1 temperature sensor per edge of concrete slab, mat or footing structure, and a minimum of 1 temperature sensor in one exterior column along each edge of the structure. Placement of sensors shall not coincide with those installed by the contractor for monitoring purposes.

b. Test Specimens
1) At least one set of four (4) cylinders for each fifty (50) cubic yards or fraction thereof of drilled pier (caisson) concrete, but not less than one set for each drilled pier requiring one or more truckloads of concrete or one set for each truck load when more than one drilled pier is cast from the same load.
2) At least one set of four (4) cylinders for each one hundred (100) cubic yards or fraction thereof of any concrete, but not less than one set of four (4) cylinders for each 5000 square feet of surface area for shear walls and slabs, and not less than one set for any one day's operation.

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a) For post-tensioned slab, a set shall consist of not less than six (6) cylinders for each one hundred (100) cubic yards of concrete.

3) For concrete placed by pumping, test specimens and concrete used for determination of slump, air content, and weight, are to be taken at the point of placement of concrete into the forms. Specimens may be taken at the pump provided an experimental correlation based on no less than ten (10) tests has been field established by the Testing Agency between the samples at the pump and the point of concrete placement. Sampling at the point of placement should continue on a periodic basis for random verification of consistency and established correlation.

4) Samples will be obtained in accordance with ASTM C172.

5) Making, curing and subsequent handling of concrete test cylinders, except as modified herein, shall be in accordance with ASTM C31. Testing shall be in accordance with ASTM C39. Curing and testing of grout cubes shall be in accordance with ASTM C109

6) The concrete cylinders shall be placed in laboratory storage in accordance with ASTM C31 and maintained therein until tested. Tests will be as follows:
   a) One (1) cylinder shall be tested at seven (7) days for information.
   b) Test two (2) – 6”x12” or three (3) – 4”x8” cylinders at twenty-eight (28) days for acceptance. The acceptance shall be based on the average of two or three tests respectively for different standard cylinder sizes. Acceptance of strength test results shall be based on the requirements of ACI 318 paragraph 5.6.3.3.
   c) A minimum of one (1) standard cylinder shall be held and not tested unless the 28-day average strength is below the specified strength or unless otherwise instructed by the Architect.

7) In-place concrete testing may be used when properly correlated with field-cured and standard-cured (ASTM C192) cylinder test results. This testing, if requested by the Contractor, shall be approved by the Architect in writing upon submitting a proposal and description, and paid for by the Contractor.

c. Test Reports: Reports of cylinder or cube tests shall be submitted as specified herein within five (5) days of laboratory testing. Test reports shall, as a minimum, include:

1) Project data including project name and address, concrete supplier, supplier’s delivery ticket number and mix identification number, Testing Agency’s test or cylinder identification number, and location of pour.

2) Results of field testing at time of sampling including but not limited to the following:
   a) Date and time of sampling;
   b) Location of the concrete placement with respect to elevation or level of the structure and proximity to major column lines;
   c) Method of concrete placement (bucketing, pumping, etc.);
   d) Amount of water, if any, added at site prior to sampling;
   e) Ambient air temperature and weather conditions;
   f) Concrete temperature, concrete slump and air content;
   g) Concrete wet unit weight for lightweight concrete only;
   h) Time concrete was batched and time when placement was finished;
   i) Specification limits for concrete temperature, slump, air content, and indication of conformance to the contract requirements.

3) Results of laboratory testing including date test specimens were transported to laboratory, date and age of concrete at time of testing, compressive strength of each cylinder tested, average compressive strength of tested cylinders, and specified design strength of concrete represented by the test.

4) Temperature record from the sensors installed in the freshly placed concrete under the cold weather as defined by ACI 306, at no longer than 12 hour increments.

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5) In the interest of the project record and response identification, it is strongly recommended that all non-compliant data be identified by easily distinguishable flags, i.e. colored paper, tags, etc.

d. Additional Testing: Contractor shall bear the cost of testing and inspection resulting as a consequence of the following:
   1) Work not in compliance with the Contract Documents.
   2) Testing requested by the Contractor or Subcontractor such as additional cylinders for early breaks, etc.
   3) Testing to verify the adequacy of work done without prior notice, without proper supervision, or contrary to standard construction practice.

e. Batch Plant Inspection: When documentation of a similar inspection conducted by the State where the project is to be constructed, or any other local authority having jurisdiction, dated no later than one year from the time of awarding the contract on the subject project, does not exist, concrete batching plant shall be inspected for conformance with contract requirements at the start of concrete work and thereafter as directed by the Architect.
   1) Such inspections shall include:
      a) Condition of equipment.
      b) Method of measurement of material quantities.
      c) Adequacy of methods for protection of stored materials.
      d) Verification of proper design mix proportions.
      e) Batching time.
      f) Type of materials used.
   2) Inspection Reports:
      a) Written reports of batch plant inspections shall be submitted as specified herein within one week.

f. Monitoring of Batch Plant Quality Control: The Testing Agency will maintain a continuous record for each class of concrete showing the results of each 28-day acceptance test, the moving coefficient of variation of the last 30 acceptance tests, and the moving average strength of the last three (3) acceptance tests. A current copy of each such record will be maintained at the job site and will be submitted to the Architect on a bi-weekly basis and within three (3) working days of the close of the reporting period. Coefficient of variation shall be computed in accordance with ACI 301 equation (4-1).

g. Reinforcing Steel
   1) Concrete reinforcing shall be inspected prior to closing of concrete formwork or placing of concrete. Inspect all reinforcing for conformance with contract requirements, including but not limited to size, spacing, placement, clear concrete cover, presence and condition of epoxy coating. Submit written reports of all inspections as specified herein on a weekly basis. Such reports shall include a description of each area inspected, deficiencies noted, and corrective action undertaken to resolve such deficiencies. Deficiencies observed shall immediately be brought to the attention of the Contractor's Field Superintendent and Reinforcing Placer's Foreman. In the event deficiencies are not corrected, or if an interpretation of the contract documents is required, the Architect shall be immediately notified.
   2) Where welding of reinforcing steel is permitted, the Testing Agency's inspector shall be present to observe welding procedures for compliance with applicable standards and shall perform such testing as he deems appropriate.
   3) In addition to the above, the Testing Agency shall verify compliance with bend radii of each shipment of mild steel rebar using properly bent and maintained samples of various rebar sizes.

5. Precast Concrete
   a. Refer to respective Section 03 41 00 of these specifications.
   b. Welding and Materials:

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1) Inspection of welding by the Testing Agency will be such as to assure that the work conforms to specified requirements, and will include:
   a) Ascertainment that electrodes used for manual shielded metal-arc welding and the electrodes and flux used for submerged arc welding conform to the requirements of AWS Code.
   b) Ascertainment that the approved welding procedure and the approved welding sequence are followed without deviation, unless specific approval for change is obtained from the Architect.
   c) Ascertainment that the welding is performed only by welding operators and welders who are properly certified. The Testing Agency shall witness such qualification testing of welding operators and welders, as may be required.
   d) Ascertainment that the fit-up, joint preparation, size, contour, extent of reinforcement, and length and location of welds conform to specified requirements and the contract drawings, and that no specified welds are omitted or unspecified welds added without approval of the Architect.
   e) Verify that quality of welds meet the requirements of paragraph 8.15, "Quality of Welds," AWS D1.1.

c. The Testing Agency shall test the field welds as follows:
   1) All welds, including wall and shoring connections: 100% visual.
   2) All full or partial penetration groove welds: 100% ultrasonic.
   3) Additional testing will be required of:
      a) If more than 10 percent of the ultrasonically inspected welds are rejected, then 100 percent of all such welds shall be ultrasonically tested after the repairs.
      b) All cost of additional inspection required by this paragraph shall be borne by the Contractor.
   4) In addition, if defective welds are discovered, the remaining uninspected welds shall receive such ultrasonic or magnetic particle inspection as may be required by the Architect.
   5) The welding inspector will have the authority to reject weldments. Such rejection may be based on visual inspection where in his opinion the weldment would not pass a more detailed investigation.
   6) Reports by the Testing Agency's inspector will contain, as a minimum, an adequate description of each weld tested. The report shall have the identifying mark of the welder responsible for the weld, a critique of any defects noted by visual inspection or testing, and a statement regarding the acceptability of the weld tested, as judged by current AWS standards. Reports shall be distributed as early as possible but not later than one (1) work week after the tests have been performed. The Architect shall be notified by phone if, in the judgment of the inspector, test results require immediate comment.
   7) Radiographic testing may be substituted for ultrasonic.

6. Bolted Connections: Visually inspect all bolted connections to ascertain that all bolts, nuts and required washers have been installed and are of proper type and that all faying surfaces have been brought into snug contact.

7. Tensioned High Strength Bolts

   a. Standard Bolts

      1) Inspect the bolt tightness of 10% of the bolts (minimum of 2), selected at random in each high strength bolted connection on the project. If rejectable bolts are found in any connection, all the remaining bolts in that connection

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shall be inspected for tightness. Inspection procedure shall be in accordance with "Specification for Structural Joints Using ASTM A325 or A490 Bolts" approved by Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation (Research Council on Structural Connections). Cost of additional inspection required by this paragraph shall be borne by the Contractor.

b. Tension Control (Self-Indicating) Bolts:

1) Inspect tightness of 10% (minimum of 2) of the bolts, selected at random in each high strength bolted connection on the project in accordance with the procedure specified for standard bolts, first paragraph.
2) Perform a visual inspection of all remaining high strength bolted connections to assure that all torque-off splines have been sheared.
3) When splines are not sheared, the Testing Agency shall determine that proper bolt tension has been achieved by the application of a properly calibrated testing torque or the Contractor may, at his option, remove and replace all bolts with unsheared splines. All cost of additional inspection required by this paragraph shall be borne by the Contractor.

8. Structural Masonry

a. Prepare test specimens when required by the Contract documents in accordance with the requirements of the governing building code.
b. Tests, consisting of three prisms each made in the field from materials currently in use, shall be conducted for each 5,000 square feet, or fraction thereof, of structural masonry throughout the course of construction. Not less than three such tests shall be conducted for the project.
c. Mortar and grout tests shall be conducted on materials used to construct the first set of three prisms above. In the event such tests fail to achieve the required strength, perform additional testing as required by the Structural Engineer.
d. The Owner's Testing Agency shall provide special inspection in accordance with the governing building code for the following work:
1) Special inspection shall be performed according to the schedule specified below for compliance with drawings and standards cited herein:
a) Observe preparation of all masonry prisms and preparation of all grout and mortar specimens.
b) For masonry constructed by low-lift grouting techniques, observe the following on a schedule of not less than two (2) times each day that masonry construction is in progress:

(1) Proportioning, mixing, and placing of mortar and grout.
(2) Placement of masonry units.
(3) Type, size and location of reinforcing, ties, and accessories.

c) For masonry constructed by high-lift grouting techniques:

(1) Observe the following on a schedule of not less than once each day that masonry construction is in progress:
(a) Proportioning, mixing and placing of mortar including provision for removal of mortar fins from inside of cells to be grouted.
(b) Placement of masonry units including size and location of clean-out openings.
(c) Type, size and location of joint reinforcing, ties and accessories.

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d) Immediately prior to the closing of clean-out openings for each section of masonry to be grouted, verify the following:
   (1) All cells to be grouted are free of obstructions (including mortar fins), which would inhibit proper placement and consolidation of grout.
   (2) Bottom of all cells to be grouted have been thoroughly cleaned of all loose mortar and debris.
   (3) Proper size, type and placement of all reinforcement in cells to be grouted including location and length of splices and provisions for maintaining proper position of reinforcing during grouting.

e) Continuously observe all grouting operations to verify proper slump, consolidation and reconsolidation of grout, proper height of each grout lift, and elapsed time between placement of successive lifts.

2) Daily reports of all special inspections shall be prepared and distributed as specified herein within 48 hours of the time the inspections were made. Provide other reports as required by the governing building code.

9. Structural Steel and Metal Fabrications

a. The Testing Agency's inspector will perform his duties in such a way that neither fabrication nor erection is unnecessarily delayed or impeded. In no case will the inspector recommend or prescribe the method of repair of a defect.

b. The shop inspection by the Testing Agency shall be for a minimum of 20% of the beams, struts and similar members. This shall include examination of steel for straightness and alignment, conformance to length tolerances, fissures, mill scale, and other defects and deformities, as described in ASTM A6, and examination of aforementioned fabricated pieces for conformity with approved shop drawings. Testing of welding will be performed as required herein.

c. Field inspection by the Testing Agency of erected steel will be such as to assure that the work conforms to specified requirements and will include:

   1) Inspection of field welding as required herein.
   2) Ascertainment of proper fit and alignment.
   3) Ascertainment of proper installation and tensioning of bolts.
   4) Ascertainment that Contractor's erection procedures adequately correct for distortion and shrinkage in field welded assemblies and connections. The Testing Agency shall measure weld shrinkage at all groove welds. Reports of such measurements shall be submitted to the Architect within two (2) days of completion of welding.

d. Welding and Materials:

   1) Inspection of welding by the Testing Agency will be such as to assure that the work conforms to specified requirements, and will include:

      a) Ascertainment that electrodes used for manual shielded metal-arc welding and the electrodes and flux used for submerged arc welding conform to the requirements of Section 05 12 00.

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b) Ascertainment that the approved welding procedure and the approved welding sequence are followed without deviation, unless specific approval for change is obtained from the Architect.
c) Ascertainment that the welding is performed only by welding operators and welders who are properly certified. The Testing Agency shall witness such qualification testing of welding operators and welders, as may be required.
d) Ascertainment that the fit-up, joint preparation, size, contour, extent of reinforcement, and length and location of welds conform to specified requirements and the contract drawings, and that no specified welds are omitted or unspecified welds added without approval of the Architect.
e) Verify that quality of welds meet the requirements of paragraph 8.15, “Quality of Welds,” AWS D1.1.

2) The Testing Agency shall perform tests in the Fabricator’s shop as follows:
a) All welds: 100% visual.
b) All full or partial penetration groove welded connections and splices: 100% ultrasonic. ASTM E164.
c) All other structural welds: 10% magnetic particle ASTM E709 (10% dye-penetrant for stainless steel ASTM E165).
d) Embedded plates and assemblies shall have all welded reinforcing tested by magnetic particle and all stud connectors tested as specified herein in the following quantities:

(1) Assemblies supporting structural elements: 100%.
(2) Assemblies supporting precast concrete or stone curtain wall elements: 60%.
(3) Assemblies supporting curtain wall elements: 20%

3) The Testing Agency shall test the field welds as follows:
a) All welds, including wall and shoring connections: 100% visual.
b) All full or partial penetration groove welds: 100% ultrasonic.
c) All other welds, including curtain wall and shoring connections: 10% magnetic particle (10% dye-penetrant for stainless steel).

4) Additional testing will be required of:

a) If more than 10 percent of the ultrasonically inspected welds are rejected, then 100 percent of all such welds shall be ultrasonically tested after the repairs.
b) All cost of additional inspection required by this paragraph shall be born by the Contractor.

5) In addition, if defective welds are discovered, the remaining uninspected welds shall receive such ultrasonic or magnetic particle inspection as may be required by the Architect.

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6) The welding inspector will have the authority to reject weldments. Such rejection may be based on visual inspection where in his opinion the weldment would not pass a more detailed investigation.
7) Reports by the Testing Agency's inspector will contain, as a minimum, an adequate description of each weld tested. The report shall have the identifying mark of the welder responsible for the weld, a critique of any defects noted by visual inspection or testing, and a statement regarding the acceptability of the weld tested, as judged by current AWS standards. Reports shall be distributed as early as possible but not later than one (1) work week after the tests have been performed. The Architect shall be notified by phone if, in the judgment of the inspector, test results require immediate comment.
8) Radiographic testing may be substituted for ultrasonic.

e. Bolted Connections: Visually inspect all bolted connections to ascertain that all bolts, nuts and required washers have been installed and are of proper type and that all faying surfaces have been brought into snug contact.

f. Tensioned High Strength Bolts

1) Standard Bolts

a) Inspect the bolt tightness of 10% of the bolts (minimum of 2), selected at random in each high strength bolted connection on the project. If rejectable bolts are found in any connection, all the remaining bolts in that connection shall be inspected for tightness. Inspection procedure shall be in accordance with "Specification for Structural Joints Using ASTM A325 or A490 Bolts" approved by Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation (Research Council on Structural Connections). Cost of additional inspection required by this paragraph shall be born by the Contractor.

2) Tension Control (Self-Indicating) Bolts:

a) Inspect tightness of 10% (minimum of 2) of the bolts, selected at random in each high strength bolted connection on the project in accordance with the procedure specified for standard bolts, first paragraph.
b) Perform a visual inspection of all remaining high strength bolted connections to assure that all torque-off splines have been sheared.
c) When splines are not sheared, the Testing Agency shall determine that proper bolt tension has been achieved by the application of a properly calibrated testing torque or the Contractor may, at his option, remove and replace all bolts with unsheared splines. All cost of additional inspection required by this paragraph shall be borne by the Contractor.

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10. Sitework: See Division 31 Sections on Field Quality Control Testing.

1.12 ADDITIONAL TESTING

A. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Contractor or Architect.

B. Contractor shall furnish additional testing upon the request of the Architect.

C. The following additional testing shall be performed at the expense of the Contractor outside of any testing allowance paid by the Owner:
1. Re-testing required because of non-conformance to specified requirements shall be paid for by General Contractor. Contractor shall pay for re-tests on failed original tests.
2. Additional testing required by the Architect to ensure compliance with specifications if material or installation is found not to comply with the Contract Documents.
3. Additional testing that the Contractor elects to do in order to expedite construction.

1.13 CORRECTIVE MEASURES

A. Corrective measures resulting from any test that fails shall be paid for by the installing contractor, including the time and expenses of the Architect or his representative spent in the conjunction with the design, inspection and/or witnessing tests, and shall be subject to the following conditions:

1. Quantity and nature of additional testing, if required, will be determined by the Architect/ Engineer.
2. All additional tests shall be performed in the presence of the Owner's representative.
3. Proof of non-compliance will make the installing contractor liable for any corrective action which the Architect / Engineer feels is prudent, including complete removal and replacement of defective material.
4. Nothing contained herein is intended to imply that the installing contractor does not have the right to have tests performed on any material at any time for his own information and job control, so long as the Owner does not assume responsibility for costs or for giving them consideration when appraising quality of materials.

1.14 CONTRACTOR'S SURVEYING SERVICES

A. Contractor to engage and pay for the services of a licensed surveyor for the purposes of locating the Work and documenting as-built locations of the Work as required by this section.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 GENERAL

A. Provide work of the specified quality; where quality level is not indicated, provide Work of quality customary in similar types of Work or as follows:
1. Where codes, laws or regulations required Work of higher quality or performance, provide Work complying with such codes, laws or regulations.
2. Where two (2) or more quality provisions of the Contract Documents conflict, comply with the most stringent requirement; where requirements are different but apparently equal, and where it is uncertain which requirement is more stringent, obtain clarification from the Architect before proceeding.
3. Actual quality may exceed the specified quality; verify that such differences are

NOT FOR BIDDING

acceptable to the Architect.

B. Perform all quality control activities specified unless indicated to be performed by other entities.

3.2 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Engineer/Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Engineer/Architect's reference during normal working hours.

3.3 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
2. Comply with the Contract Document requirements for Division 01 Section "Cutting and Patching."

B. Protect construction exposed by or for Quality Control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for Quality Control services.

3.4 GRADES, LINES AND LEVELS

A. Establish, maintain, and be responsible for grades, lines, levels and benchmarks.

B. Report to the Architect any discrepancy between the Contract Documents and the existing conditions. Do not proceed in areas of discrepancy until such discrepancies have been fully resolved.

3.5 SURVEYOR

A. Locating the Work: Surveyor engaged by the Contractor under this Specification Section shall verify that the following elements of the work have been furnished and installed in accordance with the Contract Documents:
1. Drilled Piers: Verify locations, elevations, dimensions and plumbness.
2. Strip Footings for Walls: Verify locations and dimensions of each footing including in-plan limits, thicknesses, and elevations.
3. Exterior Walls: Verify locations and plumbness.
4. Foundation Walls: Verify locations, elevations, dimensions and angles.

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B. Certification: Submit certification to the Architect for record, in the form of drawings signed by the Surveyor engaged by the Contractor under this Specification Section, stating that the Work has been accurately located relative to the property lines.

END OF SECTION

NOT FOR BIDDING

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary telecommunications services.

B. Temporary sanitary facilities.

C. Temporary Controls: Barriers, enclosures, and fencing.

D. Security requirements.

E. Vehicular access and parking.

F. Waste removal facilities and services.

1.02 TEMPORARY UTILITIES

A. Owner will provide the following:

1. Electrical power and metering, consisting of connection to existing facilities.
2. Water supply, consisting of connection to existing facilities.

1.03 TELECOMMUNICATIONS SERVICES

A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.

1.04 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Maintain daily in clean and sanitary condition.

1.05 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.06 FENCING

A. Construction: Commercial grade chain link fence.

B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.07 SECURITY

A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

B. Coordinate with Owner's security program.

1.08 VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

B. Coordinate access and haul routes with governing authorities and Owner.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

1.09 WASTE REMOVAL

A. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

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B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

C. Provide containers with lids. Remove trash from site weekly.

D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

NOT FOR BIDDING

SECTION 01 57 13

TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Prevention of erosion due to construction activities.

B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.

C. Restoration of areas eroded due to insufficient preventive measures.

D. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

1.02 REFERENCE STANDARDS

A. ASTM D4355/D4355M - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc-Type Apparatus; 2021.

B. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity; 1999a (Reapproved 2014).

C. ASTM D4533/D4533M - Standard Test Method for Trapezoid Tearing Strength of Geotextiles; 2015.

D. ASTM D4632/D4632M - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles; 2015a.

E. ASTM D4751 - Standard Test Methods for Determining Apparent Opening Size of a Geotextile; 2020.

F. ASTM D4873/D4873M - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples; 2017.

G. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit; Current Edition.

H. DNREC Sediment and Stormwater Regulations, Current Edition.

1.03 PERFORMANCE REQUIREMENTS

A. Comply with requirements of EPA (NPDES) for erosion and sedimentation control, as specified by the NPDES, for Phases I and II, and in compliance with requirements of Construction General Permit (CGP), whether the project is required by law to comply or not.

B. Also comply with all more stringent requirements of State of Delaware Erosion and Sedimentation Control Manual.

C. Coordinate and comply with owner's Certified Construction Reviewer (CCR) Inspector. Provide access as required for owner's CCR to perform inspections. Comply with deficiencies identified in report.

D. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.

E. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.

F. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.

1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
2. Anticipate runoff volume due to the most extreme short term and 24-hour rainfall events that might occur in 25 years.

G. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to

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construction activities for this project.

1. Control movement of sediment and soil from temporary stockpiles of soil.
2. Prevent development of ruts due to equipment and vehicular traffic.
3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

H. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
   1. Prevent windblown soil from leaving the project site.
   2. Prevent tracking of mud onto public roads outside site.
   3. Prevent mud and sediment from flowing onto sidewalks and pavements.
   4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

I. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
   1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.

J. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
   1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.

K. Open Water: Prevent standing water that could become stagnant.

L. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

M. Provide blue card certified CCR to be on site during all earth disturbing activities. Perform weekly self-inspection as required.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Erosion and Sedimentation Control Plan:
   1. Comply with requirements authorities having jurisdiction.

C. Certificate: Provide certificates for all erosion and sediment control devices.

PART 2 PRODUCTS

2.01 MATERIALS

A. Materials shall be in accordance with DNREC Specifications and the requirements of the Erosion and Sediment Control Handbook, current edition.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.02 PREPARATION

A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

3.03 SCOPE OF PREVENTIVE MEASURES

A. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.

B. Provide controls as shown on plans and as required by the engineer.

3.04 INSTALLATION

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Installation shall be in accordance with DNREC Erosion and Sediment Control Handbook and Manufacturer requirements.

3.05 MAINTENANCE

A. Inspect preventive measures weekly, within 24 hours after the end of any storm that produces 0.5 inches or more rainfall at the project site, and daily during prolonged rainfall.

B. Repair deficiencies immediately.

C. Clean out temporary sediment control structures weekly and relocate soil on site.

D. Place sediment in appropriate locations on site; do not remove from site.

3.06 CLEAN UP

A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Architect.

B. Clean out temporary sediment control structures that are to remain as permanent measures.

C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION

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SECTION 01 58 13
TEMPORARY PROJECT SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Project identification sign.

1.02 REFERENCE STANDARDS

A. FHWA (SHS) - Standard Highway Signs and Markings; 2004, with Supplement (2012).

1.03 QUALITY ASSURANCE

A. Design sign and structure to withstand 50 miles/hr wind velocity.

B. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawing: Show content, layout, lettering, color, sizes and grades of members.

PART 2 PRODUCTS

2.01 SIGN MATERIALS

A. Sign Surfaces: Exterior grade plywood with medium density overlay, minimum 3/4 inch thick, standard large sizes to minimize joints.

B. Rough Hardware: Galvanized.

C. Paint and Primers: Exterior quality, two coats; sign background of color as selected.

2.02 PROJECT IDENTIFICATION SIGN

A. One painted sign of construction, design, and content indicated on the attached drawing, location to be determined.

B. Graphic Design, Colors, Style of Lettering: Designated by Architect.

C. Lettering: Standard Alphabet Series C, as specified in FHWA (SHS).

PART 3 EXECUTION

3.01 INSTALLATION

A. Install sign surface plumb and level, with butt joints. Anchor securely.

3.02 MAINTENANCE

A. Maintain signs and supports clean, repair deterioration and damage.

3.03 REMOVAL

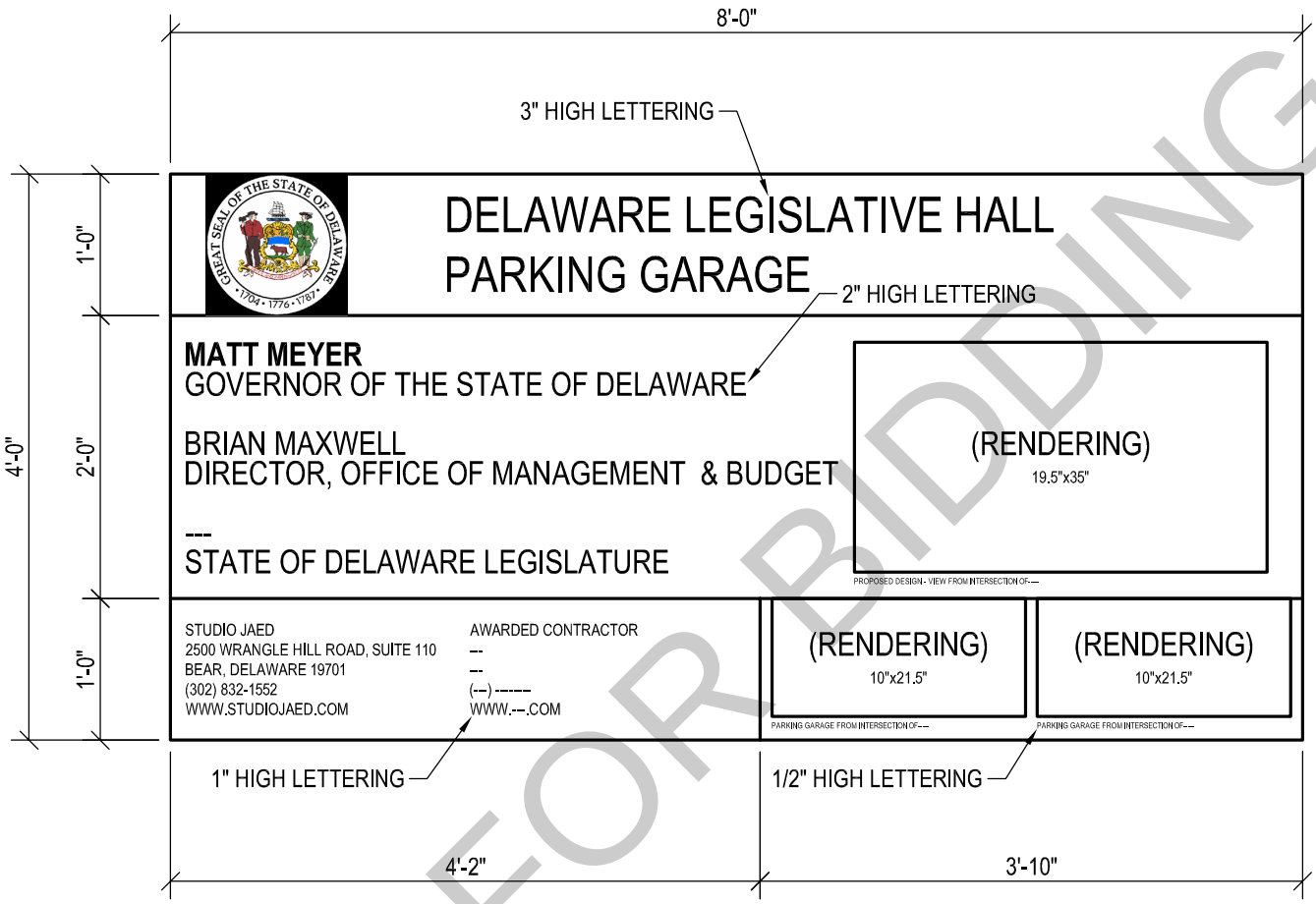
A. Remove signs, framing, supports, and foundations at completion of Project and restore the area.

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MAY 01, 2025 DATE	A-1 SHEET NO.	PROJECT: STATE OF DELAWARE OMB / DIVISION OF FACILITIES MANAGEMENT OMB / DFM CONTRACT #MJ1002000071 LEGISLATIVE HALL PARKING GARAGE MARTIN LUTHER KING JR BLVD AND E. WATER ST. DOVER, DE 19901	STUDIO JAED	REVISIONS: 1 ADDEN OR BUL. #
23094 PROJECT NO.	SIGN			

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SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Transportation, handling, storage and protection.

C. Product option requirements.

D. Substitution limitations.

E. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Section 01 40 00 - Quality Requirements: Product quality monitoring.

B. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.

C. Section 01 74 19 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.03 REFERENCE STANDARDS

A. NEMA MG 1 - Motors and Generators; 2017.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

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 Agreement.
   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.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.

B. Where other criteria are met, Contractor shall give preference to products that:
   1. If used on interior, have lower emissions, as defined in Section 01 61 16 - Volatile Orgranic Compound (VOC) Content Restrictions.
   2. If wet-applied, have lower VOC content, as defined in Section 01 61 16 - Volatile Orgranic Compound (VOC) Content Restrictions.

C. Motors: Refer to Section 22 05 13 - Common Motor Requirements for Plumbing Equipment, NEMA MG 1 Type. Specific motor type is specified in individual specification sections.

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2.02 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.

2.03 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 PROCEDURES

A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.

B. Document each request with complete data substantiating compliance of proposed substitution with

C. A request for substitution 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.
   2. Will provide the same warranty for the substitution as for the specified product.
   3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.

D. Substitution Submittal Procedure:
   1. Submit three copies of request for substitution for consideration, with one sent directly to the Owner. Limit each request to one proposed substitution.
   2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
   3. The Architect will notify Contractor in writing of decision to accept or reject request.
   4. Owner retains right to final approval of all substitution requests.

3.02 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.

NOT FOR BIDDING

3.03 STORAGE AND PROTECTION

A. 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 01 74 19 - Construction Waste Management and Disposal.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

G. Comply with manufacturer's warranty conditions, if any.

H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

I. Prevent contact with material that may cause corrosion, discoloration, or staining.

J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

K. 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

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SECTION 01 61 16
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.

D. VOC restrictions for product categories listed below under "DEFINITIONS."

E. All products of each category that are installed in the project must comply; Owner's project goals do not allow for partial compliance.

1.02 RELATED REQUIREMENTS

A. Section 01 30 00 - Administrative Requirements: Submittal procedures.

1.03 DEFINITIONS

A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:

B. VOC-Content-Restricted Products: All products in the following product categories when installed or applied on-site in the building interior:
   1. Adhersives, sealants, and sealer coatings.
   2. Paints and coatings.

C. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.

D. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.

E. 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.
   6. Solid wood flooring that is unfinished and untreated.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Evidence of Compliance: Submit for each different product in each applicable category.

C. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance, except when another type of evidence of compliance is required.

D. Installer Certifications for Accessory Materials: 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.

PART 2 PRODUCTS

2.01 MATERIALS

A. All VOC-Restricted Products: Provide products having VOC content of types and volume not greater than those specified in State of California Department of Health Services Standard Practice for the Testing of Volatile Organic Emissions From Various Sources Using Small-Scale Environmental Chambers.

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1. Evidence of Compliance: Acceptable types of evidence are:
   a. Current GREENGUARD Children & Schools certification; www.greenguard.org.
   b. Current SCS Indoor Advantage Gold certification; www.scscertified.com.
2. Product data submittals showing VOC content are NOT acceptable forms of evidence.

B. Adhesives and Joint Sealants: Provide only products having volatile organic compound (VOC) content not greater than required by South Coast Air Quality Management District Rule No.1168.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Report of laboratory testing performed in accordance with requirements.

C. Aerosol Adhesives: Provide only products having volatile organic compound (VOC) content not greater than required by GreenSeal GS-36.
   1. Evidence of Compliance: Acceptable types of evidence are:
      a. Current GreenSeal Certification.

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

NOT FOR BIDDING

SECTION 01 70 00
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances..

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, except payment procedures.

I. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 01 30 00 - Administrative Requirements: Submittals procedures, Electronic document submittal service.

C. Section 01 40 00 - Quality Requirements: Testing and inspection procedures.

D. Section 01 50 00 - Temporary Facilities and Controls: Temporary exterior enclosures.

E. Section 01 78 00 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.

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 01 30 00 - Administrative Requirements, for submittal procedures.

B. 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 field engineering and delegated design, 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.

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. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

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E. 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.

F. 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.

G. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
   1. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.

H. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

I. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

J. 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. 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.

B. Notify affected utility companies and comply with their requirements.

C. 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.

D. 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.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

G. 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 01 60 00 - 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.

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.

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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.

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 LAYING OUT THE WORK

A. Promptly notify Architect of any discrepancies discovered.

B. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Grid or axis for structures.
   2. Building foundation, column locations, and ground floor elevations.

C. Periodically verify layouts by same means.

3.04 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.

3.05 ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00 - Temporary Facilities and Controls.

C. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.
   2. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
   3. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.

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1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
    a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
    b. Provide temporary connections as required to maintain existing systems in service.
4. Verify that abandoned services serve only abandoned facilities.
5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

E. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.

F. Adapt existing work to fit new work: Make as neat and smooth transition as possible.

G. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

H. Refinish existing surfaces as indicated:
1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

I. Clean existing systems and equipment.

J. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

K. Do not begin new construction in alterations areas before demolition is complete.

L. Comply with all other applicable requirements of this section.

3.06 CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. 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.

D. 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.

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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 07 84 00 - Firestopping, 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.
   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. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically 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. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.09 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. 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.

C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

D. Verify that wiring and support components for equipment are complete and tested.

E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

F. 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.

NOT FOR BIDDING

G. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.10 DEMONSTRATION AND INSTRUCTION

A. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.

B. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of Owner's personnel.

3.11 ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

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.

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, and downspouts.

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. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.

C. Submit written certification 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 review.

D. Correct items of work listed in executed Certificates of Substantial Completion and comply with requirements for access to Owner-occupied areas.

E. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

F. 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.

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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 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes: Administrative and procedural requirements for construction waste management activities.

1.2 DEFINITIONS

A. Construction, Demolition, and Land clearing (CDL) Waste: Includes all non-hazardous solid wastes resulting from construction, remodeling, alterations, repair, demolition and land clearing. Includes material that is recycled, reused, salvaged or disposed as garbage.

B. Salvage: Recovery of materials for on-site reuse, sale or donation to a third party.

C. Reuse: Making use of a material without altering its form. Materials can be reused on-site or reused on other projects off-site. Examples include, but are not limited to the following: Crushing or grinding of concrete for use as sub-base material. Chipping of land clearing debris for use as mulch.

D. Recycling: The process of sorting, cleaning, treating, and reconstituting materials for the purpose of using the material in the manufacture of a new product.

E. Source-Separated CDL Recycling: The process of separating recyclable materials in separate containers as they are generated on the job-site. The separated materials are hauled directly to a recycling facility or transfer station.

F. Co-mingled CDL Recycling: The process of collecting mixed recyclable materials in one container on-site. The container is taken to a material recovery facility where materials are separated for recycling.

G. Approved Recycling Facility: Any of the following:

1. A facility that can legally accept CDL waste materials for the purpose of processing the materials into an altered form for the manufacture of a new product.

2. Material Recovery Facility: A general term used to describe a waste-sorting facility. Mechanical, hand-separation, or a combination of both procedures, are used to recover recyclable materials.

H. Universal waste components (UWC) are as follows: electric motors, PCB ballasts, non PCB ballasts, capacitors, contactors, circuit breakers, elemental and liquid mercury containing articles, transformers, lead acid batteries, fluorescent light bulbs, and all HID light bulbs.

1.3 SUBMITTALS

A. Contractor shall develop a Waste Management Plan: Submit 3 copies of plan within 14 days of date established for the **Notice to Proceed**.

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B. Contractor shall provide Waste Management Report: Concurrent with each Application for Payment, submit **3** copies of report.

1.4 PERFORMANCE REQUIREMENTS

A. General: Divert a minimum of **75%** CDL waste, by weight, from the landfill by one, or a combination of the following activities:

1. Salvage
2. Reuse
3. Source-Separated CDL Recycling
4. Co-mingled CDL Recycling

B. CDL waste materials that can be salvaged, reused or recycled include, but are not limited to, the following:

1. Acoustical ceiling tiles
2. Asphalt
3. Asphalt shingles
4. Cardboard packaging
5. Carpet and carpet pad
6. Concrete
7. Drywall
8. Fluorescent lights and ballasts
9. Land clearing debris (vegetation, stumpage, dirt)
10. Metals
11. Paint (through hazardous waste outlets)
12. Wood
13. Plastic film (sheeting, shrink wrap, packaging)
14. Window glass
15. Wood
16. Field office waste, including office paper, aluminum cans, glass, plastic, and office cardboard.

1.5 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of projects with similar requirements, that employs a LEED Accredited Professional, certified by the USGBC as waste management coordinator.

B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

C. Regulatory Requirements: Conduct construction waste management activities in accordance with hauling and disposal regulations of all authorities having jurisdiction and all other applicable laws and ordinances.

D. Preconstruction Conference: Schedule and conduct meeting at Project site prior to construction activities.

1. Attendees: Inform the following individuals, whose presence is required, of date and time of meeting.

a. Owner
b. Architect

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c. Contractor's superintendent
d. Major subcontractors
e. Waste Management Coordinator
f. Other concerned parties.

2. Agenda Items: Review methods and procedures related to waste management including, but not limited to, the following:

a. Review and discuss waste management plan including responsibilities of Waste Management Coordinator.
b. Review requirements for documenting quantities of each type of waste and its disposition.
c. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
d. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
e. Review waste management requirements for each trade.

3. Minutes: Record discussion. Distribute meeting minutes to all participants.
Note: If there is a Project Architect, they will perform this role.

1.6 WASTE MANAGEMENT PLAN – Contactor shall develop and document the following:

A. Develop a plan to meet the requirements listed in this section at a minimum. Plan shall consist of waste identification, waste reduction plan and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight throughout the plan.

B. Indicate anticipated types and quantities of demolition, site-cleaning and construction waste generated by the project. List all assumptions made for the quantities estimates.

C. List each type of waste and whether it will be salvaged, recycled, or disposed of in an landfill. The plan should included the following information:

1. Types and estimated quantities, by weight, of CDL waste expected to be generated during demolition and construction.

2. Proposed methods for CDL waste salvage, reuse, recycling and disposal during demolition including, but not limited to, one or more of the following:

a. Contracting with a deconstruction specialist to salvage materials generated,
b. Selective salvage as part of demolition contractor’s work,
c. Reuse of materials on-site or sale or donation to a third party.

3. Proposed methods for salvage, reuse, recycling and disposal during construction including, but not limited to, one or more of the following:

a. Requiring subcontractors to take their CDL waste to a recycling facility;
b. Contracting with a recycling hauler to haul recyclable CDL waste to an approved recycling or material recovery facility;
c. Processing and reusing materials on-site;
d. Self-hauling to a recycling or material recovery facility.

4. Name of recycling or material recovery facility receiving the CDL wastes.

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5. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on project site where materials separation will be located.

D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:

1. Total quantity of waste.
2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
3. Total cost of disposal (with no waste management).
4. Revenue from salvaged materials.
5. Revenue from recycled materials.
6. Savings in hauling and tipping fees by donating materials.
7. Savings in hauling and tipping fees that are avoided.
8. Handling and transportation costs. Including cost of collection containers for each type of waste.
9. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS (Not Used)

PART 3 – EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT, GENERAL

A. Provide containers for CDL waste that is to be recycled clearly labeled as such with a list of acceptable and unacceptable materials. The list of acceptable materials must be the same as the materials recycled at the receiving material recovery facility or recycling processor.

B. The collection containers for recyclable CDL waste must contain no more than 10% non-recyclable material, by volume.

C. Provide containers for CDL waste that is disposed in a landfill clearly labeled as such.

D. Use detailed material estimates to reduce risk of unplanned and potentially wasteful cuts.

E. To the greatest extent possible, include in material purchasing agreements a waste reduction provision requesting that materials and equipment be delivered in packaging made of recyclable material, that they reduce the amount of packaging, that packaging be taken back for reuse or recycling, and to take back all unused product. Insure that subcontractors require the same provisions in their purchase agreements.

F. Conduct regular visual inspections of dumpsters and recycling bins to remove contaminants.

3.2 SOURCE SEPARATION

A. General: Contractor shall separate recyclable materials from CDL waste to the maximum extent possible.

Separate recyclable materials by type.

1. Provide containers, clearly labeled, by type of separated materials or provide other storage method for managing recyclable materials until they are removed from Project site.

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2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water and to minimize pest attraction. Cover to prevent windblown dust.
3. Stockpile materials away from demolition area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from weather.

3.3 CO-MINGLED RECYCLING

A. General: Do not put CDL waste that will be disposed in a landfill into a co-mingled CDL waste recycling container.

3.4 REMOVAL OF CONSTRUCTION WASTE MATERIALS

A. Remove CDL waste materials from project site on a regular basis. Do not allow CDL waste to accumulate on-site.

B. Transport CDL waste materials off Owner's property and legally dispose of them.

C. Burning of CDL waste is not permitted.

3.5 UNIVERSAL WASTE DIVERSION

A. Remove all universal waste from fixtures, panels, and related devices for proper diversion and reclamation.

B. Store all universal waste in containers provided by contact person within facilities operations.

C. Store all universal waste in a secured location and request periodic removal from assigned contact person.

D. Exemption: electric motors, circuit breakers, transformers and lighting contactors are exempt from this provision provided the contractor chooses to salvage or reuse the components.

E. No identified universal waste will be discarded into the waste stream.

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WASTE MANAGEMENT PROGRESS REPORT				
	DISPOSED IN MUNICIPAL SOLID WASTE LANDFILL	**DIVERTED FROM LANDFILL BY RECYCLING, SALVAGE OR REUSE**		
MATERIAL CATEGORY		Recycled	Salvaged	Reused
1. Acoustical Ceiling Tiles				
2. Asphalt				
3. Asphalt Shingles				
4. Cardboard Packaging				
5. Carpet and Carpet Pad				
6. Concrete				
7. Drywall				
8. Fluorescent Lights and Ballasts				
9. Land Clearing Debris (vegetation, stumpage, dirt)				
10. Metals				
11. Paint (through hazardous waste outlets)				
12. Wood				
13. Plastic Film (sheeting, shrink wrap, packaging)				
14. Window Glass				
15. Field Office Waste (office paper, aluminum cans, glass, plastic, and coffee cardboard)				
16. Other (insert description)				
17. Other (insert description)				
Total (In Weight)		(TOTAL OF ALL ABOVE VALUES – IN WEIGHT)		
		Percentage of Waste Diverted	(TOTAL WASTE DIVIDED BY TOTAL DIVERTED)	

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SECTION 01 78 00
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 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Section 01 70 00 - 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. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
   2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   3. 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.
   4. 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.

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E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Field changes of dimension and detail.
   2. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. 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.

D. 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 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. Additional Requirements: As specified in individual product specification sections.

3.04 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. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

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D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

F. 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.

G. 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.

H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.

I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

J. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Maintenance instructions for equipment and systems.
   3. Part 3: Project documents and certificates, including the following:
      a. Shop drawings and product data.
      b. Air and water balance reports.
      c. Certificates.
      d. Photocopies of warranties and bonds.

3.05 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. Include originals of each in operation and maintenance manuals, indexed separately on Table of Contents.

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SECTION 02 41 00
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Selective demolition of built site elements.

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Limitations on Contractor's use of site and premises.

B. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

C. Section 01 60 00 - Product Requirements: Handling and storage of items removed for salvage and relocation.

D. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

E. Section 01 74 19 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

F. Section 31 10 00 - Site Clearing: Vegetation and existing debris removal; earth stripping and stockpiling.

1.03 DEFINITIONS

A. Demolition: Dismantle, raze, destroy or wreck any building or structure or any part thereof.

B. Remove: Detach or dismantle items from existing construction and dispose of them off site, unless items are indicated to be salvaged or reinstalled.

C. Remove and Salvage: Detach or dismantle items from existing construction in a manner to prevent damage. Clean, package, label and deliver salvaged items to Owner in ready-for-reuse condition.

D. Remove and Reinstall: Detach or dismantle items from existing construction in a manner to prevent damage. Clean and prepare for reuse and reinstall where indicated.

E. Existing to Remain: Designation for existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.04 REFERENCE STANDARDS

A. 29 CFR 1926 - Safety and Health Regulations for Construction; Current Edition.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022, with Errata (2021).

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Site Plan: Indicate:
   1. Vegetation to be protected.
   2. Areas for temporary construction and field offices.
   3. Areas for temporary and permanent placement of removed materials.

C. 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 31 20 00 - Earth Moving.

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PART 3 EXECUTION

3.01 DEMOLITION

A. Remove paving and curbs required to accomplish new work.

B. Remove all other paving and curbs as indicated on drawings.

C. Remove manholes and manhole covers, curb inlets and catch basins.

D. Remove other items indicated, for salvage, relocation, and recycling.

E. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Section 31 20 00 - Earth Moving.

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. 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.

E. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

3.03 EXISTING UTILITIES

A. Coordinate work with utility companies. Notify utilities before starting work, comply with their requirements, and obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. 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.

E. 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.

F. 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.

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G. 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. Remove materials not to be reused on site; comply with requirements of Section 01 74 19 - Waste Management.

C. Leave site in clean condition, ready for subsequent work.

D. Clean up spillage and wind-blown debris from public and private lands.

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SECTION 03 10 00

CONCRETE FORMWORK

PART 1 - GENERAL

1.1 SUMMARY

A. The extent of work included in this Section is shown on the Drawings and is specified as follows:

1. All labor, materials, equipment, services and accessories necessary to the furnishing and installation of formwork for cast-in-place concrete, complete and functional.
2. Shoring and reshoring for cast-in-place concrete, bracing of formwork when necessary, and installation into formwork of items such as anchor bolts, setting plates, bearing plates, anchorages, inserts and other items to be embedded in concrete.

1.2 SUBMITTALS

A. Manufacturer's Data:
1. Submit for Architect’s record manufacturer's data and installation instructions for materials including form coatings, manufactured form systems, ties and accessories.

B. Shop Drawings:
1. Design of formwork & shoring for structural stability, strength and sufficiency to carry all applicable loads is the Contractor’s responsibility. All Contractor’s shop drawings for fabrication and erection of formwork shall bear an appropriate seal and signature of a professional engineer licensed to practice in the state where Work is to be performed.
2. Submit shop drawings for fabrication and erection of formwork for finished concrete surfaces to the Architect for record only. Shop drawings showing contractor’s interpretation of the contract requirements regarding locations and types of surfaces and top/bottom elevations shall be submitted to the Architect for review and approval. Show general construction of forms including jointing, special formed joints for reveals, location and pattern of form tie placement, and other items, which affect the exposed concrete visually.
3. Architect’s review of shop drawings is for general architectural applications and features only.

1.3 QUALITY ASSURANCE

A. Reference Standards: Comply with the following standards, latest edition, except where more stringent requirements are shown or specified.
1. American Concrete Institute (ACI), ACI 347: Recommended Practice for Concrete Formwork.
2. American Concrete Institute (ACI), ACI 117: Standard Specifications for Tolerances for Concrete Construction and Materials.
3. American Concrete Institute (ACI), ACI 301: Specifications for Structural Concrete.
4. National Institute of Standards and Technology: Voluntary Product Standard PS-1 – Latest Edition.

B. Allowable Tolerances:

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1. Construction formwork to provide completed cast-in-place concrete structures complying with the tolerances specified in ACI 117, and as recommended by ACI 347 and ACI 301.

    a. For concrete that is to be exposed and in view of the public including public or private streets, alley right of ways and including the interior of the garage area, formwork tolerances are to be Class B.
    b. For concrete that is to be covered by architectural precast concrete and/or masonry, and structural panels that will be hidden from public view, formwork tolerances are to be Class C.

2. Before concrete placement check the lines and levels of erected formwork. Make corrections and adjustments to ensure proper size and locations of concrete members and stability of forming systems.
3. During concrete placement check formwork and related supports to ensure that forms are not displaced and that completed work will be within specified tolerances.
4. Make provisions to compensate for shrinkage and post-tensioning process in order to maintain formwork tolerances.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Forms for Exposed Finish Concrete:

1. Unless otherwise shown or specified, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood-faced or other panel type materials acceptable to Architect, to provide continuous, straight, smooth as-cast surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.

    a. Plywood: Use overlaid plywood complying with PS 1, B-B High Density Concrete Form Overlay, Class I.

B. Forms for Concrete Not Exposed:

1. Form concrete surfaces, which will not be exposed in the finished structure with plywood, lumber, metal, or other acceptable material. Use lumber that is dressed on at least 2 edges and 1 side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Form Ties

1. Use factory-fabricated, adjustable-length, removable or snapoff metal or fiber reinforced plastic form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.

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2. Unless otherwise shown, use ties so that portion remaining within concrete after removal of exterior parts is at least 1 inch from the outer concrete surface. Unless otherwise shown, use form ties, which will not leave a hole larger than 1-inch diameter in the concrete surface.
3. For exposed finish concrete, use plastic cones and coil ties. All cone holes shall be plugged with plastic plugs set in a bed of sealant as approved by the Architect.

E. Nails and similar forming accessories, if to be left cast in concrete, shall be stainless steel.

F. Reglets: Fabricate of galvanized sheet steel not thinner than 26 gage. Opening at the face of reglet shall be temporarily covered or filled with removable material to prevent intrusion of concrete or debris.

G. Dovetail Anchor Slots: Fabricate of galvanized sheet steel not thinner than 22 gage. Opening at the slot exterior shall be temporarily covered or filled with removable material to prevent intrusion of concrete or debris.

H. Form Coating:

1. Use commercial formulation form-coating compounds with a maximum VOC of 350 grams per liter that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds.

    a. Provide a release agent equal to Nox-Crete "Form Coating".

I. Metal Inserts:

1. Use galvanized metal insets for anchorage of materials or equipment to concrete construction as required for the work.
2. Use galvanized threaded inserts for thin slabs, furnished complete with full-depth bolts; 3/4-inch bolt size, unless otherwise shown. Provide inserts manufactured by Dayton/Richmond Concrete Accessories or approved equal.

2.2 DESIGN OF FORMWORK

A. Formwork and formwork systems shall be designed by a Professional Engineer employed by the Contractor. The Professional Engineer shall be registered in the state where the work is to be performed. The Contractor shall submit written certification indicating conformance with this requirement.

B. Design, erect, support, brace and maintain formwork in accordance with ACI 301 and following recommendations of ACI 347, as modified herein. Forms shall be capable of safely supporting vertical and lateral loads that might be applied, until such loads can be supported by the concrete structure. Carry vertical and lateral loads to ground by formwork system and in-place construction that has attained adequate strength and stiffness for that purpose.
1. Construct formwork so that concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
2. Monitor position of formwork in place before, during, and after concrete placement.

C. Support form facing materials by structural members spaced sufficiently close to prevent deflection. Fit forms placed in successive units for continuous surfaces to accurate alignment, free from irregularities and within allowable tolerances.

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D. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.

E. Use shores and struts with positive means of adjustment capable of taking up formwork settlement during concrete placing operations, using wedges or jacks or a combination thereof. Use trussed supports when adequate foundations for shores and struts cannot be secured.

F. Formwork for Grade Beams and Footings: Side forms are required for all footings and grade beams.

G. Formwork design for post-tensioned structures shall consider the stressing sequence and its effect on the loading of forms (and shores/re-shores) during construction.

H. The contractor's formwork designer shall pay special attention to the transfer girders and stage stressing if any, with respect to the actual loads imposed on the formwork sequentially during construction.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the conditions under which concrete formwork is to be erected. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 FORM CONSTRUCTION

A. Construct forms to be the exact sizes, shapes, lines and dimensions shown, and as required to obtain accurate alignment, location, grades, levels, and plumb work in finish structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustifications, reglets, chamfers, blocking screeds, bulkheads, anchorages and inserts, and other features required. Use selected materials to obtain required finishes.

B. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Use crush plates or wrecking plates where stripping may damage cast concrete surfaces. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and assure ease of removal.

C. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Brace temporary closures and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms in as inconspicuous location as possible; consistent with project requirements.

D. Construct formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins.

E. Falsework:
   1. Erect falsework and support, brace and maintain it to safely support vertical, lateral and asymmetrical loads applied until such loads can be supported by in-place concrete structures. Construct falsework so that adjustments can be made for take-up and settlement.
   2. Use wedges, jacks or camber strips to facilitate vertical adjustments. Carefully inspect falsework and formwork during and after concrete placement operations to determine

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abnormal deflection or signs of failure; make necessary adjustments to produce work of required dimensions.

F. Forms for Exposed Concrete:
1. Drill forms to suit ties used and to prevent leakage of concrete mortar around tie holes. Do not splinter forms by driving ties through improperly prepared holes.
2. Do not use metal cover plates for patching holes or defects in forms.
3. Provide chamfered corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, intersections.
4. Use extra studs, walers and bracing to prevent bowing of forms between studs and to avoid bowed appearance in concrete.
5. Place ties and spreaders symmetrically in plumb tiers and level rows.
6. Place pouring strips in the forms wherever horizontal construction joints are made.
7. Assemble forms so they may be readily removed without damage to exposed concrete surfaces.
8. Form molding shapes, recesses and projections with smooth-finish materials, and install In forms with sealed joints to prevent displacement.

G. Corner Treatment:
1. Form exposed corners to produce smooth, solid, unbroken lines, except as otherwise shown.
2. Form chamfers with 3/4 inch x 3/4-inch strips unless otherwise noted. Extend terminal edges to required limit and miter chamfer strips at changes in direction.
3. Unexposed corners may be formed either square or chamfered.

H. Edge Forms and Screed Strips for Slabs:

1. Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in the finished slab surface. Provide and secure units to support types of screeds required.

I. Provision for Other Trades:
1. Provide openings in concrete formwork to accommodate work of others. Accurately place and securely support items to be built into forms.

J. Cleaning and Tightening:
1. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is to be placed. Retighten forms immediately after concrete placement as required to eliminate mortar leaks.

3.3 FORM COATINGS

A. Prior to each concrete pour, treat form surfaces with a suitable release agent. Do not allow excess material to accumulate in the forms or to come into contact with surfaces which will be bonded to fresh concrete.

3.4 INSTALLATION OF EMBEDDED ITEMS

A. General: Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of the items to be attached thereto.

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B. Missed or improperly installed embedded items constitute construction deficiencies and must be repaired as directed by the Architect or the embedded item fabricator/supplier and approved by the Architect. Cost of these repairs shall be the responsibility of the contractor.

3.5 SHORES AND RESHORES

A. Shoring and Re-shoring Design: The Contractor shall assume all responsibility for the safety of shoring and re-shoring and shall provide all necessary design, construction, materials, and maintenance to produce the required concrete work safely. Design all shoring to take the full load of the concrete, formwork, and appropriate construction loads without excessive deflection. Adjust formwork construction as required for deflection of forms, if anticipated. Place all shoring directly above any re-shoring occurring below. Removal strength shall be determined in accordance with ACI 301 2.3.4. Shoring and re-shoring calculations shall be available at the request of the Architect.

B. Comply with ACI 347 for shoring and reshoring in multistory construction, and as herein specified.

C. Space out shoring in such a manner that no floor or member will be excessively loaded or will induce stress in concrete members where no reinforcing steel is provided. Extend shores beyond minimums if required to ensure the proper distribution of loads throughout the structure.

D. Re-shoring: Supplement and modify ACI 301 Article 2.3.3 as follows:

1. Remove shores and re-shore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate re-shoring to safely support the work without excessive stress or deflection.
2. Keep re-shores in place a minimum of 15 days after placing upper tier, and longer if required until the concrete has attained its required 28-day strength, and until all heavy loads due to construction have been removed.

3. Modify paragraph 2.3.3.1 to read as follows: “When re-shoring is permitted or required, submit for review of design intent only, a plan of re-shoring procedures and operations prior to their use.”
4. Add to paragraph 2.3.3.7 as follows: “ In multi-story buildings, extend re-shoring over a sufficient number of stories to distribute the weight of newly placed concrete, forms, and construction loads such that the specified design criteria for the structure is not exceeded.”

3.6 REMOVAL OF FORMS

A. Formwork not supporting concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 degrees F. for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operation, and provided that curing and protection operations are maintained.

B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs and other structural elements shall not be removed until concrete has attained its 28-day compressive design strength or as follows.

1. Form supports of prestressed members may be removed when sufficient prestressing has been applied to enable them to carry their dead loads and anticipated construction loads. Provide reshores per Section 3.5.
2. Form supports of non-prestressed members may be removed when concrete has attained 75 percent of design compressive strength provided reshores are installed per Section 3.5.

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3.7 RE-USE OF FORMS

A. Clean and repair surfaces of forms to be re-used in the work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork.

B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and latience, and tighten forms to close all joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces, except as acceptable to the Architect.

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SECTION 03 20 00

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. The extent of work included in this Section is shown on the Drawings and is specified as follows:

1. All labor, materials, equipment, services and accessories necessary to furnish and install concrete reinforcement, complete and functional.
2. Furnishing, fabrication and placement of reinforcement for concrete, including bars, welded wire fabric, ties and supports.

1.2 SUBMITTALS

A. Sustainability Submittals
1. For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
   a. Include statement indicating costs for each product having recycled content.
2. See Division 1 for additional sustainability requirements.

B. Manufacturer's Data:

1. Submit copies of manufacturer's specifications and installation instructions for all proprietary materials and reinforcement accessories.

C. Mill Certificates:

1. Contractor shall furnish the Architect for record two (2) copies of the manufacturer's records of chemical and physical properties of all heats of billet steel bars and, two (2) copies of an affidavit for all material stating that the respective material furnished meets the requirements for the steel reinforcement specified. Manufacturer’s records shall include certificates of mill analysis, tensile and bend tests.

D. Welding certificates:

1. Submit proof of current certification for field welders.

E. Shop Drawings

1. Submit to the Architect/Engineer for review a minimum of one (1) reproducible copy and two (2) prints for each shop drawings for fabrication, bending, and placement of concrete reinforcement. Comply with the ACI 315, and follow Standard Practice of ACI 315R and CRSI MSP.
2. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

1.3 QUALITY ASSURANCE

A. Codes and Standards: Comply with requirements of the following codes and standards, latest

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edition, except as herein modified:

1. American Concrete Institute (ACI):

    a. ACI 301, “Specifications for Structural Concrete”.
    b. ACI 318, “Building Code Requirements for Structural Concrete”.
    c. ACI 117, “Standard Specifications for Tolerances for Concrete Construction and Materials”.
    d. ACI 315, “Details and Detailing of Concrete Reinforcement”.
    e. ACI SP-66, “ACI Detailing Manual”

2. Concrete Reinforcement Steel Institute (CRSI):

    a. CRSI MSP, “Manual of Standard Practice”.

3. American Society of Testing and Materials (ASTM)

    a. ASTM A 185, “Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.”
    b. ASTM A 615, “Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.”
    c. ASTM A 706, “Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.”
    d. ASTM A 775, “Standard Specification for Epoxy-Coated Steel Reinforcing Bars.”
    e. ASTM A 884, “Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement.”

4. American Welding Society (AWS):

    a. D1.1 “Structural Welding Code – Steel”.
    b. D1.4 “Structural Welding Code – Reinforcing Steel”.

B. Testing will be performed by an Independent Testing Laboratory paid for by the Contractor.

1.4 DELIVERY, HANDLING & STORAGE

A. Deliver reinforcement to the project site bundled, tagged and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.

B. Store concrete reinforcement materials at the site to prevent damage and accumulation of dirt or excessive rust.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Recycled Content of Steel Products: Provide steel with minimum 90 percent total recycled content, including at least 60 percent post-consumer recycled content.

B. Reinforcing Bars: ASTM A615, deformed billet-steel bars, yield strength as noted on the Drawings.

C. Welded Wire Fabric: ASTM A185.

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1. Furnish in flat sheets, roll stock not acceptable.

D. Coated Reinforcement:

1. Epoxy Coated: ASTM A775. Fusion bonded coating, apply after fabrication and bending. Film thickness of coating after curing to be 7 to 12 mils, when measured in accordance with Method G12. Provide epoxy coated reinforcing as indicated on the drawings and as defined below:

   a. All reinforcement in the upper 3" of the slab including but not limited to slab and beam/girder top bars. Beam/girder stirrups, post-tensioning anchorage zone reinforcement and support bars.
   b. All parapet wall, crash wall and upturned beam reinforcement.
   c. Column ties within two feet of slab.
   d. Curbs and toppings in parking areas.
   e. Foundation wall reinforcement on the face subject to splash-on of de-icing chemicals.
   f. All pour strip and stressing pocket reinforcement.
   g. All epoxy coated rebar tie wire to be epoxy or plastic coated. Wires shall be 16 gage or heavier.

2. Epoxy Patching Compound: ASTM A775.

E. Supports for Reinforcement: Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcement in place.

1. Use wire bar type supports complying with CRSI recommendations, unless otherwise indicated. Do not use wood, brick, and other unacceptable materials.
2. For slabs on grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
3. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with either hot-dip galvanized, stainless steel or plastic tip protected legs, at Contractor's option.
   a. Chairs and metal accessories supporting epoxy coated rebar shall also be epoxy coated.
4. Over waterproof membranes, use concrete chairs to prevent penetration of the membrane.
5. Provide accessories and supports for welded wire fabric and reinforcement in slabs as required to maintain concrete cover and position as shown on the drawings.

F. Weldable Reinforcing Bars: ASTM A706, Grade 60.

G. Tie Wire: All tie wires shall be 16 gauge or heavier, black annealed, unless noted otherwise.

H. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615, Grade 60 deformed bars, assembled with clips.

I. Plain-Steel Wire: ASTM A 82, as drawn.

J. Epoxy-Coated Wire: ASTM A 884, Class A, Type 1 coated, as-drawn, plain-steel wire, with less than 2 percent damaged coating in each 12-inch wire length.

2.2 FABRICATION

A. General: Fabricate reinforcing bars to conform to required shapes and dimensions, with fabrication tolerances complying with CRSI "Manual of Standard Practice". In case of fabricating errors, do not re-bend or straighten reinforcement in a manner that will injure or weaken the mate-

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rial, or damage coating.

B. Unacceptable Materials: Reinforcement with any of the following defects will not be permitted in the work:

1. Bar lengths, depths and bends exceeding specified fabrication tolerances.
2. Bend or kinks not indicated on drawings or final shop drawings.
3. Bars with reduced cross-section due to excessive rusting or other cause.
4. Bars heated for bending unless so indicated on the plans.
5. Epoxy coated bars with damaged coating.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with the specified codes and standards, and Concrete Reinforcing Steel Institute recommended practice for "Placing Reinforcing Bars" for details and methods of reinforcement placement and supports, and as herein specified.

1. Do not cut or puncture vapor retarder or waterproof membranes. Repair damage and reseal vapor retarder/waterproof membrane before placing concrete.

B. Clean reinforcement to remove loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.

C. Repair the damaged bar coating with a procedure acceptable to the Architect and in accordance with the coating manufacturer’s instructions, to the satisfaction of the Independent Testing Laboratory prior to the reinforcement placement into forms. See Paragraph 3.2 below for epoxy coated rebar handling.

D. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required.

1. Place reinforcement to obtain the minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports together with 16 gauge wire to hold reinforcement accurately in position during concrete placement operations. Set wire ties so that twisted ends are directed away from exposed concrete surfaces.

E. Install welded wire fabric in as long lengths as practicable lap adjoining pieces at least one full mesh and lace splices with 16-gauge wire. Do not make end laps midway between supporting beams, or directly over beams of continuous structures. Offset end laps in adjacent widths to prevent continuous laps.

F. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

G. Provide sufficient numbers of supports and of strength to carry reinforcement. Do not place reinforcing bars more than 2 inches beyond the last leg of any continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

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H. Install reinforcement to tolerances given in ACI 117 2.2.

I. Splices:

1. Provide standard reinforcement splices by lapping ends, placing bars in contact, and tightly wire tying. Comply with requirements of ACI 318 for minimum lap of spliced bars. Unless otherwise indicated on the design drawings, comply with requirements of ACI 318 Chapter 12 for Class B tension lap splices for reinforcement with proper adjustment for location, clear cover and spacing.
2. Do not make splices at points of maximum stress if possible.
3. Stagger splices in horizontal wall reinforcement and separate at least five (5) ft. longitudinally in alternate bars of opposite tiers.
4. Stubs and dowels required to receive and engage subsequent work shall extend a sufficient length to develop the strength of the bar. Place dowel and stub bars in the forms and secure against displacement during the placing of concrete. Where stub steel and dowels extend through construction joints in structural members, they shall be adequately protected from corrosion and thoroughly cleaned of adhering particles of concrete, before continuing the placing of any subsequent concrete.

J. Welding of Reinforcement: Welding of reinforcing bars is not permitted except where specifically indicated or approved by the Architect. Where permitted, weld in accordance with AWS D1.4. Notify the Architect and the Testing Laboratory at least one day prior to welding operation.

K. Field Bending of Reinforcement: Reinforcement partially embedded in concrete shall not be field bent except as shown on the drawings or specifically permitted by the Architect.

3.2 PLACING EPOXY-COATED BARS

A. Handle epoxy-coated bars with equipment having protected contact areas. Lift bundles of coated bars at multiple pick-up points to minimize bar-to-bar abrasion from sags in the bundles. Do not drop or drag bars or bundles. Store on protected cribbing.

B. Place epoxy-coated bars in the same general manner as required for uncoated bars. Use only supports, ties, spacers, clips, tie wire, and miscellaneous accessories with epoxy or other protected coating compatible with the epoxy protection.

C. Tack welding of crossing bars to assemble coated reinforcement will not be permitted.

D. Do not field bend epoxy-coated bars partially embedded in concrete, unless specifically approved for each case. Repair damage to coating of field bent bars with the epoxy-patching compound.

E. Do not field cut epoxy-coated bars, unless specifically approved. When cutting is allowed, coat the cut ends with the same epoxy patching material used to repair the epoxy coating.

F. Repair all damage to the epoxy coating with epoxy patching compound.

3.3 INSPECTION OF REINFORCEMENT

A. Completed installation of concrete reinforcement and steel reinforcement welding must be reviewed by the Independent Testing Agency before depositing concrete.

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SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. The extent of work included in this Section is shown on the Drawings and is specified as follows:

1. Cast-in-place concrete consisting of Portland cement, fine and coarse aggregate, water, and selected admixtures; combined, mixed, transported, placed, finished and cured.
2. Expansion joints, contraction joints and water stops for cast-in-place concrete.

1.2 SUBMITTALS

A. Submit manufacturer’s data for proprietary items and other information described herein and as specified in the Project documents.

B. Mix Designs:

1. Submit substantiating data for each concrete mix design contemplated for use to the Architect not less than six (6) weeks prior to first concrete placement. Data for each mix shall, as a minimum, include the following:

a. Mix identification designation (unique for each mix submitted).
b. Statement of intended use for mix.
c. Method used to establish a proposed design for each mix (ACI 301).
d. Mix proportions, including all admixtures used.
e. Manufacturer's data and material certifications signed by the material manufacturer and the Contractor certifying conformance of all materials, including admixtures, with specified requirements.
f. Wet and dry unit weight.
g. Entrained air content. Determine of freshly mixed concrete by pressure method, ASTM C231, or volumetric method, ASTM C173.
h. Design slump, per ASTM C143.
i. When statistical data for a proposed mix is available, and has been compiled within the 12 months time prior to the commencement of this project, and is spanning a period of not less than 60 calendar days, submit required average strength qualification data per ACI 301. Submit separate qualification data for each production facility, which will supply concrete to the project.
j. Average strength qualification data (trial mix data or field test data per ACI 301. When field test data for at least 10 consecutive strength tests for one mixture is used to qualify average strength with the same materials and data acquisition encompassing a period of not less than 60 days, or trial mixtures are used to establish a design mixture proportions, submit separate qualification data for each production facility, which will supply concrete to the project. Trial mixtures evaluation shall be in strict accordance with ACI 301.
k. Field test data submitted for qualification of average strength under ACI 301 shall include copies of the Concrete Testing Agency's reports from which the data was compiled.
l. Tests of proposed mixes for water soluble chloride ion content for all above grade

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structural concrete and for slab-on-grade reinforced concrete in accordance with ASTM C1218.

m. Submit one copy of a representative concrete batch trip ticket containing information as specified herein.

1) Separate design mixes are required for each strength and class of concrete, each change in type and/or quantity of mix materials including admixtures, each change in slump limits, and each change in entrained air content.

C. Mix designs submitted without the required information outlined above will be rejected. Concrete shall not be placed without an approved mix design.

D. Product Data:

1. Submit product data with application and installation instructions for proprietary materials and items including admixtures, patching compounds, epoxies, grouts, sealer, and others as required by the Architect.
2. Submit curing compound product data and verification of its compatibility with other finish materials and surface treatments required.

E. Submit samples of concrete materials if requested by the Architect, including names, sources, and descriptions.

F. Placement Schedule: Prepare a placement schedule and submit to Architect for review prior to start of concrete placement operations.

G. Submit to the Architect for record a written program outlining procedures/measures to protect and monitor freshly mixed and/or placed concrete in cold and hot weather and procedures for protection of the freshly placed concrete against rain. The program shall be submitted no later than three weeks before pre-placement conference, and shall be discussed therein.

H. Sustainable Design Submittals:

1. General: Where indicated for specific LEED Credits this Section, Submittals must include the following:
   a. Statement of Sourcing Location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, harvesting, and recovery and the Project site.
   b. Statement of Manufacturing Location(s): Indicate location of manufacturing facility; indicate distance between manufacturing facility and the Project site.
   c. Statement of Product Value: Indicate dollar value of product containing regional materials; include materials cost only.
   d. Statement of Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product.
   e. Statement of Recycled Content: Indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
   f. Statement of Product Component(s) Value: Where product components are sourced or manufactured in separate locations, provide location information for each component. Indicate the percentage by weight of each component per unit of product
2. Submit Product Data and material safety data sheets stating compliance with VOC limits for Curing and Sealing Compounds.
3. Cementitious Materials Recycled Content
   a. Statement of Recycled Content.

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b. Submit statement of relative dollar value of recycled content product to total dollar value of product included in Project.

4. Regional Materials – Aggregates
   a. Statement of Sourcing Location(s).
   b. Statement of Manufacturing Location(s).
   c. Statement of Product Value.
   d. Statement of Product Component(s) Value.
5. Regional Materials – Water
   a. Statement of Sourcing Location(s).
   b. Statement of Manufacturing Location(s).
   c. Statement of Product Value.
6. Regional Materials – Cement
   a. Statement of Sourcing Location(s).
   b. Statement of Manufacturing Location(s).
   c. Statement of Product Value.
7. Regional Materials – Supplemental Cementitious Materials
   a. Statement of Sourcing Location(s).
   b. Statement of Manufacturing Location(s).
   c. Statement of Product Value.
8. See Division 1 for Additional Requirements.

1.3 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: The work under this section shall be subject to all applicable provisions of the state and local building and safety codes.

B. Codes and Standards: Comply with requirements of the following codes and standards, latest edition, unless more stringent provisions are indicated:

1. ACI 301, “Specification for Structural Concrete.”
2. ACI 117, “Standard Specifications for Tolerances for Concrete Construction and Materials.”
3. ACI 311.4R, “Guide for Concrete Inspection.”
4. ACI 318, “Building Code Requirements for Structural Concrete”.
5. ACI 304, “Guide for Measuring, Mixing, Transporting and Placing Concrete.”
6. ACI 305R, “Hot Weather Concreting.”
7. ACI 306.1, “Cold Weather Concreting.”
8. ASTM C 33, Standard Specifications for Concrete Aggregates.
9. ASTM C 94, Standard Specifications for Ready Mix Concrete.
10. ACI SP-66, ACI Detailing Manual.
11. ACI SP-15, ACI Field Reference Manual.
12. American Welding Society AWS D1.4-1998 “Recommended Practices for Welding Reinforcing Steel, Metal Inserts and Connections in Reinforced Concrete Construction”.
13. Concrete Reinforcing Steel Institute “Manual of Standard Practice”.

C. Mockups: Cast concrete slab on grade mockup to demonstrate typical joints, surface finish, texture, tolerance, and standard of workmanship.

D. Record of Work: A record shall be kept by the Construction Manager listing the time and date of placement of all concrete for the structure. Such record shall be kept until the completion of the project and shall be available to the Architect for examination at any time.

All concrete batch trip tickets will be collected and retained by the Contractor. Concrete batch trip tickets shall contain information specified in ASTM C94, paragraph entitled "Batch Ticket Information". Batch trip ticket shall also show the total amount of water in the mix as batched (including water present in the aggregate before batching) and the amount of water required by the

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design mix proportions.

E. The Contractor shall be responsible for designing the required concrete mixes such that mixing, placing and finishing operations are possible without compromising the performance of the finished product during service life.

F. Sustainable Design Requirements:
1. Recycled Concrete Materials: Furnish materials with recycled content
2. Regional Materials: Furnish materials extracted, processed, and manufactured within 500 miles of the Project Site.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery of Materials: Deliver materials in manufacturer's unopened containers fully identified with manufacturer's name, trade name, type, class, grade, size, and color.

B. Storage of Materials: Store materials in unopened containers. Store off ground and under cover, protected from damage.

C. Concrete:

1. Hauling Time: Discharge all concrete transmitted in a truck mixer, agitator, or other transportation device not later than 1-1/2 hours, or 300 revolutions of the drum after the mixing water has been added, whichever is earliest.
2. Extra Water: Deliver concrete to the job in exact quantities required by the design mix. No water shall be added after batching of concrete.

1.5 PROJECT CONDITIONS

A. Environmental Requirements:

1. Cold Weather Placement: When depositing concrete after the first frost or when the mean daily temperatures are below 40 degrees F., follow requirements of ACI 306.1 and recommendations of ACI 306R as modified herein.
   a. Maintain concrete temperature at a minimum of 55 degrees F. for sections having a minimum dimension of less than 12", or 50 degrees F. for sections having a minimum dimension of 12" or greater, for not less than 72 hours after depositing.
   b. Maintain temperature of concrete record during the required minimum protection period and as described in Section 01 45 00, Quality Control, of these specifications.
   c. The specified non-chloride accelerator or high-early strength Type III cement may be used when accepted by the Architect. Site-cured cylinders for verification of early strength and/or the adequacy of the Contractor's protective methods, may be required by the Architect.

2. Hot Weather Placement: When depositing concrete in hot weather, follow recommendations of ACI 305R as modified herein. The temperature of concrete at time of placement shall not exceed 90 degrees F. Protect to prevent rapid drying. Start finishing and curing as soon as possible. When the air temperature is expected to exceed 90 degrees F., the Contractor shall obtain acceptance from the Architect of the procedures to be used in protecting, depositing, finishing, and curing the concrete. The specified water reducing retarding admixture may be used upon acceptance of the Architect. The use of continuous wetting or fog sprays may be required by the Architect for 24 hours after depositing.

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B. Protection: Protect newly finished slabs from rain, snow or wind damage. Protect finished slabs from mortar leakage from pouring of concrete above. Cover masonry walls, glazing, and other finish materials with polyethylene or otherwise protect from potential damage due to placement of concrete.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Cementitious Materials:

1. General: Provide materials of the same brand or source throughout the project unless otherwise specified.
2. Portland Cement: ASTM C150, Type I. High-Early Strength Type III cement may be used in lieu of Type I at Contractor's option, provided a written notification is submitted to the Architect prior to use and the concrete ready mix supplier certifies in writing the compatibility of the proposed cement with other constituents of the mix. Type III cement shall not be used for hot weather concreting.
3. Fly Ash: ASTM C618, Class C or F.
4. Ground Granulated Blast Furnace Slag (GGBFS): ASTM C989, Grade 100 or 120.

B. Aggregates: ASTM C33, and as herein specified.

1. General: Provide aggregates from the same source throughout the project unless otherwise specified.
2. Fine aggregate: clean, sharp, natural sand free from loam, clay lumps or other deleterious substances.
3. Coarse Aggregate: Clean, uncoated, processed aggregate containing no clay lumps, mud, loam, or foreign matter, as follows:
   a. Crushed stone, processed from natural rock or stone.
   b. Washed gravel, either natural or crushed. Use of pit or bank run gravel is not permitted.
   c. Maximum Aggregate Size shall be per ACI 318. For P.T. slabs and beams, maximum aggregate size shall be 1”.
   d. No chert or lignite allowed.

C. Water: Clean, fresh, drinkable.

2.2 CONCRETE ADMIXTURES

A. General: Admixtures certified by manufacturer to contain not more than 0.05 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride or other corrosive elements. Do not use admixtures which have not been incorporated and tested in the accepted design mixes, unless otherwise authorized in writing by the Architect.

B. Prohibited Products: Calcium chloride or admixtures containing more than 0.05% chloride ions or thiocyanates are not permitted.

C. Air-Entraining Admixtures: ASTM C260, certified by manufacturer to be compatible with other required admixtures.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. "Air-Mix": Euclid Chemical Co.
   b. "Sika Aer": Sika Corporation
   c. "MB-VR”, “MB-AE90” or “Micro AIR”: BASF Construction Chemicals

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d. "Darex AEA" or "Daravair": W.R. Grace

D. Water-Reducing Admixture: ASTM C494, Type A.
1. Products: Subject to compliance with requirements, provide one of the following:
a. "WRDA Hycol": W. R. Grace
b. "Eucon WR-75 or WR-89": Euclid Chemical Co.
c. "Pozzolith" series or ""Polyheed" series: BASF Construction Chemicals
d. "Plastocrete 160": Sika Chemical Corp.

E. High-Range Water-Reducing Admixture (Superplasticizer): ASTM C494, Type F or Type G.

1. Products: Subject to compliance with requirements, provide one of the following:
a. "Sikament 300": Sika Chemical Corporation
b. "Eucon 37': Euclid Chemical Co.
c. "Daracem-100": W. R. Grace
d. "Rheobuild 1000", Glenium" series or "PS 1466": BASF Construction Chemicals

F. Water Reducing, Non-Corrosive Accelerating Admixture: The admixture shall conform to ASTM C494, Type C or E. The admixture manufacturer must have long-term non-corrosive test data from an independent testing laboratory (of at least a year's duration) using an acceptable accelerated corrosion test method such as that using electrical potential measures.

1. Products: Subject to compliance with requirements, provide the following:
a. "Accelguard 80": Euclid Chemical Co.
b. "Daraset": W. R. Grace
c. "Pozzolith NC534" or "Pozutec 20+": BASF Construction Chemicals

G. Water-Reducing and Retarding Admixture: ASTM C494, Type D.

1. Products: Subject to compliance with requirements, provide one of the following:
a. "Pozzolith" series or "DELVO" series: BASF Construction Chemicals
b. "Eucon Retarder 75": Euclid Chemical Co.
c. "Daratard": W. R. Grace
d. "Plastiment": Sika Chemical Co.

H. Structural Fiber for areas of concrete structure specifically designated: Monofilament polypropylene/polyethylene fibers, 1.5 to 2 inch in length with a minimum tensile strength of 70 ksi and the minimum Modulus of Elasticity of 600 ksi. The manufacturer shall demonstrate the attainment of average residual strength of not less than 140 psi per ASTM C1399 based on the proposed dosage. Minimum dosage shall not be less than 4.5 lbs/cu. yd.

1. Subject to compliance with requirements, provide one of the following:
a. "Strux 90/40" : Grace Construction Products
b. "Tuf-Strand SF": Euclid Chemical Co.
c. Forta Ferro: Forta Corporation
d. "Master Fiber Mac" series: BASF Construction Chemicals

I. Certification: Written certification of conformance to above requirements will be required from all admixture manufacturers prior to mix design review by the Architect.

2.3 WATERSTOPS

A. Flexible Rubber Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes, minimum web thickness 3/8 inch.

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1. Profile: Ribbed with center bulb.

B. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.

1. Profile: Ribbed with center bulb.

C. Self-Expanding Strip Waterstops: Manufactured rectangular or trapezoidal strip, for adhesive bonding to concrete.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Volclay Waterstop-RX; Colloid Environmental Technologies Co.
   b. Superstop; Progress Unlimited Inc.
   c. Swell Stop – Green Streak.

2.4 JOINT MATERIALS

A. Joint Sealing Compound & Premolded Fillers: See Division 7 Sections.

B. Preformed Expansion Joint Fillers: see Division 7 Sections.

2.5 MOISTURE BARRIER

A. Provide moisture barrier (vapor retarder) over prepared base material, minimum 6 mils thick, where indicated. The material shall conform to ASTM 1745 Class A (Plastic). In addition, the manufacturer shall demonstrate that the Water Vapor Transmission Rate (WVT) does not exceed 0.006 gr/ft²/hr, when tested in accordance with ASTM E96.

1. Products: Subject to compliance with requirements, provide one of the following:
   a. Stego Wrap (15-mil) Vapor Barrier - Stego Industries
   b. Pre-moulded Membrane with Plasmatic Core - W. R. Meadows
   c. Zero-Perm - Alumiseal

B. Provide moisture barrier (vapor retarder) accessories with the corresponding properties as indicated below:

1. Vapor Retarding Seam Tape – permeance per ASTM E 96, 0.3 perms or lower.
2. Vapor Proofing Mastic – permeance per ASTM E 96, 0.3 perms or lower.

2.6 BONDING AND REPAIR MATERIALS

A. Bonding Grout: After the existing concrete surface has been cleaned, it shall be uniformly saturated by pre-wetting for 2 hours, and free standing water shall be removed prior to placing the bonding grout before concrete repairs.

1. Bonding grout for patching concrete to existing concrete shall consist of equal parts by weight of Portland Cement and sand mixed in a portable mechanical mixer with sufficient water to form a stiff slurry. The consistency of this slurry shall be such that it can be applied with a stiff brush or broom to the old concrete in a thin, even coating that will not run or puddle in low spots.
2. Should the bonding grout dry before the concrete repairs, the Contractor will remove the dried grout and sandblast clean the grouted surface, before placing fresh bonding grout.

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B. Patching Mortar: Provide free-flowing, polymer-modified cement-based repair mortar, suitable for thin applications.

1. Products offered by manufacturers to comply with the requirements include the following:

a. "SikaTop 121 Plus or122 Plus" : Sika Chemical Corp.
b. "Verticoat or Verticoat Supreme" : Euclid Chemical Co.
c. "EMACO R310 CI or R320 CI" : BASF Construction Chemicals
d. "HB2 Repair Mortar" : ChemRex, a Div. of Degussa, Inc.

2.7 CONCRETE CURING MATERIALS

A. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd. and complying with AASHTO M182, Class 3.

B. Moisture-Retaining Cover: Provide one of the following, complying with ASTM C171:

1. Waterproof paper
2. Polyethylene film
3. White burlap-polyethylene sheet

C. Liquid Membrane-Forming Curing Compound or Dissipating Resin Compound: ASTM C309, Type 1. Curing compound shall leave no surface residue and shall be compatible with concrete sealers, paint and finish floor materials specified in other sections of this Specification. For concrete surfaces to receive clear penetrating sealer, liquid membrane-forming curing compound, if not a dissipating resin, shall be mechanically removed from the concrete surface by an approved method. The dissipating resin compound film must chemically break down in a two to four week period. Provide data from an independent laboratory indicating a maximum moisture loss of 0.03 grams per sq. cm. in 72 hours when applied at a coverage rate of 300 ft^2 per gallon. Manufacturer's certification and method of removal, if necessary for sealer application, are required.

1. Subject to compliance with requirements, provide one of the following:
   a. "Kurez DR" - Euclid Chemical Co.
   b. "L & M Cure R" - L & M Construction Chemicals, Inc.
   c. "Clear 1100" - W. R. Meadows
   d. "EZ Strip Cure" - ChemMasters

   Approved Equivalent

2. The contractor shall anticipate providing as a minimum concrete surface preparation by a power sweep or low pressure water blast (3,000 psi), as a normal part of the work.

D. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete. Evaporation retarder shall be used to retard rapid evaporation of bleeding water from exposed concrete under adverse curing conditions.

1. Subject to compliance with requirements, provide one of the following:
   a. "Eucobar" - Euclid Chemical Co.
   b. "E-Con" - L & M Construction Chemicals, Inc.
   c. "Confilm" - BASF Construction Chemicals
   d. "SikaFilm" - Sika Corp.

2.8 GROUT MATERIALS

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A. Non-shrink non-metallic grout shall be premixed and packaged silica aggregates, Portland cement, water reducing and shrinkage compensating agents. Grout shall conform to ASTM C1107, "Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)." In addition, the grout manufacturer shall furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95% bearing under a 4' x 4' base plate.

1. Products offered by manufacturers to comply with the requirements include the following:

   a. Euco NS: The Euclid Chemical Co.
   b. Masterflow 713: BASF Construction Chemicals
   c. SikaGrout 212 : Sika Corp.

B. High Flow Grout: Where high fluidity and/or increase placing time are required use high flow grout. Non-shrink, natural aggregate factory pre-mixed grout shall conform to ASTM C1107, "Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)." In addition, the grout manufacturer shall furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95% bearing under an 18" x 36" base plate.

1. Products offered by manufacturers to comply with the requirements include the following:

   a. Euco Hi-Flow Grout: The Euclid Chemical Co.
   b. Masterflow 928: BASF Construction Chemicals
   c. Sika Grout 328: Sika Corp.

2.9 PROPORTIONING AND DESIGN OF MIXES

A. Design and Properties of Concrete:

1. Prepare a concrete design mix composed of Portland cement, water, fine and coarse aggregate, appropriate admixtures and cementitious materials as required to obtain the specified strength requirements and will produce concrete with equal finish quality, surface appearance and durability required.
2. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.

B. The concrete mixes proportioned on the basis of trial mixture shall meet the provisions of ACI 301.

C. Requirements for concrete mix unless otherwise shown on drawings.

1. Compressive Strength = 5,000 psi @ 28 days for toppings and grade slabs or as indicated on drawings.
   = 4,000 psi @ 28 days for foundation walls and footing or as indicated on the drawings.

2. Slump = 3” maximum prior to addition of super plasticizer. 8” with HRWRA.

3. Water-cementitious ratio = 0.40 (Elevated Deck)
   = 0.45 (Foundation and Slab on Grade)

4. Air Content = 5 to 7-1/2%

5. Minimum Cementitious Content = 560 lb/cu. yd. for 5,000 psi concrete.
   520 lb/cu. yd. for 4,000 psi concrete.

6. Admixtures as specified in the contract documents.

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D. Prepare design mixes for each type and strength of concrete determined by either laboratory mix or field test data.

E. Cementitious Materials: For concrete exposed to deicers, limit percentage by weight, of cementitious materials other than Portland cement according to ACI 301 requirements.

F. Cementitious Materials: Limit content of the following materials by weight, of total cementitious materials other than Portland cement in concrete as follows:

1. Fly Ash: 25 Percent
2. Fly Ash plus Pozzolan: 25 Percent
3. Ground Granulated Blast Furnace Slag (GGBFS): 25 Percent
4. Fly Ash or Pozzolan plus GGBFS: 35 Percent (Min. GGBFS = 15 Percent.)

G. Adjustment to Concrete Mixes: Mix design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to the Owner and as accepted by the Architect. Laboratory test data for revised mix designs and strength results must be submitted to and accepted by the Architect before using in the work.

2.10 CONCRETE PRE-PLACEMENT CONFERENCE

A. At least 20 days prior to start of the concrete construction schedule, the contractor shall conduct a meeting to review the proposed mix designs and to discuss the required methods and procedures to achieve the required concrete quality. The contractor shall send a concrete pre-placement conference agenda to all attendees 5 days prior to the schedule date of the conference.

B. The contractor shall require responsible representatives or every party who is concerned with the concrete work to attend the conference, including but not limited to the following:

1. Contractor's Field Superintendent and Project Manager
2. Laboratory responsible for the concrete design mix.
3. Laboratory responsible for field quality control.
4. Concrete subcontractor.
5. Ready-mix concrete producer
6. Admixture manufacturer(s)
7. Concrete pumping contractor
8. Concrete finishing Foreman
9. Prime Architect’s Project Manager

C. Minutes of the meeting shall be recorded, typed and printed by the contractor and distributed to all parties concerned within 5 days of the meeting. One copy of the minutes shall also be transmitted to the following for information purposes:
1. Owner's representative
2. Resident engineer
3. Consultant engineer

D. The minutes shall include a statement by the admixture manufacturer(s) indicating that the proposed mix design and placing techniques can produce the concrete quality required by these specifications.

2.11 SUSTAINABILITY REQURIEMENTS

A. Curing Compounds: Products must meet relevant VOC requirements.

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B. Provide cement with minimum 25 percent recycled content.

C. Extraction and fabrication facility for all aggregates must be within 500 miles of Project site.

D. See Division 1 for additional sustainability requirements.

PART 3 - EXECUTION

3.1 PREPARATION

A. Pre-placement Inspection:

1. Before placing concrete, inspect and complete the formwork installation, reinforcing steel, and securely install all required inserts, anchors, sleeves, conduits and other items specified under other sections or as shown on the Contract Drawings to be embedded or cast-in.
   a. The contractor shall provide reasonable opportunity for the Owner and his representative(s) to perform pre-placement inspection of items noted above.

2. Where concrete is placed on the ground or sub-course, the foundation upon which concrete is placed shall be clean, damp, and free from frost, ice, and standing or running water. Prior to placing concrete, bottom of the foundation shall be compacted and approved by the Geotechnical Engineer.
3. Soil at bottom of foundation systems is subject to testing for soil bearing capacity by the testing laboratory, as directed by the Geotechnical Engineer. Place concrete immediately after approval of foundation excavations.
4. Thoroughly wet wood forms immediately before placing concrete, as required where form coatings are not used.
5. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.

3.2 CONCRETE PLACEMENT

A. General: Place concrete in compliance with the practices and recommendations of ACI 304R and ACI 304.2R and as herein specified.
   1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete~~,~~ which is hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be place continuously, provide construction joints as herein specified. Perform concrete placing at such a rate that concrete which is being integrated with fresh concrete is still plastic. Deposit concrete as nearly as practicable to its final location to avoid segregation due to rehandling or flowing. Do not subject concrete to any procedure which will cause segregation.
   2. Do not use concrete which becomes non-plastic and unworkable, or does not meet the required quality control limits, or which has been contaminated by foreign materials. Do not use re-tempered concrete. Remove rejected concrete from the project site and dispose of it in an acceptable location.

B. Placement Schedule: Place concrete in conformance with the approved placement schedule to ensure an even distribution of loads throughout the entire structure.

C. Concrete Conveying: Handle concrete from the point of delivery and transfer to the concrete conveying equipment and to the locations of final deposit as rapidly as practicable by methods which will prevent segregation and loss of concrete mix materials.
   1. Provide mechanical equipment for conveying concrete to ensure a continuous flow of concrete at the delivery end. Keep interior surfaces of conveying equipment, including

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chutes, free of hardened concrete, debris, water, snow, ice and other deleterious materials.

D. Placing Concrete Into Forms:

1. Deposit concrete in forms in horizontal layers not deeper than 12 inches unless additional thickness is permitted by the Architect, and in a manner to avoid inclined construction joints.
2. Free fall shall not exceed ten (10) feet for concrete containing a high range water-reducing admixture (super-plasticizer) or six (6) feet for other concrete. Use chutes or trunks of variable lengths to prevent segregation of concrete.
3. Remove temporary spreaders in forms when concrete placing has reached the elevation of such spreaders.
4. Consolidate concrete placed in forms by mechanical vibrating equipment supplemented by handspading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with the recommended practices of ACI 309R, to suite the type concrete and project conditions. Vibration of forms and reinforcing will not be permitted.
5. Use appropriate size vibrators for the elements, in which concrete is being consolidated.
6. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate the layer of concrete and at least 6 inches into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set.
7. In order to allow for shrinkage or settlement, at least 4 hours shall elapse after placing concrete in walls, columns or beams before depositing concrete in girders, beams or slabs supported thereon, unless otherwise specified or shown on the plans.

E. Placing Concrete Slabs:

1. Deposit and consolidate concrete slabs in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed.
2. Maintain reinforcing steel in the proper position continuously during concrete placement operations.
3. Consolidate concrete during placing operations using mechanical vibrating equipment, so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
4. Floor slabs shall be poured up-hill at ramps.
5. Bring slab surfaces to the correct level with a straight edge over screed rails and strike off space screed rails at 10 to 12 feet on center, or as required based on screed stiffness, to produce a concrete slab of uniform thickness. Use bull floats, highway straight edges or darbies to smooth the surface, leaving it free of humps or hollows. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to beginning finishing operations.

F. Bonding:

1. Prepare for bonding of fresh concrete to new concrete that has set but is not fully cured by using neat bonding grout.
    a. Roughen surfaces of set concrete at all joints, except where bonding is obtained by use of a concrete bonding agent, and clean surfaces of laitance, coatings, loose particles, and foreign matter. Roughen surfaces in a manner to expose bonded aggregate uniformly.
    b. At joints between footings and walls, and between walls and slabs they support, and elsewhere unless otherwise specified herein, dampen, but do not saturate the roughened and cleaned surface of set concrete immediately before placing fresh concrete.

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c. At joints in exposed work: At vertical joints in walls, at joints in supported slabs and other structural members; dampen the roughened and cleaned surface of set concrete and apply a liberal coating of the bonding grout consisting of equal parts Portland cement and fine aggregate by weight and sufficient water to achieve the consistency of stiff grout or thick paint. Apply with a stiff broom, brush, or spray to a minimum thickness of 1/16 inch. Deposit fresh concrete before cement grout has attained its initial set.

G. Cold Weather Placing:

1. Protect all concrete work from physical damage or reduced strength, which could be caused by frost, freezing actions, or low temperatures, in compliance with the requirements of ACI 306.1, recommendations of ACI 306R and as herein specified.
2. When the air temperature has fallen to or is expected to fall below 40 degrees F., uniformly heat all water and aggregates before mixing as required to obtain a concrete mixture temperature of not less than 50 degree F. and not more than 80 degree F. at point of placement.
3. Provide adequate means to maintain a cure temperature in the area where concrete is being placed at either 70 degrees F. for 3 days or 50 degrees F. for 5 days after placing. Provide temporary housings or coverings including tarpaulins or plastic film. Keep protections in place and intact at least 24 hours after artificial heat is discontinued. Avoid rapid dry-out of concrete due to overheating, and avoid thermal shock due to sudden cooling or heating.
4. Do not use frozen materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. Ascertain that forms, reinforcing steel, and adjacent concrete surfaces are entirely free of frost, snow and ice before placing concrete.
5. Only the specified non-corrosive non-chloride accelerator shall be used. Calcium chloride, thiocyanates or admixtures containing more than 0.05% chloride ions are not permitted.
6. Use set-control admixtures when required and accepted in mix designs.

H. Hot Weather Placing:

1. When hot weather conditions exist that would seriously impair the quality and strength of concrete, place and protect concrete in compliance with ACI 305R and as herein specified.
2. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees F. Mixing water may be chilled or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated to the total amount of mixing water.
3. Wet forms thoroughly before placing concrete.
4. Retarding admixture may be used with approval of Architect.

3.3 JOINTS

A. Construction Joints:

1. Locate and install construction joints, which are not shown on the drawings, so as not to impair strength and appearance of the structure, as acceptable to the Architect.
2. Provide keyways at least 1 1/2 inches deep in all construction joints in walls, slabs on grade, and between walls and footings.
3. Place construction joints perpendicular to the main reinforcement. Continue all reinforcement across construction joints.
4. Tool or saw-cut construction joints in supported slabs approximately 3/8 inch wide by 3/4

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inch deep.

B. Waterstops:
1. Provide waterstops in construction joints and expansion joints as shown on the drawings. Install waterstops to form a continuous diaphragm in each joint. Make provisions to support and protect waterstops during the progress of the work.

C. Isolation Joints in Slabs on Ground:
1. Provide isolation joints in slabs on ground at all points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundation walls, and elsewhere as indicated.

D. Control Joints in Slabs on Ground:
1. Provide control joints in slabs on ground to form panels or patters as shown. If not shown, provide joints to form panels approximately fifteen (15) feet by fifteen (15) feet in size.
2. Tool or Soff-cut with V-blade within one to four hours after the finishing process and before final set without dislodging aggregates. The V-joint shall be 1 (one) inch deep and ⅜ inch wide.

E. Control Joints in Topping Slabs:
1. Provide control joints in the topping slabs to form panels or patterns as shown on the drawings.
2. Tool or Soff-cut with V-blade within one to four hours after the finishing process and before final set without dislodging aggregates. The V-joint shall be 1 (one) inch deep and 3/8 inch wide.

F. Joint Sealant/Filler Strips:
1. All construction joints and control joints shall be filled with sealant material and isolation joints shall be filled with filler strips in conformance with Section 07 92 00.

3.4 FINISHING FORMED SURFACES

A. General:
1. The intent is to obtain materials and workmanship of such quality that only nominal finishing will be required to produce concrete surfaces equal to the best obtainable with the concrete and forming material specified.

B. Rough Formed Finish:
1. Standard rough form finish shall be the concrete surface having the texture imparted by the form facing material used, with tie holes and defective areas repaired and patched and all fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.

C. Smooth Formed Finish:
1. Produce smooth form finish by selecting form material to impart a smooth, hard, uniform texture and arranging them orderly and symmetrical with a minimum of seams. Repair and patch defective areas with all fins or other projections exceeding 1/16 inch in height completely removed and smoothed.
2. Apply to concrete surfaces that are to be exposed to public view, or that are to be covered with coating material applied directly to the concrete, or a covering material bonded to the concrete such as waterproofing, dampproofing, painting, or other similar system.

D. Smooth Rubbed Finish:

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1. Provide a smooth rubbed finish to surfaces which have received smooth form finish treatment, not later than the day after form removal.
2. Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than cement paste drawn from the concrete itself by the rubbing process.

E. Related Unformed Surfaces:
1. At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with a texture matching the adjacent formed surfaces. Continue the final surface treatment of formed surfaces uniformly across the adjacent unformed surfaces, unless otherwise shown.

3.5 MONOLITHIC SLAB FINISHES

A. Float Finish:
1. Apply float finish to monolithic slab surfaces that are to receive trowel finish and other finishes as hereinafter specified.
2. After placing concrete slabs, do not work the surface further until ready for floating. Begin floating when the surface water has disappeared or when the concrete has sufficiently stiffened. Consolidate the surface with power-driven low RPM floats approved by the Architect, or by hand-floating if area is small or inaccessible to power units. Check and level the surface plane to a tolerance per ACI 117, paragraph 4.5.7 for conventional bullfloated profile. Cut down high spots and fill all low spots. Uniformly slope surfaces to drains.
3. For parking garage deck areas intended for traffic and parking, bullfloat immediately after screeding. Complete floating operations before any excess moisture or bleed water appears on the surface. Follow recommendations of ACI 302.1R.

B. Non-Slip Broom Finish:

1. Apply non-slip broom finish to parking garage concrete deck slabs and ramps and elsewhere as shown on the drawings or in schedules.
2. For parking garage deck areas intended for traffic and parking, immediately after bullfloating, slightly roughen the concrete surface by brooming in the direction perpendicular to the main traffic route. Use fiber-bristle broom unless otherwise directed. Coordinate the required final finish with the Architect before application.

C. Non-Slip Aggregate Finish:
1. Apply non-slip aggregate finish to concrete stair treads, platforms, and elsewhere as shown on the drawings, or in schedules.
2. After completion of float finishing, and before starting trowel finish, uniformly spread 25 lbs. of dampened non-slip aggregate per 100 sq. ft. of surface. Tamp aggregate flush with the surface using a steel trowel, but do not force the non-slip aggregate particles below the surface. After broadcasting and tamping, apply trowel finishing.

D. Trowel Finish:

1. Apply trowel finish to monolithic slab surfaces to be exposed to view in non-vehicular areas and slab surfaces to be covered with resilient flooring, ceramic tile, protected waterproofing membrane subsurface or as required by the membrane manufacturer or other finishes. Power troweling of monolithic slab surfaces subject to freeze-thaw is not allowed. Power troweling of monolithic slab surfaces not subject to freeze-thaw is preferred.

3.6 CONCRETE CURING AND PROTECTION

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A. General:
   1. Protect freshly placed concrete from premature drying and excessive cold or hot temperature, and maintain without drying at a relatively constant temperature for the period of time necessary for hydration of the cement and proper hardening of the concrete. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.
   2. Start initial curing as soon as free moisture has disappeared from the concrete surface after placing and finishing**.** Keep continuously moist for not less than 72 hours.
   3. Begin final curing procedures immediately following initial curing and before the concrete has dried. Continue final curing for at least 7 days and in accordance with ACI 301 procedures. Avoid rapid drying at the end of the final curing period.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before final finishing operations.

C. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces, by one or a combination of the following methods:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days, or 14 days for exposed slabs, with the following materials:
      a. Water.
      b. Continuous water-fog-spray.
      c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

   2. Moisture-retaining cover curing:
      a. Cover the concrete surfaces with the specified moisture-retaining cover for curing concrete, placed in the widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during the curing period using cover material and waterproof tape.

   3. Liquid curing and hardening compound:
      a. Apply the specified liquid curing and hardening compound immediately after final finishing. Apply uniformly in a continuous operation by power spray equipment in accordance with the manufacturer's direction. Recoat areas, which are subjected to heavy rainfall within 3 hours after initial application. Maintain the continuity of the coating and repair damage to the coat during the entire curing period.
      b. Coordinate the use of this curing and hardening compound with surfaces, which are to receive subsequent coatings or finishes.
      c. The concrete surface cured with curing compound or dissipating resin compound shall be compatible with concrete sealers. However, because most resin compounds typically do not totally dissipate by the time it is necessary to apply concrete sealers, the Contractor is expected to provide surface preparation as required by a power sweep or low pressure water blast (3,000 PSI), as a normal part of the work. The work shall be coordinated with the product manufacturer as indicated in Section 07 19 11.

D. Formed Surfaces: Cure formed concrete surfaces, including the undersides of girders, beams, supported slabs, and other similar surfaces by moist curing with the forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

E. Protection from Mechanical Injury: During the curing period, protect concrete from damaging mechanical disturbances including load stresses, heavy shock, excessive vibration, and from damage caused by rain or flowing water. Protect all finished concrete surfaces from damage by

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subsequent construction operations.

3.7 MISCELLANEOUS CONCRETE ITEMS

A. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersection, and terminations slightly rounded.

B. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on the drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with certified diagrams or templates of the manufacturer furnishing the machines and equipment.

C. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work. The interface between earlier placed, cured concrete and the infill concrete shall be treated as construction joints for purposes of reinforcement, tooling and sealant application.

3.8 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: No patching work shall be done without prior review by the Architect. The Contractor shall submit actual repair locations, procedures and material to be used. The following is a general guideline for concrete repair work.

1. Cut out honeycomb, rock pockets, voids over ½ inch diameter, and holes left by tie rods and bolts, down to solid concrete but in no case, to a depth of less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Before placing the cement mortar, thoroughly clean, dampen with, and brush-coat the area to be patched with a bonding grout consisting of one part cement, one and a half part fine sand and a 50/50 mixture of the specified bonding admixture and water to achieve the consistency of thick paint. Patching shall be in accordance with ACI 117 latest addition.

    a. For exposed to public view surfaces, blend white Portland cement and standard Portland cement so that, when dry, the patching mortar will match the color of the surrounding concrete. Compact mortar in place and strike off slightly higher than the surrounding surface.

2. Proprietary patching compounds may be used in lieu of the cement mortar with prior approval of the Architect and when color match of the adjacent concrete is not required.

B. Remove fins and irregularities in exposed concrete surfaces while concrete is green. Grind smooth and patch with mortar if required, to make surface smooth.

C. Repair of Unformed Surfaces:

1. Slabs with low area and improper slopes to drains shall be corrected by the use of a polymer patching mortar.

    a. Sawcut the edges of the defective area to a minimum depth of ½ inch and roughen and clean hardened concrete. Coat surface with bonding grout or bonding compound.
    b. Mix polymer repair mortar in strict conformance with manufacturer's instructions.
    c. Apply fill to the required thickness and blend into adjacent areas. Finish surface to match surrounding concrete.

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2. Repair unformed surfaces that contain defects, which adversely affect the durability of the concrete. Surface defects, such as, include crazing, cracks in excess of 0.01 inch wide or which penetrate to the reinforcement or completely through concrete sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.
   a. Use high-pressure epoxy injection to repair cracks in beams and girders.
   b. Route a "v" groove in cracks at support slabs and slabs on grade, 3/8 inch wide at the top and 3/8 inch deep. Caulk with sealant specified in Section 07 92 00.
   c. Use polymer-patching mortar to repair crazing, spalling, pop-outs, honeycomb, rock pockets and other objectionable surface conditions.

D. Structural Repair:

1. All structural repairs shall be made with prior approval of the Architect as to method and procedure, using the specified low shrinkage structural repair mortar, epoxy adhesive and/or epoxy mortar. Where epoxy injection procedures must be used, an approved low viscosity epoxy made by the manufacturers previously specified shall be used.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Refer to Section 01 45 00 Article 1.11 of these Specifications for required tests and inspections to be provided by Testing Agency.

3.10 EVALUATION AND ACCEPTANCE CRITERIA

A. Evaluation and acceptance of work under this section shall be in accordance with the provisions of ACI 301 Subsection 1.6.6 and Section 1.7, and as amended below.

B. The Contractor should submit to the Architect copies of the Contractor's concrete protection records with maximum of information to aid in evaluation and acceptance of concrete durability. In the absence of such records, the records submitted by the Owner's Testing Agency will be used in considering durability parameters for acceptance per ACI 301 Subsection 1.7.5.

C. After the completion of all post-tensioned concrete work, and within one month prior to the scheduled completion of the project, the Architect will conduct an inspection of all post-tensioned concrete slabs exposed as wearing surfaces. The Contractor shall repair all cracks and other unacceptable conditions identified by this inspection in a manner acceptable to the Architect. The cost of any repairs required by this paragraph shall be borne by the Contractor.

3.11 MISCELLANEOUS CONCRETE REQUIREMENTS

A. All other concrete work indicated on the drawings shall be provided and installed, even though not specifically mentioned herein, to complete the work, including the following:

1. Anchors: Install anchors furnished under other sections in accordance with approved shop drawings and/or setting instructions.
2. Equipment Bases: Install concrete bases for all pumps, boilers, tanks, fans, transformers, floor mounted electrical equipment, etc., including anchor bolts and inserts in accordance with setting instructions furnished by the Contractor responsible for installing the equipment. Finish all bases in a workmanlike manner with a troweled finish. The bases shall be located and sizes determined by the Contractor furnishing the equipment.

END OF SECTION

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SECTION 03 41 00

STRUCTURAL PRECAST CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. The extent of work included in this Section is shown on the Drawings and is specified as follows:

1. Long-span double tee units.
2. Structural framing units including columns, beams and girders.
3. Exterior spandrels, wall panels and perimeter columns with Architectural precast finish.
4. Stairs and solid slab/plank units.
5. Loadbearing “light-wall” or “stitch-wall” units and solid shear wall units.
6. Fire walls and stair walls.
7. Platform slab units.

B. Provide all labor, materials, equipment, services and accessories necessary to furnish and install the work of this Section, complete and functional.

1.2 ACTION SUBMITTALS

A. Product Data: Submit manufacturer's specifications and instructions for manufactured materials and products. Include manufacturer's certifications and laboratory test reports as required.

B. Sustainability Submittals
1. For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content.
   a. Include statement indicating costs for each product having recycled content.
2. See Division 1 for additional Sustainability requirements.

C. Mix Designs: Submit written reports of each proposed concrete mix as specified in Part 2 of this section.

D. Shop Drawings: Submit shop drawings showing complete information for fabrication and installation of precast concrete units. Indicate member dimensions and cross section; location, size and type of reinforcement, including special reinforcement and lifting devices necessary for handling and erection. Detail fabrication of precast structure concrete units, including connections at member ends and to adjoining construction. Shop drawings shall be stamped and signed by a Professional Engineer licensed to practice in the State where the project is located.

E. Delegated-Design Submittal: For precast structural concrete indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

F. Indicate layout, dimensions, and identification of each precast unit corresponding to sequence and procedure of installation. Indicate welded connections by AWS Standard symbols. Provide location and details of inserts, connections, and joints, including accessories and construction at openings in precast units.

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1. Provide location and details of anchorage devices that are to be embedded in other construction. (foundations, structural support members other than precast concrete, etc.) Furnish templates if required for accurate placement.
2. Include erection procedure for precast units and sequence of erection.

G. Calculations: Provide stamped and signed design calculations prepared by the registered Professional Engineer licensed to practice in the State where the project is located. Precast concrete units and connections shall be designed to withstand all applicable loads required by governing codes and erection conditions. See Paragraph 1.3.G for detailed description.

H. Samples:

1. Submit three sets of samples approximately 12 inches by 12 inches by 2 inches to illustrate the quality, color, and texture of the surface finish for the Architectural Finish precast units; exterior spandrels, wall panels and perimeter columns.
2. Full Size Panel: Upon approval of small sample panels, and before fabrication of any other architectural precast concrete work commences, construct one full height panel approximately 8 feet long, and deliver it to the site at a location designated by the Architect. If this panel is approved by the Architect, it shall remain on site and be used as a standard of quality for architectural precast concrete work required for this project. Fabrication of the architectural precast work shall not commence until on-site, full-size panel has been approved by the Architect.

1.3 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of following codes, specifications and standards, except as otherwise indicated.

1. ACI 301 "Specifications for Structural Concrete".
2. ACI 318 "Building Code Requirements for Structural Concrete".
3. Concrete Reinforcing Steel Institute, "Manual of Standard Practice".
4. Prestressed Concrete Institute MNL 116, Manual for Quality Control for Plants and Production of Precast Concrete Products".
5. Prestressed Concrete Institute MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products".
6. Prestressed Concrete Institute MNL 135, "Tolerance Manual for Precast and Prestressed Concrete Construction".
7. Prestressed Concrete Institute, MNL 120, "PCI Design Handbook".
8. American Welding Society, AWS D1.1, "Structural Welding Code-Steel", D1.4 "Structural Welding Code – Reinforcing Steel", D1.6 "Structural Welding Code – Stainless Steel", C5.4, "Recommended Practices for Stud Welding".

B. Fabricator Qualifications: Firms which have five years successful experience in fabrication of precast concrete units similar to units required for this project will be acceptable. Fabricator must have sufficient production capacity to produce required units without causing delay in work.
1. Fabricator must be producer member of the Prestressed Concrete Institute (PCI) and/or participate in its Plant Certification Program.
2. Each facility utilized must be certified for the type of product produced.

C. Erector Qualifications: The erector must be certified by PCI and shall have five years successful experience in the erection of precast concrete units similar to those required for this project. Submit proof of current erection certification certified for complex structural systems.
1. Welder Qualifications: Field Welder shall be certified on the material and for the type of welding performed. Submit proof of current certification.

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D. Analysis and Design by the Professional Engineer retained by the Fabricator: The Professional Engineer shall have a minimum of five years of experience in designing Precast Concrete Parking Structures.

1. All precast concrete units and precast concrete structural frame shall be analyzed and designed by the fabricator to support self-weight, superimposed dead, live and impact loads, volume change and thermal loads, handling loads and lateral (including but not limited to wind and seismic) loads as required for compliance with the governing Building Code. In addition, the following shall be required of the precast concrete fabricator:
2. For precast concrete structures where stability of the structure and the structural resistance to the lateral loads in accordance with the governing Building Code is to be provided by the precast concrete components, walls, frames, braces, etc., either by themselves or in combination with other structural members, the precast concrete fabricator shall analyze the structure in accordance with the structural system identified in the contract documents. The fabricator shall calculate lateral loads as required by the Building Code to be used in such analysis.
3. The precast concrete fabricator shall provide complete analysis and design calculations prepared and stamped by the Registered Engineer, licensed in State where project is located. The information in the calculations shall be paginated, provided with the index page, and shall include the following as a minimum:
   a. Sketches of structural system(s) which have been analyzed.
   b. Calculation of the required gravity and lateral loads.
   c. Sketches of models analyzed (with node and member numbering per computer analysis, if used).
   d. Summary of material and member properties and boundary conditions assumed.
   e. Summary of individual loadings and load combinations.
   f. Reactions at supports and connections due to the loading combinations considered.
   g. Forces in most critical individual members due to the loading combinations considered.
   h. Design calculations of representative connections and member reinforcement.

   (Where word “Fabricator” is used, it means the Engineering Work to be done by the approved Professional Engineer retained by the Fabricator.)

E. Fire-Resistance Rated Precast Units: Where precast concrete units required by Code to meet a particular fire-resistance classification, provide units tested and listed by U.L. in "Fire-Resistance Directory", with each unit bearing U.L. label and marking, or in accordance with PCI Manual, MNL – 124, “Design for Fire Resistance of Precast Prestressed Concrete”.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver precast concrete units to project site in such quantities and at such times to assure continuity of installation. Store units at project site to prevent cracking, distortion, staining, or other physical damage, and so that markings are visible. Lift and support units at designated lift points.

B. Deliver anchorage items, which are to be embedded in other construction before start of such work. Provide setting diagrams, templates, instructions and directions as required for installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 “Quality Requirements”, to design precast concrete platform slab units.

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B. Design Standards: Comply with ACI 318 and with design recommendations in PCI MNL 120, "PCI Design Handbook – Precast and Prestressed Concrete", applicable to types of precast structural concrete units indicated.

C. Structural Performance: Precast structural concrete units and connections shall withstand design loads indicated within limits and under conditions indicated.

2.2 FORMWORK

A. Provide forms and where required, form facing materials of metal, plastic, wood, or other acceptable material that is non-reactive with concrete and will produce required finish surfaces.

B. Accurately construct forms, mortar-tight, of sufficient strength to withstand pressures due to concrete placing operations, temperature changes, and when prestressed, pretensioning and detensioning operations. Maintain formwork to provide completed precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified in PCI MNL 116.

2.3 REINFORCING MATERIALS

A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products with minimum 90 percent total recycled content, including at least 60 percent post-consumer recycled content.

B. Reinforcing Bars: ASTM A615, Grade 60, unless otherwise indicated. Reinforcement to be welded shall conform to ASTM A706 Grade 60.

C. Steel Wire: ASTM A82, plain, cold-drawn, steel.

D. Welded Wire Fabric: ASTM A185.

E. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing, complying with CRSI recommendations and according to PCI MNL 116.

1. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).

F. Coated Reinforcement

1. Epoxy Coated: ASTM A775. Fusion bonded coating apply after fabrication and bending. Film thickness of coating after curing to be 7 to 12 mils when measured in accordance with Method G12. Provide epoxy coated reinforcing as defined below.
   a. All reinforcement and/or welded wire fabric placed within the top 3" of precast concrete double tees.
   b. All reinforcement extending from precast concrete components into the cast-in-place concrete topping.
   c. All reinforcement placed into grouted joints between precast concrete units, if those joints are subject to elements or vehicular traffic.
   d. Support steel for all epoxy coated reinforcing steel.
   e. See Specification 03 20 00 for additional requirements

2. Epoxy Patching Compound: ASTM A775.

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2.4 PRESTRESSING TENDONS

A. Uncoated, 7-wire stress-relieved low-relaxation strand complying with ASTM A416. Use Grade 250 unless Grade 270 is indicated.
   1. Coat unbonded post-tensioning strand with post-tensioning coating complying with ACI 423.7 and sheath with polyprophylene tendon sheathing complying with ACI 423.7. Include anchorage devices and couple assemblies.

B. Strand similar to above, but having size and ultimate strength of wires increased so that ultimate strength of the strand is increased approximately 15 percent, or strand with increased strength but with fewer number of wires per strand, may be used at manufacturer's option.

2.5 CONCRETE MATERIALS

A. Portland Cement: ASTM C150, Type I or Type III.

   1. Use only one brand and type of cement, fly ash and round granulated blast furnace slag throughout project, unless otherwise acceptable to Architect.
   2. Uniformity of cured concrete appearance resulting from the concrete mix and its constituents, manufacturing or handling practices is the manufacturer’s responsibility.

B. Aggregates: ASTM C33, and as herein specified. Provide aggregates from a single source for exposed concrete.

C. Water: Potable.

D. Air-Entraining Admixture: ASTM C260.

E. Water-Reducing Admixture: ASTM C494, Type A, or other Type approved for fabricator's units.

F. Corrosion Inhibiting Admixture: ASTM C494 Type C. Refer to Section 03 30 10 of these specifications for non-corrosive, non-chloride accelerator and corrosion inhibiting admixture respectively.

2.6 CONNECTION MATERIALS

A. Carbon Steel Shapes and Plates: ASTM A36: All connection plates, bars and shapes shall be hot dip galvanized in accordance with ASTM A123 or A153 as applicable. Removal of zinc coating for welding and re-installation of the same after welding shall be per paragraph 3.1.C.2 of this specification section.

B. Anchor Bolts: ASTM A307, low-carbon steel bolts, regular hexagon nuts and carbon steel washers.

   1. Galvanized: Provide ASTM A307, hot-dip zinc coated, with ASTM A563 heavy hex nuts and carbon steel washers, hot-dip galvanized ASTM A153.

C. Threaded Fasteners: ASTM A307 or A325 heavy hexagon structural bolts, heavy hexagon nuts and washers.

   1. Galvanized: ASTM A307 or A325, with ASTM A563 heavy hex nuts and carbon steel washers, hot-dip galvanized ASTM A153.

D. Bolts at column splices: For anchoring columns within a 2’-0” height above a respective floor level, stainless steel anchor bolts conforming to ASTM F593, Group A, Type 304 shall be used together with

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corresponding stainless steel nuts and washers. For column splices outside of the 2'-0" zone above any floor level, see sub-paragraph C above.

E. Bearing Pads: Provide bearing pads for precast concrete units as indicated on drawings. At locations where bearing type is not specified, provide bearing pads for precast structural concrete units as recommended by precast fabricator for application.

1. Elastomeric Pads: Vulcanized, chloroprene elastomeric compound, molded to size or cut from a molded sheet, 50-60 shore A durometer.
2. Frictionless Pads: Tetrafluoroethylene (TFE), with glass fiber reinforcing as required for service load bearing stress.
3. Random Oriented Fiber Reinforced: Shall support compressive stress of 3,000 psi with no cracking, splitting or delaminating in internal portions of the pad. One specimen shall be tested for every 100 pads used.
4. Cotton Duck Layer Reinforced: Elastomeric pads with closely spaced layers of fabric meeting AASHTO specification section 18.10.2.
5. Plastic: Multi-monomer plastic strips shall be non-leaching and support construction loads with no visible overall expansion. Limit to plank bearing only.
6. Tempered or Untempered Hardboard: Limit use to plank bearing only. Do not use in areas where bearing material in service may remain wet for extended periods of time.

F. Tee Flange Connection: Plates and bars; stainless steel per ASTM A666, Type 304, Type 201L or Type 201LN.

G. Welding Electrodes: Comply with AWS standards.

H. Accessories: Provide clips, hangers, and other accessories required for installation of project units and for support of subsequent construction or finishes.

2.7 GROUT MATERIALS

A. Cement Grout: Portland cement, ASTM C150, Type I, and clean, natural sand, ASTM C404. Mix at ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum water required for placement and hydration.

B. Non-metallic, Shrinkage-Resistant Grout: Pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with ASTM C1107.

1. Products: Subject to compliance with requirements, products, which may be incorporated in the work, include, but are not limited to, the following:
   a. Euco N.S.: The Euclid Chemical Co.
   b. Crystex; L & M Construction Chemicals
   c. Masterflow 713 Plus; Master Builders
   d. Five Star Grout; U.S. Grout Corp.

2.8 PROPORTIONING AND DESIGN OF MIXES

A. Prepare design mixes for each type of concrete required in conformance with the requirements of Section 03 30 10 - Cast-in-Place Concrete.
1. Design mixes may be prepared by independent testing facility or by qualified precast manufacturing plant personnel, at precast manufacturer's option.

B. Produce standard weight concrete consisting of specified Portland cement, aggregates, admixtures, and water to produce the following minimum properties.

NOT FOR BIDDING

1. Compressive strength; 5000-psi minimum at 28 days. Release strength for prestressed units: 3500 psi.
2. Cure compression test cylinders using same methods as used for cast-in-place concrete work, and as required by the Section 01 45 00 of these Specifications.

C. Submit written reports to Architect and Engineer of proposed mix for each type of concrete at least 15 days prior to start of precast unit production. Do not begin concrete production until mixes and evaluations have been reviewed by Architect and Engineer.

D. Adjustment to Concrete Mixes: Mix design adjustments may be requested when characteristics of materials, job conditions, weather, test results, or other circumstances warrant. Laboratory test data for revised mix designs and strength results must be submitted to and accepted by Architect and Engineer before using in the work.

E. Sustainability Requirements
1. Provide cement with minimum 25 percent recycled content.

F. Admixtures:

1. Use air-entraining admixture in concrete and shall conform to the following air content limits, unless otherwise indicated. Total air content (percent by volume): 6% + 1-1/2% or 6% - 1%.
2. Use water-reducing admixtures in strict compliance with manufacturer's directions. Admixtures to increase cement dispersion, or provide increased workability for low-slump concrete, may be used subject to Architect's and Engineer’s acceptance.
3. Use amounts as recommended by admixture manufacturer for climatic conditions prevailing at time of placing. Adjust quantities of admixtures as required to maintain quality control.

G. Chloride Ion Content of Design Mix (ASTM C1218): For the purposes of this sub-section only, compliance to the requirements below shall be provided for elements of the structure exposed to the chloride ions in service. These include among others, precast concrete double-tees, double-ledger beams, single-ledger beams, spandrel beams, hollow-core slabs/planks, walls and columns in parking areas, reinforced concrete walls, columns and piers in parking areas, and cast-in-place concrete topping.

1. For protection against corrosion, maximum water soluble chloride ion concentration in hardened concrete at 28 days shall be limited to quantities indicated in the ACI 318 Table 4.4.1, except that percentages listed shall be taken against the weight of cementitious materials (Portland Cement plus Fly Ash or other pozzolans, plus GGBFS).
2. Mixes with the water soluble chloride ion concentration in excess of the limits per ACI 318 Table 4.4.1 as determined by testing per ASTM C1218, will not be accepted. The contractor shall identify the source of the excess chloride ions (aggregates, water, admixtures, etc.) take measures to remove it from the affected mix(es). Alternatively, the contractor may choose to use the specified corrosion inhibiting admixture at 1 gallon per cubic yard for every 0.01% of excess water soluble chloride ion, to the maximum of 3 gallons per cubic yard.

2.9 THIN BRICK VENEER

A. Materials:
1. General Shale Old Brick Originals US Modular Dover Blend
2. Endicott Clay Sands and/or Heritage US Modular Dover Blend
3. Metrobrick Vintage and/or Wirecut US Modular Dover Blend
4. Accepted Equal.

NOT FOR BIDDING

B. Grade: Exterior.

C. Brick Size: 2-1/4 inches high by 7-5/8 inches wide by 9/16 inch thick.

D. Maximum variation from indicated nominal dimensions:
   1. Length: Plus 0, minus 1/16 inch
   2. Height: Plus 0, minus1/16 inch
   3. Thickness: Plus or minus 1/16 inch

E. Brick color(s) shall match the brick of the adjacent Legislative building to the extent possible. US Modular Flemish Bond. Brick color shall be selected from full range of manufacturer's available colors.

F. Special Shapes: Include corners, edge corners, and end edge corners.

G. Cold Water Absorption at 24 hours: Maximum 6.5% when tested in accordance with ASTM C 67.

H. Efflorescence: Provide brick that has been tested in accordance with ASTM C 67 and rated "not effloresced."

I. Single– Use Template System for Brick Embed Application: modular templates formed of recyclable styrene plastic to surround single brick units, having factory- applied bond breaker.
   1. Template Dimensional Tolerances: Maximum variation from indicated nominal dimensions of brick cavities:
      a. Length: Plus or minus 1/64 inch.
      b. Height: Plus or minus 1/64 inch
      c. Depth: Plus or minus 1/64 inch
   2. Maximum variation from square, measured diagonally across non-adjacent corners: Plus or minus 1/64 inch.

J. Variation of Shape (Corners and Edgecaps) from Specified Angle: Plus or minus 1 degree.

K. Tensile Bond Strength: Not less than 150 psi, before and after freeze-thaw testing, when tested per modified ASTM E 488. Epoxy steel plate with welded rod on a single brick face for each test.

L. Freeze-Thaw Resistance: No detectable deterioration (spalling, cracking, or chafing) after 300 cycles when tested in accordance with ASTM C 666 Method A or B.

M. Modulus of Rupture: Not less than 250 psi when tested in accordance with ASTM C 67.

N. Chemical Resistance: Provide brick that has been tested in accordance with ASTM C 650 and rated "not affected".

O. Surface Coloring: Brick with surface coloring shall withstand 50 cycles of freezing and thawing per ASTM C 67 with no observable difference in applied finish when viewed from 20 ft (6 m).

P. Test sample size and configuration shall conform to the following parameters in order to validate compliance by brick manufacturer with PCI Specification for use in embedded brick precast concrete systems. Back surface texture of samples for tensile bond and freeze-thaw shall be the same.

Q. Minimum number of test specimens: Comply with appropriate ASTM specifications except for freeze-thaw and tensile bond strength tests on assembled systems.

NOT FOR BIDDING

R. Minimum number of test specimens for freeze-thaw and tensile bond strength tests: Ten (10) assembled systems measuring 8 x 16 in. long with the brick embedded into the concrete substrate (assembled system). The ten (10) assembled systems are divided into 5 Sample A assemblies and 5 Sample B assemblies. The precast concrete substrate shall have a minimum thickness of 2-1/2 in. plus the embedded brick thickness. The precast concrete shall have a minimum compressive strength of at least 5000 psi and 4 to 6% entrained air. The embedded brick coursing pattern for testing purposes shall be modular size brick on a half running bond pattern with a formed raked joint geometry of no less than 3/8 in. wide and a depth no greater than 1/4 in. from the exterior face of the brick.

S. One brick from the center of each Sample A assembly shall be tested for tensile bond strength, Item #12. In place of anchor specified in ASTM E488, use 3/8 in. minimum thickness steel plate of same size as single brick face bonded with epoxy to a single brick face for each tensile bond strength test. The steel plate shall have a centrally located pull-rod welded to the plate. Each Sample B assembly shall first be tested for freeze-thaw resistance, Item #13 and then one brick from the center of each Sample B assembly shall be tested for tensile bond strength, Item #12.

2.10 ARCHITECTURAL PRECAST

A. Architectural Precast Units: All exterior precast units including but not limited to columns, shear walls, light walls, wall panels, spandrel panels, and stair and elevator towers shall be cast and finished to produce an Architectural precast finish as follows:
   1. Precast Concrete PC-1 (Roughly Grid Location D-2 through D-6): Provide a mix of white cement with crushed red granite sand, crushed black granite sand, and red granite course aggregates as required to achieve Product #607 as presented on the Precast / Prestressed Concrete Institute Color and Texture Selection Guide. Precast units shall have an acid etched texture with a light sandblast finish. This applies to all exterior precast units in the region specified.
   2. Precast Concrete PC-2 (Remainder of Exterior Building): Provide a mix of white cement with white sand, and white limestone aggregates as required to achieve Product #143 as presented on the Precast / Prestressed Concrete Institute Color and Texture Selection Guide. Precast units shall have a medium sandblast finish. This color applies to all Architectural precast units in the region specified.
   3. Precast units shall be uniform in appearance, color and texture to match sample panels prepared by the Precaster and approved by the Architect.

2.11 FABRICATION

A. General: Fabricate precast concrete units complying with manufacturing and testing procedures, quality control recommendations, and dimensional tolerances of PCI MNL-116, and as specified for types of units required.

B. Ready-Mix Concrete: Comply with requirements of ASTM C94, and as herein specified.
   1. Delete references for allowing additional water to be added to batch for material with insufficient slump. Addition of water to batch will not be permitted.
   2. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required when the air temperature is between 85 deg. F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hour to 75 minutes and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

C. Cast in Anchors, Inserts, Plates, Angles, and other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Built-in Anchorages: Accurately position built-in anchorage devices and secure to formwork. Locate anchorages

NOT FOR BIDDING

where they do not affect position of main reinforcement or placing of concrete. Do not relocate bearing plates in units unless acceptable to Architect and Engineer.

1. Lifting devices shall be placed and cast so as not to weaken the unit during manufacturing, handling and erection. Such devices shall not interfere with the erection or placing of the unit in its final position in the building. These devices shall also be protected from rusting, or other deterioration or damage. Under no circumstances shall these devices be visible in the completed work.

D. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing precast structural concrete units to supporting and adjacent construction.

E. Cast-in Holes for openings larger than 10" diameter or 10" square in accordance with final shop drawings. Provide sleeves for horizontal electrical conduit runs and plumbing lines as required. Holes in precast flanges and other small holes that will be field cut by trades requiring them will not be allowed without prior approval by the Architect and the Precast Concrete Manufacturer. See Part 3 of this Section for additional information.

F. Coat Surfaces of forms with bond-breaking compound before reinforcement is placed. Provide commercial formulation form-coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces requiring bond or adhesion. Apply in compliance with manufacturer's instructions.

G. Clean reinforcement of loose rust and mill scale, earth and other materials, which reduce or destroy bond with concrete.

H. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required.

I. Place reinforcement to obtain at least the minimum cover for concrete protection. per ACI 318. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.

J. Pretensioning of tendons for prestressed concrete may be accomplished either by single strand tensioning method or multiple-strand tensioning method. Comply with PCI MNL-116 requirements.

K. Place concrete in a continuous operation to prevent formation of seams or planes of weakness in precast units, complying with requirements of ACI 304R. Thoroughly consolidate placed concrete by internal and external vibration without dislocation or damage to reinforcement and built-in items.

L. Identification: Provide permanent markings to identify pick-up points and orientation in structure, complying with markings indicated on final shop drawings. Imprint date of casting on each precast unit on a surface, which will not show in finished structure.

M. Curing by low-pressure steam, by steam vapor, by radiant heat and moisture, or other similar process may be employed to accelerate concrete hardening and to reduce curing time.

N. Delay detensioning of prestressed units until concrete has attained at least 3500 psi or higher as required by design.

1. If concrete has been heat-cured, perform detensioning while concrete is still warm and moist to avoid dimensional changes which may cause cracking or undesirable stresses in concrete.

NOT FOR BIDDING

2. Detensioning of pretensioned tendons may be accomplished either by gradual release of tensioning jacks or by heat cutting tendons, using a sequence and pattern to prevent shock or unbalanced loading.

O. Finish of Formed Surfaces: Provide finishes for formed surfaces of precast concrete as indicated for each type of unit, and as follows:

1. Standard Finish: Tees, Beams, Girders and Interior Columns - Normal plant run finish produced in forms that impart a smooth finish to concrete. Small surface holes caused by air bubbles, normal form joint marks, and minor chips and spalls will be tolerated, but no major or unsightly imperfections, honeycomb, or structural defects will be permitted.

P. Finish of Unformed Surfaces: Apply trowel finish to unformed surfaces unless otherwise indicated. Consolidate concrete, bring to proper level with straightedge, float and trowel to a smooth uniform finish. No surfaces exposed to freeze-thaw cycles in service shall be finished with power equipment, unless evidence acceptable to the Architect presented by the manufacturer that such a finishing does not reduce the amount of air entrainment in the top 1/8” of precast concrete.
1. Provide a broom finish on tees parallel with the long direction of the unit or swirl finish as approved by the Architect.
2. Provide an intentionally roughened surface (1/4” amplitude) on tees and beams to receive a concrete topping, where indicated on drawings and where required or determined by the precaster for erection/construction.

Q. For Structural Precast with architectural finish: Comply with the dimensional tolerances of PCI MNL 116.

R. Lift devices shall be placed and cast so as not to weaken the unit during manufacturing and handling. Such devices shall not interfere with the erection or placing of the unit in its final position in the building. These devices shall be cast into recesses or pockets to allow removal to at least one inch below the exposed concrete surface before patching. Exposed metal of these devices shall also be protected from rusting by cold galvanizing paint prior to patching. Recesses and pockets shall be patched as described later in Part 3 of this section. Under no circumstances shall they be visible in the completed work.

S. Discard and replace precast structural concrete units that do not comply with the requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 116 and meet Engineer’s approval.

2.12 LONG SPAN UNITS

A. Type: Plant fabricated, precast prestressed double tee concrete units, produced under rigid, factory-inspected process.

B. Furnish units, which are free of voids or honeycomb, with straight true edges and surfaces.

C. Provide "Standard Finish" units as specified.

D. Where ends of strands will not be enclosed or covered, cut flush and cover with high strength mortar, bonded to unit with epoxy resin bonding agent.

E. Adequately reinforce units to resist transporting and handling stresses.

F. Include cast-in weld plates where required for anchorage or lateral bracing to framing units and adjacent precast members.

NOT FOR BIDDING

G. Coordinate with other trades for installation of items to be cast in long-span units.

H. Provide block-outs for openings in accordance with design drawings or precast unit manufacturer's recommendations.

2.13 STRUCTURAL FRAMING UNITS

A. Type: Plant fabricated precast prestressed column, girder, floor and stair slab panels, wall panels and spandrel units produced under a rigid factory-inspected process.

B. Furnish units, which are free of voids or honeycomb, with straight true edges and surfaces.

C. Provide "Standard Finish" or “Architectural Finish” units as specified.

D. Where ends of strands will not be enclosed or covered, cut flush and cover with a high strength mortar bonded with an epoxy resin-bonding agent.

E. Adequately reinforce units to resist transporting and handling stresses.

F. Include cast-in weld plates where required for anchorage or lateral bracing to other supporting members.

G. Coordinate with other trades for the installation of items to be cast-in precast structural framing units.

2.14 SOURCE QUALITY CONTROL

A. The Owner may employ a separate testing laboratory to evaluate precast manufacturer's quality control and testing methods.

B. The precast manufacturer shall allow Owner's testing facility access to materials storage areas, concrete production equipment and concrete placement and curing facilities. Cooperate with Owner's testing laboratory and provide samples of materials and concrete mixes as may be requested for additional testing and evaluation.

C. Dimensional Tolerances: Units having dimensions smaller or greater than required, and outside specified tolerance limits of MNL 116, will be subject to additional testing as herein specified.

D. Precast units having dimensions greater than required will be rejected if appearance or function of the structure is adversely affected, or if larger dimensions interfere with other construction. Repair, or remove and replace rejected units as required to meet construction conditions.

1. Precast units having dimensions smaller than required will be rejected unless directed otherwise by the Architect and Engineer.

E. Strength of Units: The strength of precast concrete units will be considered potentially deficient if the manufacturing processes fail to comply with any of the requirements which may affect the strength of the precast units, including the following conditions.

1. Failure to meet compressive strength tests requirements.
2. Reinforcement, and pretensioning and detensioning of tendons of prestressed concrete, not conforming to specified fabrication requirements.
3. Concrete curing, and protection of precast units against extremes in temperature, not as specified.
4. Precast units damaged during handling and erection.

NOT FOR BIDDING

F. Testing Precast Units: When there is evidence that strength of precast concrete units does not meet specification requirements, the concrete testing service shall take cores drilled from hardened concrete for compressive strength determination, complying with ASTM C42 and as follows.

1. Take at least three representative cores from precast units of suspect strength, from locations directed by Architect and CM.
2. Test cores in a saturated surface dry condition per ACI 318 if concrete will be wet during use of completed structure.
3. Test cores in an air-dry condition per ACI 318 if concrete will be dry during use of completed structure.
4. Strength of concrete for each series of cores will be considered satisfactory if their average compressive strength is at least 85 percent of 28-day design compressive strength.
5. Test results will be made in writing on same day that tests are made, with copies to Architect, Contractor, CM, and precast manufacturer. Include in test reports the project identification name and number, date, name of precast concrete manufacturer, name of concrete testing service, identification letter, name, and type of member or members represented by core tests, design compressive strength compression breaking strength and type of break (corrected for length-diameter ratio), direction of applied load to core with respect to horizontal plan of concrete as placed, and moisture condition of core at time of bearing.

G. Patching: Where core test results are satisfactory and precast units are acceptable for use in work, fill core holes solid with patching mortar, and finish to match adjacent concrete surfaces.

H. Defective Work: Precast concrete units which do not conform to specified requirements, including strength, tolerances, and finishes, shall be replaced with precast concrete units that meet requirements of this section. Contractor shall also be responsible for cost of corrections to other work affected by or resulting from corrections to precast concrete work.

I. Repair Work: If repairs are required for any precast concrete member after casting, the Contractor shall submit a description of the repair (E.G. crack, spall, etc.) and a detailed description of the proposed fix to be used for Architect's and Engineer's review.
1. Mock-up: Upon acceptance by the Architect and Engineer of the Contractor's repair procedure, a single repair shall be made for Architect and Engineer review in accordance with the accepted procedure and, upon acceptance, this repair shall be maintained as a standard of acceptance for all future repairs of this type.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads during erection. All columns to be braced in all directions prior to erecting other members. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds.

B. Bearing Pads: Install flexible bearing pads where indicated, as precast units are being erected. Set pads on level, uniform bearing surfaces and maintain in correct position until precast units are placed.

C. Welding: Perform welding in compliance with AWS D 1.1, including qualification of welders.

1. Protect units from damage by field welding or cutting operations and provide non-combustible shield as required.
2. Zinc coated (galvanized) surfaces shall be properly prepared for welding by grinding the coating and ascertaining no inclusion of zinc into any weld.

NOT FOR BIDDING

a. Surfaces where zinc coating has been either removed for welding or damaged due to handling shall be repaired. Repair damaged metal surfaces by cleaning in accordance with SSPC-SP6 and applying a coat of approved galvanizing repair compound. Where cleaning per SSPC-SP6 is impractical, use SSPC-SP3 standard. In all instances of coating repair on shop galvanized surfaces, the surface preparation prior to coating application as well the application of the coating shall be witnessed by the Owner's Testing Agency per Section 01 45 00 of these Specifications.

D. Powder-Actuated Fasteners: Do not use powder-actuated fasteners for surface attachment of accessory items in precast, prestressed unit unless otherwise accepted by precast manufacturer.

E. Erection Tolerances: Install precast units without exceeding tolerance limits specified in PCI MNL-127 "Recommended Practice for Erection of Precast Concrete" or PCI MNL-120 Chapter 8.

F. Grouting Connections and Joints: After precast concrete units have been placed and secured, grout open spaces at connection and joints as follows:
1. Non-structural joints: The joints shall be grouted with material per paragraph 2.6A of this Section.
2. Structural joints: shrinkage-resistant grout consisting of premixed compound and water to provide a flyable mixture without segregation or bleeding.

Provide forms or other acceptable method to retain grout in place until sufficiently hard to support itself. Pack spaces with stiff grout materials, tamping until voids are completely filled. Place grout to finish smooth, plumb, and level with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it hardens.

G. Close coordination and cooperation must be maintained between the General Contractor and the Precast Concrete Fabricator to overcome any physical obstructions in the area of the work which would prevent suitable access for trucks and cranes in the delivery, receipt and placing of the precast material.

H. Any attachments made to the precast units in the field must be accepted by the Precast Concrete Fabricator as well as the Architect and Engineer to avoid cutting or otherwise damaging the prestressing tendons or reinforcing steel.

I. If field cut openings are required by the Contractor, the Contractor shall coordinate with the Precast Concrete Fabricator. Locations and sizes shall be approved by the Architect and Engineer.

J. Protection of Existing Structure: Protect the existing structure during installation of new precast platform slabs. Any damage to existing platform shall be repaired by the Contractor at the Contractor's expense.

3.2 ADJUST AND CLEAN

A. Plank and tees that are broken, cracked or chipped shall be repaired or replaced, as directed by the Architect and Engineer.

B. After erection and grouting is completed be responsible for the protection of slabs and wall panels.

C. Surfaces to receive topping shall be clean and thoroughly saturated prior to placing topping slab.

D. Patch lifting pockets, inserts and other openings with patching mortar blended to match the color of the surrounding concrete. See Section 03 30 10 for patching materials.

E. Patch defective areas with cement mortar and bonding agents as specified in Section 03 30 10. Blend patching mortar to match surrounding area.

NOT FOR BIDDING

F. Repair or patch architectural concrete with mortar material identical in color to precast members so that when dry, the repair will match surrounding concrete surface.

G. As directed by the Architect and Engineer, repair cracks in structural members with low viscosity epoxy, pressure injected or route a “V” groove over cracks and caulk with sealant. See Section 03 30 10 and Section 07 92 00 for materials.

3.3 Remove rubbish and debris resulting from precast concrete work from premises upon completion. Protect work of this Section from fabrication to the completion of installation.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
1. Erection of precast structural concrete members.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Visually inspect field welds and test according to ASTM E 165 or to ASTM E 709 and ASTM E 1444. High-strength bolted connections are subject to inspections.

D. Testing agency will report test results promptly and in writing to CM and Engineer.

E. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.

F. Additional testing and inspecting, at Contractor’s expense, shall be performed to determine compliance of replaced or additional work with specified requirements.

G. Prepare test and inspection reports.

3.5 REPAIRS

1. Repair precast structural concrete units if permitted by Engineer.

   a. Repairs may be permitted if structural adequacy, serviceability, durability, and appearance of units have not been impaired.

2. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet.

3. Remove and replace damaged precast structural concrete units that cannot be repaired or when repairs do not comply with requirements as determined by Engineer.

3.6 CLEANING

A. Clean mortar, plaster, fireproofing, weld slag, and other delirious material from concrete surfaces and adjacent materials immediately.

NOT FOR BIDDING

B. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.

1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's written recommendations. Protect other work from staining or damage due to cleaning operations.
2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finished or damage adjacent materials.

3.7 CERTIFICATION

A. After the completion of the project, the Registered Professional Engineer retained by the Precast Fabricator (who certified precast drawings and calculations), shall inspect all the precast framing and connections in the field and submit a letter certifying that all members and connections have been observed and the as-built conditions are in accordance with the approved shop drawings and calculations.

END OF SECTION

NOT FOR BIDDING

SECTION 04 20 00

UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. The extent of work included in this Section is shown on the Drawings and is specified as follows:

1. All labor, materials, equipment and services necessary for and incidental to the furnishing and installation of concrete masonry units as well as built-in metal doorframes.

2. Coordination and placement of built-in loose steel lintels.

1.2 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 SUBMITTALS

A. Manufacturer's Data: Submit manufacturer's data for concrete masonry units required, including certified copies of laboratory test reports and other data as may be required to show compliance with the specified requirements.
   1. For fire rated masonry units, include data showing compliance with acceptable authorities.

B. Shop Drawings: For the following:
   1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
   2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
   3. Reinforced Masonry: Provide minimum ¼" scale detailed shop drawings showing bar sizes, locations, spacing, quantities, bends, cutting, and supporting devices. Provide elevations of all reinforced assemblies showing the reinforcing to be used.

C. Samples: Submit samples of each type of masonry unit specified. Select units to show the range of color and texture which can be expected in the finished work.

D. Material Certificates: For each type and size of the following:
   1. Masonry units: For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units. Include compliance with fire resistance ratings.
   2. Reinforcing bars.
   3. Joint reinforcement.
   4. Anchors, ties, and metal accessories.

E. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

NOT FOR BIDDING

F. Submit proposed mix designs for each type of mortar and grout used.

1.4 QUALITY ASSURANCE

A. Codes: Comply with the applicable requirements of governing authorities and codes for the types of masonry construction shown.
   1. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

B. Fire Resistance: Where fire-resistance ratings are indicated or required by authorities having jurisdiction, provide materials and construction which is identical to assemblies whose fire-resistance rating has been tested in compliance with ASTM E119 and authorities having jurisdiction.

C. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

D. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitous component and from single source or producer for each aggregate.

E. Coordination: Review installation procedures and coordinate with work that must be integrated with masonry.

F. Construction Tolerances: Lay-up all wall and partitions plumb and true with courses level and accurately spaced and coordinated with other work. Variations from plumb, true or level of more than 1/8 inch in 10 feet-0 inches in any direction are unacceptable.

G. Job Mock-up: prior to installation of masonry work, erect sample wall panel mock-up using materials, bond and joint tooling shown or specified for final work. Build mock-up at the site, where directed, of full thickness and approximately 4 feet x 3 feet, unless otherwise shown, indicating the proposed range of color, texture and workmanship to be expected in the completed work. Obtain Architect's acceptance of visual qualities of the mock-up before start of masonry work. Retain mock-up during construction as a standard for judging completed masonry work. Do not alter, move or destroy mock-up until work is completed.

H. Provide adequate bracing of walls during erection to prevent damage due to high winds or other lateral loads until permanent bracing is installed. Contractor shall assume all responsibility for damage due to failure to take such precautions.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

NOT FOR BIDDING

D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 PROJECT CONDITIONS

A. Masonry Protections:

1. Protect masonry materials during storage and construction from wetting by rain, snow or ground water and from soilage or intermixture with earth or other materials.
2. In exposed work, do not use masonry units with chips, cracks, voids, discolorations or other defects, which might be visible or cause staining in finished work.
3. Protect partially completed masonry against weather, when work is not in progress, by covering top of walls with strong, waterproof, non-staining membrane.
4. Protect masonry from freezing when the temperature of the surrounding air is 40 degrees F. and falling. Heat materials and provide temporary protection of completed portions of masonry work. Comply with governing codes and NCMA TEK 16 recommendations for cold weather concrete masonry construction.
5. Frozen Materials: Do not use frozen materials or materials mixed or coated with ice or frost.

B. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

C. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

A. Regional Materials: Provide CMUs that have been manufactured within 500 miles of Project site from aggregates and cement that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Units: Hollow load-bearing, ASTM C90. Aggregate shall conform with ASTM C33.

NOT FOR BIDDING

1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2500 psi, ASTM C 90.
2. Density Classification: Normal weight, 125 PCF.
3. Size: Manufacturer's standard units with nominal face dimensions of 16 inches long x 8 inches high. Provide thicknesses indicated on the drawings.
4. Special Shapes: Provide special shaped units for lintels, corners, jambs, headers, control joints and other conditions. Never expose cores.
5. Color/Finish: Provide manufacturers standard units suitable for field applied paint finish unless otherwise noted on the drawings.

2.3 MORTAR & GROUT MATERIALS

A. Regional Materials: Provide aggregate for mortar and grout, cement, and lime that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Portland Cement: ASTM C150, Type I, non-staining, without air entrainment and of natural color or white to produce the required color of mortar or grout.

1. Use Type III high-early-strength as required for laying masonry in cold weather.
2. Efflorescence: Provide cement that exhibits no efflorescence when tested in conformance with standard efflorescence test, ASTM C67, modified to use 2" x 7" x 2-1/2" mortar samples consisting of a mixture of 1 part by weight of cement under test and 2 parts of sand mixed to a flow of 100% with water.
3. Color: Provide cement color as necessary to provide mortar color indicated as approved by Architect.
4. Restrictions: Do not use masonry cement, blended hydraulic cement, fly ash, pozzolans, or blast furnace slag.

C. Hydrated Lime: ASTM C207, Type S.

D. Aggregates for Mortar: ASTM C144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

E. Aggregate for Grout: ASTM C 404.

F. Water: Clean, free of deleterious materials, which would impair strength or bond.

G. Mortar Mix:

1. Type S for reinforced and load bearing masonry; ASTM C270
2. Type N for masonry above grade and interior work.
3. Type M for masonry below grade and in contact with earth.

H. Grout for Masonry Fill: Portland cement, sand, gravel and water, proportioned as required to provide a 28-day minimum compressive strength of 2000 psi.

2.4 REINFORCEMENT, TIES & ANCHORS

A. Masonry Joint Reinforcement, General: ASTM A 951.

NOT FOR BIDDING

B. Horizontal Joint Reinforcement: Provide galvanized ladder or truss type reinforcement with a single pair of side rods for single wythe masonry equal to Durowal "Standard" types unless otherwise noted.

1. Wire: 9 (nine) gauge side and cross rods hot-dip galvanized in conformance with ASTM A153, Class B2, 1.5 oz. per sq. ft.
2. Corners and Intersections: Provide prefabricated corners and tees.
3. Width: Provide one side rod for each concrete masonry shell face. Provide width as recommended by manufacturer for wall width and which gives at least 5/8" minimum cover on exterior walls.

C. Reinforcing Steel: Provide deformed rebars complying with ASTM A615, Grade 60.

D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

E. Partition Top anchors: 0.105-inch- thick metal plate with 3/8-inch- diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

2.5 ISOLATION CONTROL GASKETS

A. Gaskets: Closed cell neoprene conforming to ASTM C509 equal to "Everlastic Neoprene" Type NN as manufactured by William Products, Inc.

2.6 MORTAR AND GROUT MIXES

A. General: 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. Use portland cement-lime mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

1. For masonry below grade or in contact with earth, use Type M.
2. For reinforced masonry, use Type S.
3. For above-grade, load-bearing and non-load-bearing walls Type N.
4. For interior non-load-bearing partitions, Type N.

C. Grout for Unit Masonry: Comply with ASTM C 476.

1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C 476, paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.

NOT FOR BIDDING

3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143, unless otherwise directed by the Architect.

PART 3 - EXECUTION

3.1 CONDITION OF SUBSTRATE

A. Examine the areas and conditions under which unit masonry work is to be installed. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Do not wet concrete masonry units.

3.3 INSTALLATION, GENERAL

A. Thickness: Build single-wythe walls to the actual thickness of the masonry units, using units of nominal thickness shown or specified.

B. Cut masonry units using motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide pattern shown and to fit adjoining work neatly. Use full-size units without cutting wherever possible.

3.4 LAYING MASONRY WALLS

A. General:

1. Do not use mortar or grout which has begun to set or if more than 2-1/2 hours have elapsed since initial mixing. Re-temper mortar during the 2-1/2 hour period only as required to restore workability.
2. Layout walls in advance for accurate spacing of surface bond patterns with uniform joint widths and to properly locate openings, movement-type joints, returns and offsets. Avoid the use of less-than-half-size units at corners, jambs and wherever possible at other locations.
3. Lay-up walls plumb and true to comply with specified tolerances, with courses level, accurately spaced and coordinated with other work.
4. Pattern Bond: Lay concrete masonry units in running bond with vertical joint in each course centered on units in courses above and below, unless otherwise shown on the drawings.

B. Mortar Bedding and Jointing:

1. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course on floor slabs and where adjacent to cells or cavities to be reinforced or filled with concrete or grout.
2. Joint Width: Lay masonry with 3/8-inch wide joints, unless otherwise indicated.
3. Lay solid masonry units with completely filled bed and head joint; butter ends with sufficient mortar to fill head joints and shove into place. Do not slush head joints.
4. Tool exposed joints slightly concave unless otherwise shown. Compress mortar to form a dense, smooth, water-tight surface.

NOT FOR BIDDING

5. Remove masonry units disturbed after laying; clean and reset in fresh mortar. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

C. Stopping and Resuming Work: Rake back 1/2-block length in each course; do not tooth. Clean exposed surfaces of set masonry and remove loose masonry units and mortar prior to laying fresh masonry.

D. Grouting: Grout cells of masonry units where shown and at all masonry lintels, bond beams, jambs and bearing points. Fully grout concrete masonry for three full courses below bearing points. Fully grout metal frames built into masonry work. Fully grout cells of masonry units, which contain vertical reinforcing bars.
1. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.
2. Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
3. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
4. Limit height of vertical grout pours to not more than 60 inches.
5. Pour grout using container with spout and consolidate immediately by rodding or puddling; do not use trowels. Place grout continuously; do not interrupt pouring of grout for more than one hour. Terminate pour 1-1/2 inches below top of highest course in pour.

E. Expansion Joints: Provide expansion, and isolation joints in masonry where shown. Build-in related items as the masonry work progresses. Rake out mortar in preparation for application of caulking and sealants. See "Caulking, Sealing, and Joint Fillers" section.

1. If expansion joints are not shown, provide joints 30 feet o.c. throughout the work.
2. For non-load bearing work allow for deflection between top of walls and structure above. Maintain lateral stability with concealed clip angles attached to structure above in a manner acceptable to Architect. Provide compressible fillers and joint sealers to maintain acoustical performance of wall assembly.

3.5 REINFORCEMENT, TIES AND ANCHOR INSTALLATION

A. Horizontal Joint Reinforcing: Provide continuous horizontal joint reinforcing as shown and specified. Fully embed longitudinal side rods in mortar for their entire length with a minimum cover of 5/8 inch on side of walls. Lap reinforcement a minimum of 6 inches at ends of units.

1. Reinforce all single wythe or multi-wythe walls with continuous horizontal joint reinforcing not more than 16 inches on center vertically unless otherwise shown.
2. Space reinforcing at 8 inches o.c. above and below openings and extend reinforcing at least 2 feet beyond each jamb.

B. Reinforced Concrete Masonry: Reinforce concrete masonry units where shown on the drawing with #4 rebars at 16 inches o.c. unless otherwise noted. Provide horizontal joint reinforcing as stated above.

3.6 LINTEL INSTALLATION

A. Metal Lintels: Install loose metal lintels where shown on the Drawings.

B. Masonry Lintels: Provide masonry lintels where indicated and wherever openings are shown without another type of lintel. Provide precast, preformed or built-in-place lintels which are adequate for loading conditions encountered. Provide at least 8 inches of bearing at each end. Obtain Architect's approval of all masonry lintels used.

NOT FOR BIDDING

3.7 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
2. For conspicuous horizontal lines do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
4. For conspicuous vertical lines do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.8 REPAIR, POINTING AND CLEANING

A. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge any voids or holes, and completely fill with mortar. Point-up all joints at corners, openings and adjacent work to provide a neat, uniform appearance, properly prepared for application of caulking or sealant compounds.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

NOT FOR BIDDING

2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent nonmasonry surfaces from contact with cleaner.
4. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.9 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Excess Masonry Waste: Remove excess masonry waste, and legally dispose of off Owner's property.

END OF SECTION

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SECTION 04 26 16

ADHERED MASONRY VENEER

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Thin Brick.

B. Mortar.

C. Weather-resistive Barrier

D. Adhesives.

E. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 41 00 - Structural Precast Concrete: Thin brick at concrete elements.

B. Section 05 40 00 - Cold-Formed Metal Framing: Steel stud backup for masonry veneer.

C. Section 07 62 00 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.

D. Section 07 92 00 - Joint Sealants: Sealing control and expansion joints.

1.03 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. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2023.

C. ASTM C91/C91M - Standard Specification for Masonry Cement; 2023.

D. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.

E. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2018.

F. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019a, with Editorial Revision.

G. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2018.

H. ASTM C1088 - Standard Specification for Thin Veneer Brick Units Made from Clay or Shale; 2023.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.

J. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2024.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for thin brick units, mortar, grout, and adhesive.

C. Samples: Submit four samples of thin brick units to illustrate color, texture, and extremes of color range.

D. Manufacturer's Certificate: Certify that thin brick units, adhesives, mortar, and grout meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

1.06 MOCK-UPS

A. Construct a mock-up panel sized 8 feet long by 6 feet high; include mortar, grout, substrate, and representative wall openings in mock-up.

B. Locate where directed.

NOT FOR BIDDING

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

B. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

1.08 FIELD CONDITIONS

A. Do not install adhesives in an unventilated environment.

PART 2 PRODUCTS

2.01 THIN BRICK

A. Manufacturers:
   1. Endicott Clay Products Co; Clay Sands and/or Heritage US Dover Blend: www.endicott.com/#sle.
   2. General Shale Brick; Old Brick Originals US Modular Dover Blend: www.generalshale.com/#sle.
   3. Metro Brick; Vintage and/or Wirecut US Modular Dover Blend: www.metrothinbrick.com/#sle.
   4. Architectural Polymers; www.apformliner.com
   5. Approved Equal.
   6. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ADHESIVE MATERIALS

A. Thin-Set Mortar: ANSI A118.4, polymer-modified; freeze-thaw stable.

B. Epoxy Adhesive: ANSI A118.3, thinset bond type.

C. Thin Brick Setting Adhesive: Elastomeric, waterproof, liquid applied.

2.03 MORTAR MATERIALS

A. Masonry Cement: ASTM C91/C91M Type N.

B. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.

C. Hydrated Lime: ASTM C207, Type S.

D. Grout Aggregate: ASTM C404.

E. Water: Clean and potable.

2.04 MORTAR MIXES

A. Mortar for Unit Masonry: ASTM C270, Proportion Specification.
   1. Exterior, non-loadbearing masonry: Type N.

B. Mixing: Use mechanical batch mixer and comply with referenced standards.

2.05 FLASHINGS

A. Metal Flashing Materials: Copper, see Section 07 62 00.

B. EPDM Flashing: ASTM D4637/D4637M, Type I, 0.040 inch thick.

C. Rubberized Asphalt Flashing: Self-adhering composite material comprising rubberized asphalt adhesive compound bonded to cross-laminated polyethylene film, minimum 0.030 inch total thickness.

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.

2.06 LATH

A. Glass-FIber Lath with Rainscreen Drainage Sheet: Factory-assembled combination of dimpled and grooved high-density polyethylene drainage sheet and woven alkali-resistant glass-fiber lath.

NOT FOR BIDDING

1. Overall Thickness: 4/10 inch.
2. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less (Class A), when tested in accordance with 1.

B. Glass-Fiber Lath: Open weave, self-furred, 1/8 inch thick glass fiber reinforcing lath, 39 inches wide and weighing 4.34 ounces per yard.

C. Corner Mesh: Formed sheet steel, minimum 0.018 inch thick, perforated flanges shaped to permit complete embedding in plaster, minimum 2 inch size; same finish as lath.

D. Strip Mesh: Expanded metal lath, same weight as lath, 2 inch wide by 24 inch long; same finish as lath.

E. Beads, Screeds, Joint Accessories, and Other Trim: Depth governed by plaster thickness, maximum possible lengths.
1. Material: Formed sheet steel with rust inhibitive primer, expanded metal flanges.

2.07 ACCESSORIES

A. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

B. Air and Water-Resistive Barrier: Single component, fluid applied, vapor permeable; waterproofing, crack isolation, and air barrier membrane.
1. Manufacturers:
a. LATICRETE International, Inc; LATICRETE MVIS Air & Water Barrier: www.laticrete.com/#sle.
b. WR Meadows; www.wrmeadows.com
c. Sika Corporation; WeatherTech WeatherBlock VB AB: www.parexusa.com/#sle.
d. Approved Equal.
e. Substitutions: See Section 01 60 00 - Product Requirements.

2.08 THIN BRICK PANEL SYSTEM

A. Thin Brick Panel System with Mesh Backing: Thin brick factory-mounted and -aligned on mesh sheets.
1. Adhesive: Manufacturer's recommended type.
2. Grout: Manufacturer's recommended type.
3. Caulk Joints: Sealant type and location recommended by manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive thin brick veneer.

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 installation of thin brick veneer.

3.02 INSTALLATION

A. Exterior Applications: Comply with TCNA (HB) Method W201, W202, or W244E.

B. Install metal lath with rainscreen drainage material in accordance with the manufacturer's instructions.

C. Thin Brick Panel System: Install according to manufacturer's written instructions.

3.03 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. Brick Units:
1. Bond: Flemish.
2. Coursing: Three units and three mortar joints to equal 8 inches.
3. Mortar Joints: Flush.

NOT FOR BIDDING

3.04 PLACING AND BONDING

A. Remove excess mortar as work progresses.

B. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove and replace.

C. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

3.05 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.

3.06 TOLERANCES

A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

B. Maximum Variation from Plane of Wall: 1/4 inch in 10 feet and 1/2 inch in 20 feet or more.

C. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

D. Maximum Variation from Level Coursing: 1/8 inch in 3 feet and 1/4 inch in 10 feet; 1/2 inch in 30 feet.

E. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.

3.07 CUTTING AND FITTING

A. Cut and fit for pipes and conduit. Coordinate with other sections of work to provide correct size, shape, and location.

3.08 CLEANING

A. Clean soiled surfaces with cleaning solution.

3.09 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

NOT FOR BIDDING

SECTION 05 12 00

STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SUMMARY

A. The extent of work included in this Section is shown on the Drawings and is specified as follows:

1. All labor, materials, equipment and services necessary for and incidental to the furnishing and installation of structural steel, as defined in the AISC "Code of Standard Practice."

1.2 SUBMITTALS

A. Manufacturer's Data:

1. Submit copies of producer's or manufacturer's specifications and installation instructions for the following products. Include laboratory test reports and other data as required to show compliance with these specifications.

   a. Structural steel (each type), including certified copies of mill reports covering the chemical and physical properties.
   b. High-strength bolts (each type), including nuts and washers.
   c. Unfinished bolts and nuts.
   d. Paint products.
   e. Shrinkage-resistant grout.
   f. Description of each type of welding stud and arc shield.

B. Shop Drawings:

1. Submit shop drawings including complete details and schedules for fabrication and shop assembly of members, and details, schedules, procedures and diagrams showing the sequence of erection.
2. Shop drawings submitted shall be signed and sealed by a Qualified Structural Engineer.
3. Review of shop drawings will be for general considerations only. Compliance with requirements for materials fabrication and erection of structural steel is the Contractor's responsibility.

   a. Include details of cuts, connections, camber, holes, and other pertinent data. Indicate welds by standard AWS symbols, and show size, length, and type of each weld.
   b. Provide setting drawings, templates, and directions for the installation of anchor bolts and other anchorages to be installed by others.
   c. Shop drawings shall include complete details of the painting work to be performed.

C. Erection Procedure: Submit data, illustrative and written to describe the structural steel erection procedure, including the sequence of erection and temporary staying and bracing. Contractor shall provide sufficient bracing, etc. so that the erected steel is stable during construction or until all the concrete slabs are poured.

D. Welding Procedure and Equipment:

NOT FOR BIDDING

1. Submit written description as required to illustrate each welding procedure to be performed in the specified work.
2. Submit descriptive data for field welding equipment, including type, voltage and amperage.

1.3 QUALITY ASSURANCE

A. Codes and Standards: Comply with the provisions of the following codes and standards except as otherwise indicated:

1. AISC "Code of Standard Practice for Steel Buildings and Bridges".
2. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" and including the "Commentary" and supplements thereto as issued.
3. AISC "Specifications for Structural Joints using ASTM A325 OR A490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.
4. AWS D1.1 "Structural Welding Code".
5. ASTM A6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use".

B. Qualifications:

1. Qualify welding processes and welding operators in accordance with AWS D1.1.
2. Provide certification that welders to be employed in the work have satisfactorily passed AWS qualification tests within the previous 12 months.
3. All welders working on this project will be assigned an identifying symbol or mark. Each welder will be required to mark or stamp his symbol on each weldment completed for identification. Contractor shall maintain a record of welders employed, date of qualification and symbol or identification mark assigned to each.
4. Steel Fabricator: Fabricator shall have not less than five (5) years experience in the fabrication of structural steel. Submit a written description of fabrication ability including fabricating and surface preparation facilities, personnel and list of similar completed projects.
5. Steel Erector: Erector shall have not less than five (5) years experience in the erection of structural steel. Submit a written description of structural steel erection ability including equipment, personnel and a list of similar completed projects.

C. Source Quality Control:

1. Materials and fabrication procedures are subject to inspection and tests in the mill, shop, and field by the Architect. Such inspections and tests will not relieve the Contractor of responsibility for providing materials and fabrication procedures in compliance with specified requirements.

D. Design of Members and Connections:

1. All details shown are typical, similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at the site whenever possible without causing delay in the work.
2. Promptly notify the Architect whenever design of members and connections for any portion of the structure are not clearly indicated.

E. Steel Testing: Materials and installed work may require testing and retesting, as directed by the Architect, at any time during the progress of the work. Allow free access to material stockpiles and facilities at all times. Tests, not specifically indicated to be done at the Owner's expense,

NOT FOR BIDDING

including the retesting of rejected materials and installed work, shall be done at the Contractor's expense.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the site at such intervals to insure uninterrupted progress of the work.
   1. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete or masonry, in ample time to not delay that work.

B. Store materials to permit easy access for inspection and identification. Keep steel members off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.
   1. Do not store materials on the structure in a manner that might cause distortion or damage to the members of the supporting structures. Repair or replace damaged materials or structures as directed.

C. Handling, shipping, and erecting of painted steel shall not be performed until thoroughly dry. Special care shall be exercised to avoid abrasion or other damage to the coated surfaces. Stacking and storing of painted members in the shop, in transit, and at the job site shall be done using softeners and timbers to keep individual members free from contact with the ground, and with each other; and shall be protected from soiling by adjacent fabrication of construction operations.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. Steel Base Plates: ASTM A36, Grade 36, except where other type steel is shown.

B. Structural Steel Beams, Columns, and Cross Bracing Members, Low Alloy Steel: ASTM A572 Grade 50 or 50W.

C. Cold-Formed Steel Tubing: ASTM A500, Grade B, Fy 46 ksi.

D. Steel Pipe: ASTM A53, Type E or S, Grade B, double extra strong.

E. Carbon Steel Castings: ASTM A27, Grade 65-35, medium-strength carbon steel.

F. Anchor Bolts: ASTM A307, nonheaded type unless otherwise indicated.

G. Headed Stud Type Shear Connectors: ASTM A108, Grade 1015 or 1020, cold finished carbon steel; with dimensions complying with AISC Specifications.

   1. Studs shall be end welded, spacing as per drawings or the number of studs per beam length to be uniformly distributed in a zigzag pattern along the length of the beam.
   2. Mechanical properties of finished studs, ASTM A370, shall be:

      a. Minimum tensile strength, 60,000 psi.
      b. Minimum yield strength, 50,000 psi (2% offset).
      c. Minimum elongation, 20% in 2 inches.

H. High-Strength Bolts and Nuts: Heavy hexagonal structural bolts, heavy hexagon nuts, and hardened washers, all galvanized and complying with ASTM A325.

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I. Electrodes for Welding: Comply with AWS Code.

J. Filler Material for Welding:

1. Shielded metal-arc welding AWS A5.1
2. Welded joints designed using E7018 low hydrogen electrodes.
3. Fabricator or Erector may substitute filler material in accordance with Section 1.17.2 of AISC Specification for Structural Steel for Buildings after obtaining Architect's approval.

K. Metallic Non-Shrink Grout: Corps of Engineers CRD-C588, Type M, pre-mixed factory-packaged ferrous aggregate grouting compound.

1. Products offered by manufacturers to comply with the requirements include the following:

a. Embeco; Master Builders.
b. Ferrolith G; Sonneborn.
c. Irontox; Toch Brothers.
d. Kemox C; Sika Chemical.
e. Vibra-Foil; W.R. Grace.
f. Or approved equal

L. The coatings materials specified are products of the Tnemec Company. Equal products by Koppers, Dupont or an approved equal will be considered for approval if submitted with a copy of data sheets that include performance criteria of the proposed coating and color charts. Minimum dry film thickness herein specified shall hold precedence over whatever recommendations are made for other supplier's products. Colors shall be as selected by the Architect.

M. The coatings system shall consist of the following:

1. Shop Applied Primer: No. 90-97
Tneme-Zinc at 2.0 to 4.0 mils
dry film thickness.
2. Shop Applied Topcoat: No. 73
Endurashield III at 3.5 to 5.0 mils
dry film thickness.
3. Field Touch-up: No. 50-330
Poly-ura-primer at 2.0 to 4.0 mils
dry film thickness

N. The manufacturer's printed label instructions for all handling, applying, and re-coat intervals for the coatings system shall be followed. No work shall be performed when temperature and humidity conditions are outside the limitations stated by the coatings manufacturer.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. The Owner shall employ an approved testing laboratory to perform field quality control testing.

B. Provide access for the Architect to places where structural steel work is being fabricated or produced.

C. The Architect reserves the right, at any time before final acceptance, to reject material not complying with specified requirements.

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D. Correct deficiencies in structural steel work, which inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests as may be necessary to reconfirm any non-compliance of the original work, and as may be necessary to show compliance of corrected work.

E. All certificates and reports as specified shall be submitted to the Architect. A Testing Agency shall be employed by the Owner for the tests specified below, and for other tests as may be required.

F. The Testing Agency shall perform the following tests:

1. Shop Welding: Inspect and test during fabrication of structural steel assemblies, as follows:

    a. Certify welders and conduct inspections and tests as required. Record types and locations of all defects found in the work. Record work required and performed to correct deficiencies.
    b. Perform visual inspection of all welds.
    c. Perform tests of welds as follows:

        1) Magnetic Particle Inspection: ASTM E709; performed on the root pass and on the finished weld. Cracks or zones of incomplete fusion or penetration not acceptable.
        2) Radiographic Inspection: ASTM E94; minimum quality level "2-2T".
        3) Ultrasonic Inspection: ASTM E164.

2. Field Bolted Connections: Inspect in accordance with AISC specifications.
3. Field Welding: Inspect and test during erection of structural steel as follows:

    a. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in the work. Record work required and performed to correct deficiencies.
    b. Perform visual inspection of all welds.
    c. Perform tests of welds as follows:

        1) Magnetic Particle Inspection: ASTM E709; performed on the root pass and on the finished weld. Cracks or zones of incomplete fusion or penetration not acceptable.
        2) Radiographic Inspection: ASTM E94 minimum quality level "2-2T".

4. Determine mechanical properties, in accordance with ASTM A370, of the following materials:

    a. Anchor bolts.
    b. Filler metals for welding.

5. Inspection of Shop Painting:

    a. Surface preparation prior to painting shall be visually evaluated for degree of cleaning by comparison with SSPC pictorial standards Vis-1.

6. Testing laboratory shall report test results in writing to the Architect on the same day that tests are made. The reports shall contain the project identification name and number, date, name of Contractor, name of material supplier, name of testing service, type and class of steel, location of test in the structure, and type and results of tests taken.

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G. Defective Work: Steel work, which does not conform to the specified requirements, including strength, tolerances, and finishes, shall be corrected at the Contractor's expense. The Contractor shall also be responsible for the cost of corrections to any work affected by or resulting from corrections to the steel work, including but not limited to any additional testing as may be required when unacceptable steel work is suspected and verified.

3.2 FABRICATION

A. Shop Fabrication and Assembly:

1. Fabricate and assemble structural assemblies in the shop to the greatest extent possible. Fabricate items of structural steel in accordance with the governing specifications and as indicated on the final shop drawings. Provide camber in structural members as shown, and fabricate so that the natural camber of the beams is turned upward.
2. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence, which will expedite erection and minimize field handling of materials.
3. Where finishing is required, complete the assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in the final structure free of markings, burrs, and other defects.
4. Fabricate Structural Steel in accordance with the latest AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.

B. Connections:

1. Weld or bolt shop connections, as indicated. Contractor to provide all design calculations for these connections.
2. Bolt field connections, except where welded connections or other connections are indicated.

    a. Provide high-strength threaded fasteners for all principal bolted connections, except where otherwise shown.

3. High-Strength Bolted Construction: Install high-strength threaded fasteners in accordance with AISC "Specifications for Structural Joints using ASTM A325 or A490 Bolts".

    a. All high strength bolts shall be tightened by standard impact wrench using the turn-of-the-nut method.
    b. Other tightening methods, conforming to specifications for structural steel joints may be used only with approval of the Architect.

4. Welded Construction: Comply with AWS Code for procedures, appearance and quality of welds, and methods used in correcting welding work.

    a. Assemble and weld built-up sections by methods which will produce true alignment of axes without warp.

5. Shear Connectors: Prepare steel surfaces as recommended by the manufacturer of the shear connectors.

    a. Provide headed stud type shear connectors welded to beams, girders, and other areas as detailed. Spacing as indicated on the drawings or, if not so indicated, studs to be uniformly spaced in a zigzag pattern along the length of the member.
    b. Headed type shear connectors shall be automatically end welded in accordance with Article 431 and 432 of AWS Building Code.

6. Bearing Plates:

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a. Bearing plates shall be provided under beams and girders resting on footings, piers and walls.
b. Bearing plates shall be either loose or attached.

7. Base Plates:

a. Column base plates shall be rolled, pressed and milled as per AISC Specification, Sect. 1.21.3 and furnished attached to the column.

C. Holes for Other Work:

1. Provide holes required for securing other work to structural steel framing, and for the passage of other work through steel framing members, as shown on the final shop drawings. Provide threaded nuts welded to framing, and other specialty items as shown to receive other work.
2. Cut, drill or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.

3.3 SURFACE PREPARATION AND PAINTING

A. It is intended that the primer and finish coats of the protective coatings system be applied in the shop. Provisions shall be made for proper handling at all stages of the painting, shipping, storing at the job site, and erecting that will protect coated surfaces from damage or soiling.

B. Surface Preparation:
1. All steel shall be cleaned in accordance with Steel Structures Painting Council SP-6; Commercial Blast Cleaning.
2. Surface profile shall not exceed 1.5 mils.
3. Cleaning shall be done after fabrication and no more than six (6) hours prior to shop painting.

C. Shop paint all structural steel work, except those members or portions of members to be embedded in concrete or mortar. Paint embedded steel, which is partially exposed on the exposed portions and the initial 2" of embedded areas only.

D. Painting:
1. Immediately after surface preparation, apply structural steel primer paint in accordance with the manufacturer's instructions. Use painting methods, which will result in full coverage of joints, corners, edges and all exposed surfaces.
2. Application shall be by spray to thoroughly cleaned surfaces only, in accordance with all provisions of SSPC PA-1 Paint Application, with specified dry film thicknesses maintained on edges and corners. Sharp cut edges shall be uniformly relieved to form a slight radius sufficient to permit proper wrap of the coatings.

E. Surfaces inaccessible to blast cleaning after assembly shall be blast cleaned and coated beforehand. Paint faying surfaces of high strength bolted friction connections as permitted by AISC Manual of Construction for the specified primer.

F. A pre-production conference shall be arranged by the Contractor with the Architect, the Fabricator and a representative of the paint manufacturer in attendance, to discuss all details relevant to performing the work in accordance with the requirements.

G. Mock-up shall be produced on a sample piece or section, for approval before production.

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H. Touch-up after erection shall consist of smoothing all damaged painted areas, and building back each coat to achieve initial condition. Where abraded to bare metal, and all other bare surfaces such as on field welds, bolts, washers and nuts - the surfaces shall be cleaned to the standard of the shop applied system and painted with the two coat system, in proper re-coating intervals.

3.4 INSPECTION

A. Examine the areas and conditions under which structural steel work is to be installed. Do not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner.

3.5 ERECTION

A. General: Comply with the governing Specifications and as herein specified.

B. Employ a Professional Engineer, registered in the jurisdiction where the work is performed, to supervise surveys during erection as follows:

1. Check elevations of bearing surfaces.
2. Check locations of anchor bolts.
3. Ensure accuracy of erection within specified tolerances.
4. Individual pieces shall be erected so that deviation from plumb, level and alignment shall not exceed 1 to 500.

C. Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made.

D. Temporary Planking: Provide temporary planking and working platforms as necessary to effectively complete the work. Comply with all City, State, and OSHA regulations as required.

E. Anchor Bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place work.

1. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations.

   a. Refer to Division 3 of these specifications for anchor bolt installation requirements in concrete, and Division 4 for masonry installation.

F. Setting Bases and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean the bottom surface of base and bearing plates.

1. Set loose and attached base plates and bearing plates for structural members on wedges or other adjusting devices.
2. Tighten the anchor bolts after the supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the base or bearing plate prior to packing with grout.
3. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure in strict compliance with the manufacturer's instructions, or as otherwise required.

G. Field Assembly: Set structural frames accurately to the lines and elevations indicated. Align and adjust the various members forming a part of a complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces, which will be in permanent contact

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before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of the structure within specified AISC tolerances.
2. Fastening of splices of compression members shall be done after the abutting surfaces have been brought completely into contact.
3. Splices shall be permitted only where indicated.
4. Field connections, including high strength bolted construction, welded construction and shear connectors shall be as specified under "Fabrication".

H. Erection Bolts: On exposed welded construction, remove erection bolts, fill holes with plug welds and grind smooth at exposed surfaces.

I. Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and the removal of paint on surfaces adjacent to field welds.

1. Do not enlarge unfair holes in members by burning or by the use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.

J. Gas Cutting: Do not use gas-cutting torches in the field for correcting fabrication errors in the structural framing. Cutting will be permitted only on secondary members, which are not under stress, as acceptable to the Architect. Finish gas-cut sections equal to a sheared appearance when permitted.

END OF SECTION

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SECTION 05 40 00
COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formed steel stud exterior wall and interior wall framing.

B. Exterior wall sheathing.

1.02 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.

1.03 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).

B. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

E. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

F. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.

G. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020.

H. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021.

I. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018, with Errata (2022).

J. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. PS 1 - Structural Plywood; 2019.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on cold-formed steel structural members; include material descriptions and base steel thickness.

C. Shop Drawings: Indicate component details, anchorage, loading, and type and location of fasteners, and accessories or items required of related work.
   1. Indicate stud and ceiling joist layout.

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. Manufacturer's Installation Instructions: Provide installation instructions for connectors.

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F. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before the start of scheduled welding work.

1.05 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: Company specializing in manufacturing the types of products specified in this section, and with minimum three years of documented experience.

C. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and AWS D1.3/D1.3M and dated no more than 12 months before start of scheduled welding work.

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. Structural Framing:
   1. CEMCO: www.cemcosteel.com/#sle.
   2. ClarkDietrich: www.clarkdietrich.com/#sle.
   3. MarinoWARE: www.marinoware.com/#sle.
   4. SCAFCO Corporation: www.scafco.com/#sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Connectors:
   1. Same manufacturer as metal framing.

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. Design Criteria: In accordance with applicable codes.
   1. Live load deflection meeting the following, unless otherwise indicated:
   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: As required to meet design criteria.

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. Thickness and Depth: Depth as indicated on the drawings; thickness and structural grade as required to meet 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.

C. Structural Performance: Maintain load and movement capacity required by applicable building code and specified design criteria.

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2.06 MISCELLANEOUS CONNECTIONS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot-dip galvanized per ASTM A153/A153M.

2.07 SHEATHING

A. Plywood; PS 1, Grade C-D, Exposure I.

2.08 ACCESSORIES

A. 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.

3.02 INSTALLATION - GENERAL

A. Install structural members and connections in compliance with ASTM C1007.

3.03 INSTALLATION OF STUDS

A. Install wall studs plumb and level.

3.04 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.

3.05 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.

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SECTION 05 44 00
COLD-FORMED METAL TRUSSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Light gauge cold-formed steel roof trusses.

B. Anchorages, bracing, and bridging.

1.02 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.

C. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

D. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015, with Errata (2016).

E. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018, with Errata (2022).

F. CFSEI 5000 - Field Installation Guide for Cold-Formed Steel Roof Trusses; May 2000.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meeting: Meet at project site prior to beginning of installation to review requirements. Require attendance by representatives of the following:
   1. Truss installer.
   2. Other entities affected by the work of this section, including but not limited to truss support framing installer, mechanical systems installer, and electrical systems installer.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Span charts.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings:
   1. Include detailed roof truss layout.
   2. Show member type, location, spacing, size and gauge, methods of attachment, and erection details. Indicate supplemental bracing, strapping, splices, bridging, and accessories.
   3. Include truss design drawings, signed and sealed by a qualified professional engineer registered in the State in which the Project is located, verifying ability of each truss design to meet applicable code and design requirements.
      a. Include the following:
         1) Design criteria.
         2) Engineering analysis depicting member stresses and deflections.
         3) Member sizes and gauges.
         4) Details of connections at truss joints.
         5) Truss support reactions.
         6) Bracing requirements.

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.

E. Fabricator's Qualification Statement.

F. Installer's Qualification Statement.

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1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design trusses 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. SFIA Code Compliance Certification Program: www.CFSteel.org/#sle: Use metal studs and connectors certified for compliance with International Building Code.

C. Fabricator Qualifications: Steel truss fabricator with minimum 10 years of experience designing and fabricating truss systems equivalent to those required for this project and licensed by an acceptable manufacturer.

D. Installer Qualifications: Experienced installer approved by truss system fabricator.

E. Welder Qualifications: Welding processes and welding operators qualified within previous 12 months in accordance with AWS D1.1/D1.1M and AWS D1.3/D1.3M.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver trusses and other materials in manufacturer's unopened bundles or containers, each marked with manufacturer's name, brand, type, and grade. Exercise care to avoid damage during unloading, storing, and erection.

B. Store trusses on blocking, pallets, platforms, or other supports, off the ground and in an upright position, sufficiently braced to avoid damage from excessive bending. Gently slope stored trusses to avoid accumulation of water on interior of truss chord members.

C. Protect trusses and accessories from contact with earth, corrosion, deformation, mechanical damage, or other deterioration when stored at project site.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cold-Formed Steel Trusses:
   1. Aegis Metal Framing, a Division of MiTek Industries: www.aegismetalframing.com/#sle.
   2. Alpine TrusSteel, an ITW Company Inc: www.trussteel.com/#sle.
   3. All-Span, Inc.: www.allspaninc.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 TRUSS DESIGN REQUIREMENTS

A. Design: Calculate structural characteristics of cold-formed steel truss members according to AISI S100.

B. Structural Performance: Design, engineer, fabricate, and erect trusses to withstand specified design loads for project conditions within required limits.
   1. Design Loads: In accordance with applicable codes.
      a. Roof Live Loads:
         1) Minimum Uniformly Distributed: 21 psf.
         2) Photovoltaic Array (Grid D only): 10 psf
         3) Wind Load: 61.5 psf.
   2. Deflections: Live load deflection meeting the following, unless otherwise indicated:
      a. Roofs: Maximum vertical deflection under live load of 1/240 of span.
   3. Design trusses to accommodate movement attributable to temperature changes within a range of 120 degrees F without damage or overstressing, sheathing failure, undue strain on fasteners and anchors, or other deleterious effects.

2.03 COMPONENTS

A. Trusses: Light gauge steel assemblies providing a complete horizontal framing system for locations indicated, ready for deck installation.
   1. Truss Type, Span, and Height: As indicated on drawings.
   2. Chord and Web Members: Fabricate required shapes from commercial quality galvanized steel sheet complying with ASTM A653/A653M, with minimum yield strength of 40,000 psi;

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minimum G90/Z275 coating; gauges as required for load conditions; all edges rolled or closed.

B. Fasteners: Self-drilling, self-tapping screw fasteners with corrosion-resistant plated finish, as recommended by steel truss manufacturer and marked for easy identification.
   1. Welding: Comply with applicable provisions of AWS D1.1/D1.1M and AWS D1.3/D1.3M.

C. Bracing, Bridging, and Blocking Members: Fabricate required shapes from commercial quality galvanized steel sheet complying with ASTM A653/A653M, with minimum yield strength of 33,000 psi; minimum G90/Z275 coating; gauges as required for load conditions.

2.04 FABRICATION

A. Factory fabricate cold-formed steel trusses plumb, square, true to line, and with secure connections, complying with manufacturer's recommendations and project requirements.
   1. Fabricate trusses using jig templates.
   2. Cut truss members by sawing, shearing, or plasma cutting.
   3. Fasten members in full compliance with instructions of manufacturer. Wire tying of framing members is not permitted.

B. Tolerances: Fabricate trusses to maximum allowable tolerance variation from plumb, level and true line of 1/8 inch in 10 feet.
   1. Up to 30 feet Long: Maximum plus or minus 1/2 inch from design length.
   2. Over 5 feet High: Maximum plus or minus 1/2 inch from design height.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine structure, substrates, and installation conditions. Notify Architect of unsatisfactory preparation. Do not begin installation until substrates have been properly prepared and unsatisfactory conditions have been corrected.

B. Proceeding with installation indicates installer's acceptance of substrate conditions.

3.02 INSTALLATION

A. Install cold-formed steel trusses in strict accordance with manufacturer's instructions and approved shop drawings, using approved fastening methods.

B. Install temporary erection bracing and permanent bracing and bridging before application of any loads. Erect trusses with plane of truss webs vertical and parallel to each other, accurately located at spacing indicated. Anchor trusses securely at bearing points.

C. Adequately distribute applied loads to avoid exceeding the carrying capacity of any one joint, truss, or other component.

D. Exercise care to avoid damaging truss members during lifting and erection and to minimize horizontal bending of trusses.

E. Removal, cutting, or alteration of any truss chord, web, or bracing member in the field is prohibited, unless approved in advance by Architect or the engineer of record and the truss manufacturer.

F. Repair or replace damaged members and complete trusses as directed and approved in writing by Architect or the engineer of record and the truss manufacturer.

G. Galvanizing Repair: Touch up bare steel with zinc-rich paint in compliance with ASTM A780/A780M.

H. Field Welding: In accordance with AWS D1.1/D1.1M and AWS D1.3/D1.3M, as applicable, and as follows:
   1. Connections: Provide fillet, flat, plug, or butt welds, as indicated.
   2. Minimum steel thickness for welded connections, 18 gauge, 0.0478 inch.

I. Roof Trusses:
   1. Comply with recommendations of CFSEI 5000.

NOT FOR BIDDING

2. Align truss bottom chords with load-bearing studs or continuously reinforce track as required to transfer loads to structure.
3. Install continuous bridging and permanent truss bracing as indicated.
4. Install roof cross bracing and diagonal bracing as indicated.

3.03 TOLERANCES

A. Install trusses to maximum allowable tolerance variation from plumb, level, and true to line of 1/8 inch in 10 feet.

B. Space individual trusses not more than plus or minus 1/8 inch from plan location. Cumulative error in placement may not exceed minimum fastening requirements of sheathing or other material fastened to trusses.

3.04 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01 40 00 - Quality Requirements.

3.05 PROTECTION

A. Protect trusses from damage by subsequent construction activities.

B. Repair or replace damaged trusses, truss members, and bracing members; obtain approval in advance by Architect or the engineer of record and the truss manufacturer for all cutting, repairs, and replacements.

END OF SECTION

NOT FOR BIDDING

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel and aluminum items.

B. Downspout boots.

1.02 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

B. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2022.

C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.

D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

E. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

F. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

G. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.03 SUBMITTALS

A. See Section 01 30 00 - 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) Support reactions.
        6) Bracing requirements.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

C. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

D. 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.

2.03 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

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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. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.04 FABRICATED ITEMS

A. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.

B. Door Frames for Overhead Door Openings: Channel sections; galvanized finish.

C. Mud and Foot Grilles: As detailed; aluminum, mill finish.

2.05 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.

2.06 ABRASIVE METAL STAIR NOSINGS

A. Single Part Unit: Aluminum with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder.
   1. Ribbed bar abrasive. Aluminum alternating with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder
   2. Basis of-Design Product: Babcock-Davis, BSTSB
   3. Nosing Types:
      a. Short Nose Tread: 3 inches (76 mm) wide, with 1/2 inch (13 mm) lip for poured concrete applications.
         1) Attachment Method: Cast-In, continuous extruded anchor.
   4. Finish: 6063-T5 aluminum, mill finish.
   5. Abrasive Colors: Safety yellow.
   6. Options:
      a. Taped Top.
   7. Or approved Equal.

2.07 FINISHES - STEEL

A. Prime paint steel items.

B. Prime Painting: One coat.

2.08 FINISHES - ALUMINUM

A. Aluminum Surfaces: 6063-T5 aluminum, mill finish.

2.09 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

NOT FOR BIDDING

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

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. Obtain approval prior to site cutting or making adjustments not scheduled.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

NOT FOR BIDDING

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SECTION 05 51 33
METAL LADDERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop-fabricated metal ladders.

1.02 RELATED REQUIREMENTS

A. Section 09 91 23 - Interior Painting: Paint finish.

1.03 REFERENCE STANDARDS

A. 29 CFR 1910.23 - Ladders; Current Edition.

B. 29 CFR 1926.1053 - Ladders; Current Edition.

C. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008 (Reaffirmed 2018).

D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

F. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.

G. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

H. SSPC-SP 2 - Hand Tool Cleaning; 2018.

1.04 SUBMITTALS

A. See Section 01 30 00 - 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.

C. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Mechanical Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

C. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATED LADDERS

A. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint finish.
   1. Side Rails: 3/8 by 2 1/2 inches members spaced at 20 inches.
   2. Rungs: 3/4 inch diameter solid round bar spaced 12 inches on center.

2.03 FINISHES - STEEL

A. Prime paint steel items.

B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Prime Painting: One coat.

D. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

NOT FOR BIDDING

2.04 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 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.

END OF SECTION

NOT FOR BIDDING

SECTION 05 52 13
PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall mounted handrails.

B. Stair railings and guardrails.

C. Free-standing railings at steps.

1.02 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

D. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

E. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

F. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021.

G. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015, with Errata (2016).

H. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, 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. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated within the previous 12 months.

D. Designer's Qualification Statement.

E. Fabricator's Qualification Statement.

1.04 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 within previous 12 months.

C. Fabricator Qualifications:
   1. A company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Handrails and Railings:
   1. ATR Technologies Inc: http://www.atr-technologies.com/#sle.
   2. Avcon Railing Systems: www.avcon.com/#sle.
   3. The Wagner Companies: www.wagnercompanies.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

NOT FOR BIDDING

2.02 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.

B. Allow for expansion and contraction of members and building movement without damage to connections or members.

C. Dimensions: See drawings for configurations and heights.

D. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.

E. Provide slip-on non-weld mechanical fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.03 STEEL RAILING SYSTEM

A. Steel Pipe: ASTM A53/A53M, Grade B Schedule 80, black finish.

B. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

C. Galvanizing: In accordance with requirements of ASTM A123/A123M.
   1. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic.

2.04 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

D. Welded Joints:
   1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
   2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.
   3. 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.

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 per ASTM A780/A780M.

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 items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

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B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Install railings in compliance with ADA Standards for accessible design at applicable locations.

D. Anchor railings securely to structure.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

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SECTION 05 52 16

PRESTRESSED BARRIER CABLE GUARD SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. The extent of work included in this Section is specified as follows:

1. Furnishing, fabricating, and installation of Prestressed Barrier Cable Guard Systems as indicated in the Contract Documents and as required by Project conditions. System, not by way of limitation, must include the following:
    a. Barrier cable guard system (the “System”) consisting of a series of prestressed seven-wire steel cables (strands) and complete with all related sleeves, supports and anchors, jacks and jacking, distribution plates, spacer bars, accessories, devices, etc. for the following locations:
        1) Prestressed barrier cable assemblies for vehicular guards.
2. Providing structural analysis and design for complete Prestressed Barrier Cable Guard System including assemblies including all system supports and connections to building superstructure.

B. The work also consists of furnishing all labor, material, and equipment necessary for completion of the following work:

1. Furnish and install all system materials intended for use in aggressive environments.
2. Perform all prestressing operations, including but, not limited to stressing, back stressing and anchoring cables (strands).
3. Keep records of stressing operations.
4. Terminating cable (strand) ends (after Architect’s review) and patching stressing pockets (as applicable).
5. See Structural Drawings for additional general notes applying to work under this section.

1.2 RELATED REQUIREMENTS

A. Related Sections

1. Section 01 45 00 - Quality Control.
2. Section 03 41 00 – Structural Precast Concrete.

1.3 DEFINITIONS

A. Barrier Cable: A steel prestressing strand meeting the requirements of this Specification. Barrier cables may interchangeably be referred to as either “cables”, “tendons” or “strands”.

1.4 PERFORMANCE REQUIREMENTS

A. General Performance

NOT FOR BIDDING

1. Prestressed Barrier Cable Guard Systems must comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
2. No attachments shall be made to Prestressed Barrier Cable Guard Systems for any items not specifically identified in the Delegated Design Submittal without prior approval by the Structural Engineer.

B. Delegated Engineering Responsibility: Design Prestressed Barrier Cable Guard Systems, including comprehensive engineering analysis by a qualified Delegated Design Engineer, using performance requirements and design criteria indicated in the Contract Documents in compliance with the design intent indicated and in compliance with all governing codes.

1. Delegated Design Engineer: Employ a professional engineer, licensed to practice in the State where the project is located, to perform design and prepare a Design Submittal per the requirements of this Section.
    a. Design Submittal must be signed and sealed by the Delegated Design Engineer and submitted per the requirements of this Section.

C. Design Requirements: All guard assemblies, including cables, anchors and connections, must withstand the effects of gravity loads and the following loads within limits and under conditions indicated in the Structural General Notes and on the Drawings:

1. Pedestrian Guard Loads: In accordance with applicable building code.
2. Vehicular Guard Loads: In accordance with the following:
    a. Pedestrian guard loads are applicable to all vehicle barrier systems and are not required to act concurrently with loads applicable to those systems.
    b. Vehicle Barrier Systems for Passenger Vehicles:
        1) The loading selected must be that producing a more unfavorable effect of the following:
            a) Article 4.5.3. of ASCE 7-16, “Minimum loads for Buildings and other Structures”.
            b) Local governing building code.
        2) Deflection of Cables
            a) Design to provide and maintain minimum cable heights and maximum spacing between cables due to self-weight of cables.
            b) Unless noted otherwise, limit maximum cable impact deflection to 18-inches.
        3) Cable Placement Tolerances: Unless noted otherwise, rail height shall not be less than 42" (from finish floor surface) and clear spacing of cables and slab surface and bottom cable shall not exceed 4".
3. Design of Connections (includes Anchorages)
    a. Design of connections based on forces indicated on Drawings are the Delegated Design Engineer’s responsibility unless an individual connection is fully detailed by the Architect/Structural Engineer.
        1) All details shown are typical, similar details apply to similar conditions, unless otherwise indicated. Verify dimensions at the site whenever possible without causing delay in the work.

1.5 SUBMITTALS

NOT FOR BIDDING

A. Product Data: Manufacturer's data, specifications, recommendations, and standard details and installation instructions for all proposed products to be used in the fabrication of guard assemblies, including painting products and patching materials.

B. Shop Drawings: Drawings showing details of fabrication and installation of guard assemblies. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items. Provide templates for anchor bolt installation.

1. Shop Drawings must include, but not be limited to, the following information:
    a. Dimensioned cable (strand) layout.
    b. Final effective forces of each cable (strand).
    c. Type and description of method to ascertain that this force has been achieved.
    d. Details, location and arrangement of cable (strand) dead end and stressing end anchorage devices. These details must be thoroughly coordinated with the placement of the corresponding column and beam reinforcement to ascertain ability to install anchorages without interference with other components within the supporting structure or the joints between structural support members.
    e. Details and/or description of procedure ascertaining proper field connection between the cable (strand) and anchor as per the system manufacturer’s requirements.

C. Samples for Verification: Submit one (1) sample of all Prestressed Barrier Cable Guard System materials.

D. Quality Control Submittals

1. Qualification Data
    a. Delegated Design Engineer(s).
    b. Welding Personnel (Operators): Provide welding certificates indicating the operators to be employed in the work have satisfactorily passed AWS qualification tests within the previous six (6) months. If certificates are older than six (6) months, employer of operator must certify, in writing, that operator is in compliance with applicable AWS provisions pertaining to certification validity.
2. Welding Procedure and Equipment
    a. Provide written description as required to illustrate each welding procedure to be performed in the specified work (for procedures not prequalified by AWS only).
    b. Include detailed surface preparation requirements.
    c. Provide descriptive data for field welding equipment, including type, voltage and amperage.
3. Manufacturer’s Certifications:
    a. Provide certifications with substantiating test reports indicating required compliance per the QUALITY ASSURANCE Article below.
        1) Mill Certificates: Signed by manufacturers of steel products certifying that products furnished comply with requirements.
    b. Provide the following for review and acceptance by the Architect not less than three (3) weeks prior to commencement of work:
        1) Mill Tests: Results of certified mill tests (including typical stress-strain curve) for each production lot from which project material will be taken. Such results must include guaranteed ultimate tensile strength, yield strength, elongation, cross-sectional area and modulus of elasticity of the material tested.

NOT FOR BIDDING

2) Equipment Calibration Tests: Results of certified calibration tests made within the last three months by an independent testing agency of all stressing equipment to be used on the project. Stressing equipment must be calibrated as a unit especially when consisting of jack, gage, and pump. Components of calibrated units may not be interchanged during the course of the work without recalibration. Contractor must submit method of identification of all stressing units. Calibration reports must include a curve relating jack forces to gage readings. For other types of stressing equipment and/or anchoring systems, submit respective calibration tests relating gage readings to attained force.

4. Delegated Design Submittal: Provide detailed System design calculations and construction drawings sealed and signed by the Delegated Design Engineer, and prepared specifically for this Project.

a. Design Calculations: Include calculations showing how all design loads and performance requirements have been met. Clearly show all resultant loads on structural members due to work of this Section.

1) Calculations of anticipated elongations based on the required effective prestress for each type of cable (strand) and anchor. When seating loss is not available, use 3/8" for a wedge-based anchorage.

2) Calculations of bearing stress applied to the structure by the proposed anchoring device and engineering opinion on the adequacy of the structural component to carry this bearing stress.

b. Construction Drawings: Shop drawings per the requirements indicated above.

c. Design Submittal must be transmitted to the Architect at least three (3) weeks prior to the commencement of construction.

E. Stressing Record: The Installer must provide a stressing record for all tendons to the Architect. This record must be in a form in conformance with recommendations of PTI and acceptable to the Architect, and include as a minimum for each tendon its mark, location and length, stressing unit identification, required and actual field gauge reading at each anchorage, and signatures of the pump/gage operator and the Testing Agency's representative witnessing the stressing operation.

1.6 QUALITY ASSURANCE

A. General: The Quality requirements of this Section are intended to be complimentary to the requirements of Division 1. In the event of an apparent conflict, the Architect must be notified in a timely manner.

B. Correlation of Performance Requirements: The Work of this Section is subject to the performance requirements indicated in the Contract Documents and as follows:

1. Requirements of Regulatory Agencies: The Work is subject to all applicable provisions of the Codes and Standards required by the authorities having jurisdiction.

2. Reference Standards: For the purposes of the Work of this Section, the documents listed below are applicable "Reference Standards". Comply with following documents, latest edition:

a. American Society of Civil Engineers (ASCE):

- ASCE 7-10 – "Minimum Design Loads for Buildings and Other Structures".

b. American Welding Society (AWS):

- AWS D1.1, "Structural Welding Code – Steel".

NOT FOR BIDDING

c. Post-Tensioning Institute (PTI):
- "Guide Specifications for Post-Tensioning Materials".
- "Specifications for Unbonded Single Strand Tendons".
- "Post-Tensioning Manual".
- "Field Procedures Manual for Unbonded Single Strand Tendons".
- "Specification for Seven-Wire Prestressing Steel Strand for Barrier Cable Applications".
- "Design of Prestressed Barrier Cable Systems, Technical Notes, Issue 14."

d. See Section 05 50 00 for additional information pertaining to fabricated steel assemblies.

3. Manufacturer's published specifications, installation requirements, and instructions as approved by the Architect.

4. Design Requirements: Where the Contract Documents indicate specific design requirements, any performance criteria included within the design requirements will be subject to the correlation requirements of this Section.

5. Correlation and Intent of the Contract Documents: In the event of conflicts or discrepancies between the Contract Documents, the requirements of regulatory agencies, and the indicated Reference Standards, the most stringent requirements govern.

C. Qualifications

1. Installer: All stressing of tendons must be under the immediate control of an experienced installer who has completed five (5) previous installations of similar scope and complexity to this Project and whose work has resulted in construction with a record of successful in-service performance.

a. Installer must exercise close check and rigid control of all operations as necessary for full compliance with all related Contract requirements.

b. Work must be supervised by individuals experienced in post-tensioning construction. Qualifications of project supervisor(s) must be included in bid submittal.

2. Welding Personnel

a. Operators must be qualified for each welding procedure according to the following (as applicable to the Work):

1) AWS D1.1, "Structural Welding Code – Steel."

b. All welders working on this project will be assigned an identifying symbol or mark. Each welder will be required to mark or stamp his symbol on each weldment completed for identification. Contractor must maintain a record of welders employed, date of qualification and symbol or identification mark assigned to each.

D. On-Site Personnel Required:

1. Contractor: Provide supervisory personnel on site at all times during tendon stressing operations.

2. Installer: Provide supervisory personnel on site at all times during tendon placement, and stressing operations. Provide name and position of such supervisory person to Contractor at start of work, but not later than seven (7) days prior to tensioning.

NOT FOR BIDDING

3. Testing Agency Representative: On site at all times during tendon layout, placement, and stressing operations. Do not proceed with stressing operations without a Testing Agency representative present during operations.
4. Prestressed Barrier Cable Guard System Manufacturer: Supervise, as a minimum, the first occurrence of each stressing operation with subsequent monitoring as deemed necessary.

E. Project Quality Control: See CONTRACTOR'S QUALITY CONTROL SYSTEM and INDEPENDENT TESTING AGENCY SERVICES Articles below.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver guard systems and related components in protective packaging and store components to avoid damage from moisture, abrasion and other construction activities.

1.8 COORDINATION AND SCHEDULING

A. Coordinate installation of anchorages for guard systems. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items in time for installation.

B. Coordinate the provision of sleeves to accommodate cables passing through structural items as indicated in the Drawings.

C. The prestressed barrier cable assemblies are solely intended to act as guards as prescribed by the performance requirements of this Section. No ancillary attachments shall be made to any prestressed barrier cable assemblies without prior approval by the Architect in writing.

1.9 CONTRACTOR'S QUALITY CONTROL SYSTEM

A. General

1. In accordance with Division 1 requirements, the Contractor must establish a Quality Control System for the work of this Section.

B. Pre-Installation Conference: The work of this Section must be included in the Contractor’s conference schedule for Post-Tensioning materials (Section 03 38 16).

C. Quality Control During Construction: See FIELD QUALITY CONTROL Article in Part 3 of this Section.

1.10 INDEPENDENT TESTING AGENCY SERVICES

A. General

1. Comply with Division 1 requirements for all testing and/or inspections applicable to this Section.
    a. See Section 01 45 00 for additional Quality Control requirements.
2. The Owner will employ and pay for the services of an Independent Inspection and Testing Agency (indicated herein as “Testing Agency” or “TESTING AGENCY”) to perform the inspections, tests and other services outlined in the Contract Documents. Services must be performed in accordance with requirements of governing authorities and with specified standards.

NOT FOR BIDDING

B. Quality Control Tests and Inspections During Construction: See FIELD QUALITY CONTROL Article in Part 3 of this Section.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers offering systems of products complying with the requirements for Prestressed Barrier Cable Guard Systems include the following:

1. AMSYSCO, Inc.
2. DYWIDAG-Systems International USA Inc.
3. Suncoast Post-Tension, Ltd.
4. VStructural, LLC (VSL)
5. Another manufacturer approved based on equivalent qualifications demonstrated by submitting information relative to record of successful projects of similar type and complexity within the past 5 (five) years, participation in the industry and professional organizations, and at least 3 (three) positive client references.

2.2 MATERIALS

A. General: Provide cables, anchors, tensioning, grouting, etc. as indicated on the Drawings. All components are to be hot-dip galvanized. Comply with PTI “Specification for Seven-Wire Prestressing Steel Strand for Barrier Cable Applications”.

B. Barrier Cables: Seven-wire steel strand, 0.5 in. diameter, galvanized per ASTM A475, Extra high Strength Grade, Class A with a minimum ultimate tensile strength of 230, 250, or 270 KSI. All strand to be manufactured by a single source.

C. Anchorages: All castings and machined barrel anchors must comply with PTI requirements applicable to corrosive environments. Where specifically indicated on the Drawings, provide capped anchors with exterior thread and corresponding galvanized metal or otherwise corrosion resistant caps acceptable to the Architect.

1. Wedges must be designed to preclude premature failure of the barrier strand due to notch or pinching effects under test load conditions specified in Section 2.2.1.1 and 2.2.1.2 in PTI’s “Specification for Unbonded Single Strand Tendons”

D. Related Steel Components and Fabrications: Where steel brackets and supports are indicated in the Drawings, these must comply with the requirements of Section 05 50 00.

1. Finish: All related steel components and fabrications must be hot dip galvanized.

E. Manufacturer’s standard corrosion resistant assembly components must be hot dip galvanized and must conform to ASTM A123 or ASTM A153, As applicable.

F. Sleeves: General Contractor to coordinate the provision of PVC pipe sleeves to accommodate cables passing through structural concrete items as indicated in the Drawings.

G. Grout Materials for Stressing Pockets (where specifically detailed only):

NOT FOR BIDDING

1. Non-metallic Shrinkage-resistant Grout: Pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, Portland Cement, shrinkage compensating agents, plasticizing, water reducing agents and corrosion inhibitors, complying with ASTM C 1107, grade B and Army Corps of Engineers CRD-C621. Subject to compliance with requirements, provide one of the following:
   a. "Euco NS" - The Euclid Chemical Co.
   b. "Crystex" - L & M Construction Chemicals.
   c. "Masterflow 713" or "Masterflow 928Plus" - Master Builders
   d. "Five Star Grout" - U.S. Grout Corp.
   e. Approved Equivalent.
2. When specifically directed by the Architect, adjust color of the pre-manufactured product by mixing it with trial-and-error selected quantity of white cement, to attain final cured color of the patch as close as possible to the surrounding concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, structural support, sleeves, anchorage, 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.

3.2 PREPARATION

A. Inserts and Anchorages: Furnish inserts and anchoring devices that must be set in concrete for installation of Cable Guard Systems.

3.3 INSTALLATION

A. Provide system as indicated on the Drawings installing cables in straight lines and at true heights.

B. Trim ends of PVC pipe sleeves flush with face of concrete. Patch spalling around PVC pipe sleeves as directed by the Architect.

C. Install fabricated anchorage, attachment and support items as shown in the final approved Shop Drawings.

D. Stressing Procedure for Cables

1. Back stress and stress cables to seat wedges as shown on the Drawings. Follow PTI recommended procedures. Consult with Architect concerning stressing/back stressing against materials other than concrete.
   a. All cables to be back stressed immediately after stressing to precent build-up of forces on the anchorage assemblies.
2. Wedges must be seated at 80% minimum ultimate tensile strength (MUTS) of the strand.
3. Coordinate jack placement and bracing as required to protect any structural members being attached to from damage during tensioning process.

NOT FOR BIDDING

E. Upon completion of the stressing and receiving the Architect's approval of the stressing record, terminate excess length of cable by an approved method and apply two coats of galvanizing compound and/or install manufacturer's screw-on cap tightly.

F. Final Disposition of Cable Anchors

1. For anchors left exposed in the final condition, provide approved caps or cover assemblies to completely conceal trimmed ends of cables, unless otherwise detailed on the Drawings.
2. For anchors recessed in concrete construction, fill pockets with non-shrink grout for smooth, flush condition.

3.4 FIELD QUALITY CONTROL

A. General

1. Construction Monitoring: During progress of the work of this Section, Contractor must monitor construction activities and coordinate all inspection activities required by the Contract Documents to ensure compliance with specified parameters.

B. Identified Deficiencies and Review of Proposed Remedial Work

1. Where Project inspections and/or testing indicate deficiencies in the Work, or non-compliance with this Section and/or the System manufacturer's specifications, the subject Work will be considered defective. For defective work:
   a. Contractor must prepare recommendations for additional or remedial work to compensate for deficiencies. Submit all recommendations to the Architect for review.
   b. Once submitted recommendations have been reviewed and found acceptable by the Architect, proceed with additional or remedial work as required to compensate for deficiencies.
   c. Additional testing and inspecting, at Contractor's expense, must be performed to determine compliance of replaced or additional work with specified requirements.
2. Remedial action deemed necessary by the Architect and resulting from non-compliance with the Contract requirements must be addressed as described for "Corrective Measures" in Division 1 of these Specifications.
3. Where remedial action was deemed necessary based on Quality Control Testing, retest all remedial work until test results prove subject Work complies with indicated requirements.

C. Independent Inspection and Testing

1. General: An independent testing agency engaged per Part 1 of this Section must monitor the work of this Section for compliance with the Contract Documents and the approved Submittals. As such, Testing Agency scope of work indicated in the Contract Documents must be construed as a minimum requirement.
2. Inspections and Tests: Perform the following inspections and testing:
   a. Comply with Section 01 45 00 , REQUIRED TESTS AND INSPECTIONS TO BE PERFORMED BY TESTING AGENCY Article, "Prestressed Barrier Cable Guard Systems" Subparagraph requirements and as additionally required to ensure compliance with the Contract Documents.

3.5 REPAIRS

A. Galvanized Coatings

NOT FOR BIDDING

1. Field Repair: For field touch up of hot-dip galvanized components, repair using zinc rich coating or “cold galvanizing” compound. Provide factory mixed and prepared organic binder, zinc-rich paint specifically formulated for use on steel surfaces and for repair of hot dip galvanized steel. Minimum 95% by weight of dry film of “ultra-pure” zinc dust per ASTM D520 Type III. Provide a minimum dry film thickness of 8 mils.

3.6 CERTIFICATION

A. After the completion of the project, the Registered Professional Engineer retained by the barrier cable guard system installer (who certified barrier cable guard system drawings and calculations), must inspect all the barrier cable guards and connections in the field and submit a letter certifying that all members and connections have been observed and the as-built conditions are in accordance with the approved shop drawings and calculations.

END OF SECTION

NOT FOR BIDDING

SECTION 05 53 05
METAL GRATINGS AND FLOOR PLATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formed metal floor gratings.

B. Flat surface floor and stair tread plating.

C. Perimeter closure.

1.02 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

B. ASTM A786/A786M - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates; 2015 (Reapproved 2021).

C. NAAMM MBG 531 - Metal Bar Grating Manual; 2017.

D. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide span and deflection tables.

C. Shop Drawings: Indicate details of component supports, openings, perimeter construction details, and tolerances.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Ross Technology Corporation: www.rosstechnology.com/#sle.

B. SLIPNOT Metal Safety Flooring; Grip Grate (Basis-of-Design): www.slipnot.com/#sle.

C. Approved Equal.

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS

A. Comply with applicable code for loading requirements.

B. Maximum Allowable Deflection Under Live Load: 1/240 of span; size components by single support design.

C. Maximum Spacing Between Bars: 15/16".

2.03 MATERIALS

A. Steel Floor Plate: ASTM A786/A786M; manufacturer's standard pattern.

B. Cross Bars: 2" cross bars with heavy duty spacing to match existing..

C. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of Specification Section 01 61 16.

2.04 ACCESSORIES

A. Perimeter Closure: Of same material as grating.

2.05 FABRICATION

A. Fabricate grates and plates to accommodate design loads.

B. Fabricate support framing for openings.

C. Top Surface: Non-slip.

NOT FOR BIDDING

2.06 FINISHES

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Powder Coat color: Black.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that opening sizes and dimensional tolerances are acceptable.

B. Verify that supports are correctly positioned.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions.

B. Place frames in correct position, plumb and level.

C. Set perimeter closure flush with top of grating and surrounding construction.

D. Secure to prevent movement.

3.03 TOLERANCES

A. Comply with NAAMM MBG 531.

NOT FOR BIDDING

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sheathing.
B. Roofing nailers.
C. Miscellaneous framing and sheathing.
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. PS 2 - Performance Standard for Wood Structural Panels; 2018.
C. PS 20 - American Softwood Lumber Standard; 2021.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

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 01 78 00 - Closeout Submittals for additional warranty requirements.

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 at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

2.02 CONSTRUCTION PANELS

A. Roof Sheathing: PS 2 type, rated Structural I Sheathing.
   1. Bond Classification: Exterior.
   2. Span Rating: 60.
   3. Performance Category: 3/4 PERF CAT.
B. Wall Sheathing: PS 2 type.
   1. Bond Classification: Exterior.
   2. Grade: Structural I Sheathing.
   3. Span Rating: 24.
   4. Performance Category: 5/16 PERF CAT.
   5. Edge Profile: Square edge.

2.03 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.

NOT FOR BIDDING

2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
3. Anchors: Toggle bolt type for anchorage to hollow masonry.

PART 3 EXECUTION

3.01 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.

3.02 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. Provide the following specific nonstructural framing and blocking:
1. Cabinets and shelf supports.
2. Wall brackets.
3. Handrails.
4. Grab bars.
5. Towel and bath accessories.
6. Wall-mounted door stops.
7. Wall paneling and trim.
8. Joints of rigid wall coverings that occur between studs.

3.03 INSTALLATION OF CONSTRUCTION PANELS

A. Roof Sheathing: Secure panels with long dimension perpendicular to framing members, with ends staggered and over firm bearing.
1. Nail panels to framing; staples are not permitted.

B. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.

3.04 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Variation from Plane, Other than Floors: 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.05 CLEANING

A. Waste Disposal: See Section 01 74 19 - 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

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SECTION 06 60 00

CELLULAR PVC FABRICATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fabrications including the following:
   1. Trim.
   2. Mouldings.

1.2 RELATED SECTIONS

A. Section 06 10 00 - Rough Carpentry.

1.3 REFERENCES

A. ASTM International (ASTM): ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

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. Installation methods.

C. Shop Drawings: Provide detailed shop drawings of each moulding type including profiles and elevations.

D. Verification Samples: For each finish product specified, two samples, minimum size 6 inches square representing actual product, color, and patterns.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with requirements of authorities having jurisdiction and applicable codes at the location of the project.

B. Mock-Ups: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
   1. Construct a 3-foot-long section of each profile and deliver to the Site for approval.
   2. Do not proceed with remaining work until workmanship is accepted by Architect.
   3. Remodel mock-ups as required to produce acceptable work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.

B. Comply with manufacturer's recommendations. Handle materials to avoid damage.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under

NOT FOR BIDDING

environmental conditions outside manufacturer's recommended limits.

1.8 WARRANTY

A. Provide manufacturer's standard limited warranty for products, stating that components will be free from defects in material that occur as a direct result of the manufacturing process, occur under normal use and service, occur during the warranty period and result in blistering, peeling, flaking, cracking, splitting, cupping, rotting or structural defects from termites or fungal decay.
   1. Trim Warranty Period: 25 years.
   2. Moulding Warranty Period: 25 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Melton Classics (Basis-of-Design)

B. AZEK Building Products, Inc.

C. Versatex: www.versatex.com

D. Fypon

E. Mitten Building Products: www.mittensiding.com

F. Approved Equal

G. Substitutions: See Section 01 60 00 – Product Requirements.

2.2 TRIM

A. Fire Performance Characteristics: Provide products complying with the following:
   1. Flame Spread Index: Less than 25, ASTM E 84.

2.3 MOULDINGS

A. Cornice Profiles: Material shall have the following characteristics:
   1. Material: Fiberglass.
   2. Crown Moulding Profile: MC-2 (Basis-of-Design)

B. Detail Profiles: Material shall have the following characteristics:
   1. Material: Solid Cellular PVC.
   2. Detail Profile: To be selected by Architect

C. Door Casings: Material shall have the following characteristics:
   1. Material: Polyurethane
   2. Casing Profiles: Custom profiles as indicated on the Drawings and as follows:
      a. (2) Custom Headers: 10-1/4"P x 1'-6"H x 6'_2-1/8"W w/ Hollow, Open Back
      b. (1) Custom Header: 10-1/4"P x 1'-6"H x 15'_6-1/8"W w/ Hollow, Open Back - Shipped in (2) Pieces; Right & Left.
      c. (2) Custom Small Door Surrounds - Complete: 3-1/4"P x 8'_7-3/8"H x 6'_2 1/8"W w/ Hollow, Open Back - Shipped in (5) Pieces - Top Moulding, Left Moulding, Right Moulding, & (2) Each Plinths.
      d. (1) Custom Large Door Surround - Complete: 3-1/4"P x 8'_7-3/8"H x 15'_6 1/8"W w/ Hollow, Open Back - Shipped in (6) Pieces - (2) Each Top Moulding, Left Moulding, Right Moulding, & (2) Each Plinths.

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2.4 ACCESSORIES

A. Fasteners: Stainless steel or hot-dip galvanized, with thin shank, blunt point, full round head as recommended by the manufacturer.

B. Adhesives: A non-toxic, odorless, UV stable, water-based PVC cement.

C. Sealants: Urethane, polyurethane or acrylic based sealants without silicone.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which Work is to be performed and identify conditions that may be detrimental to proper or timely completion.

B. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install products in accordance with manufacturer's instructions, approved submittals, and in proper relationship with adjacent construction.
   1. Use manufacturer's recommended fasteners, not more than 2 inches from ends.
   2. Glue joints to eliminate joint separation.
   3. Allow for expansion and contraction at ends of the runs.

3.3 CLEANING AND PROTECTION

A. Protect from damage during construction operations. Promptly repair any damaged surfaces. Remove and replace work which cannot be satisfactorily repaired.

B. Clean products, prior to Substantial Completion, using materials recommended by the manufacturer to remove stains, dirt and debris prior to final acceptance.

END OF SECTION

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SECTION 06 82 00

GLASS FIBER REINFORCED PLASTIC ARCHITECTURAL ELEMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Fabrication of fiberglass - reinforced polyester cornice profiles.
   2. Related Documents and Sections:
      a. General Conditions, Supplementary Conditions and Division 1 General Requirements apply to the work of this section.
      b. Section 06 10 00, “Rough Carpentry”, for blocking.
      c. Section 07 92 00, “Joint Sealants”.

1.02 QUALITY ASSURANCE

A. The fiberglass manufacturer shall be one who is currently in the business of manufacturing and supplying architectural fiberglass components for the building construction industry.

B. The fiberglass manufacturer shall have been engaged in the fiberglass industry for at least 5 years doing work with projects comparable in size, scope, detail, and complexity to that shown and specified.

C. Fire Test Response Characteristics: Provide architectural fiberglass and related materials with fire test response characteristics as specified elsewhere in this section as determined by testing identical products per test method ASTM E-84 or other testing and inspecting agency acceptable to authorities having jurisdiction.

1.03 SUBMITTALS

A. Qualification Data for firms and persons specified in the “Quality Assurance” Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

B. Product Data:
   1. For products of standard manufacture, not custom fabricated for this work, submit manufacturer’s catalog illustrations, specifications, anchor details and installation instructions.

C. Color Selection:
   1. Submit custom color sample selection chips of actual material showing color, texture and sheen available for initial review.
   2. Architect will supply custom paint color sample for matching.

D. Shop Drawings:
   1. Submit shop drawings for fabrication and erection. Include plans, elevations, sections, profiles, and details of cornice panels. Indicate dimensions of each profile and component. Include for comparison a dimensioned drawing showing plan elevation section and details of existing cornice section used for model purposes if applicable. Indicate those features, which differ from fiberglass replication. Include details for panel connections, anchorage to substructure and all miscellaneous accessories. Show all special corner pieces, splices for panels and inside corner transitions and terminations for panels. Provide layout drawings including seam locations for each elevation.

E. Samples:
   1. For each cornice type submit sample cornice panel section, large enough to include all panel features including joints.

F. Submit detailed maintenance instructions for inclusion in final operation and maintenance manuals.

NOT FOR BIDDING

G. Submit warranty on completed fiberglass components in writing against defects of materials and workmanship and to meet the specified requirements of this Section for a period of one (1) year from delivery to site.

1.04 HANDLING AND SHIPMENT

A. Provide shipping crates of sufficient size and strength to protect components during shipping or ship fiberglass components in padded dedicated van.
   1. Provide additional protection as may be necessary to prevent soiling of surfaces and marring of finish.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, fiberglass manufacturer offering products that may be incorporated in work include:
   1. Melton Classics Inc. (Basis-of-Design)
      a. P.O. Box 465020
      b. Lawrenceville, GA 30042
      c. Phone: 800-963-3060 Fax 770-962-6988
      d. www.meltonclassics.com
   2. Royal Corinthian
   3. Stromberg Architectural
   4. Approved Equal.

2.02 PRODUCTS

A. Subject to compliance with requirements, products that may be incorporated in work include:
   1. Melton Classics Inc.: Cornice MC-2 (Basis-of-Design)
   2. Approved Equal.

2.03 MATERIALS

A. General: The fiberglass reinforced polyester plastic components shall be designed, fabricated and erected to conform to the state of Building Code, Local Codes and to the Architect's design criteria.

B. Glass cloth, matt and "chop" shall be equal to the products of PPG-Owens Corning.

C. Polyester resin shall be flame retardant, promoted thixotropic polyester resin designed for use in hand laid up and spraying processes. The resin shall be specifically formulated for use in applications that require an ASTM E 84, Class I flame spread rating, without the use of fillers or antimony trioxide, with an ASTM E 84 flame spread rating of 25 unfilled smoke density of 380 or under.

D. Gel Coat: The gel coat shall be a high-performance product with ultraviolet inhibitors as recommended by the gel coat and fiberglass panel manufacturer. Acceptable products are:
   1. "951-Armorcote IMC" by Cook Composites and Polymers Co., P. O. Box 419389, Kansas City, MO 64141-6389, (816) 391-6000.
   2. "Max-Guard" Series by Neste Polyester Inc., 5106 Wheeler Avenue, Fort Smith, AK 72901, (501) 646-7865
   3. "Ultra Shield-NPG" by Ferro Corporation, One Erieview Plaza, Cleveland OH 44114, (216) 641-8580
   4. Approved Equal

E. Fiberglass-reinforced polyester components shall be manufactured using the specified resins, reinforced with chopped glass fibers. All exposed surfaces shall be finished with custom colored gel-coat.

F. Internal metal reinforcement, anchorage clips, brackets and all other "built-in" accessories shall be captured and additionally reinforced with additional glass fiber and matt of sufficient thickness as required by the panel manufacturers design.

G. All metal hardware, both loose and embedded, shall be stainless steel.

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H. Gel coat thickness shall be 0.015” minimum to 0.025” maximum.

I. Panel thickness shall be 3/16” minimum.

2.04 PANEL FABRICATION

A. Prior to commencement of work review the job site before selective demolition begins to determine the layout, spacing and termination of the existing cornice. Duplicate these layouts intersections and relationships in so far as practical. Identify and resolve panel detail conflicts in advance and identify such condition and resolutions on the shop drawings.

B. Carefully measure each existing cornice assembly component and replicate size, profile, position, and detail in the finished panel so far as practical. Indicate on shop drawings those indentations and/or detail which cannot be duplicated in the replication due to physical limitations of the manufacturing process.

C. Full-size models and mockups shall be hand carved and machined as required to produce the replication patterns.

D. Production molds shall be constructed from successive layers of glass fiber with tooling gel coat or alternately from rubber molds. Molds shall be constructed with sufficient thickness and rigidity to prevent deflection, warpage and defects during panel production.

E. Form panel ends with sealable lap joints. Use lap joints with sufficient depth to accommodate mating and alignment of panel surfaces and panel-to-panel sealant components.

F. Provide all special transition, corner pieces (inside and outside) and special closures necessary for a complete, visually continuous, weather tight installation.
   1. All inside and outside corners shall be shop fabricated. Fabrication of corners in field will not be permitted.

G. Coordinate cutouts required for drain inlets, rainwater conductors and other penetrations. Reinforce panel as required and provide special formed closures to make joints and intersection weather tight.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Coordinate required blocking for attachment of cornice panels to substructure. Provide additional, wood preservative treated or metal stud framing as may be required to attached and reinforce cornice panels for a solid installation.
   1. Coordinate installation with any metal gutter lining work or flashing above and wood/metal substrates.

B. Erect cornice panels plumb, square and true to line and level. Follow fiberglass panel manufacturer’s recommendations with regard to installation clearances, notches, and formation of panel-to-panel joints.

C. Install sealant and accessories as work progresses, so as to make the work weather tight.

D. Provide each panel with joints such that adjacent panels mate to produce flush joints. Recess blocking or notch continuously behind each panel joint. Set panels to ensure a maximum joint thickness of 3/8”.

E. Prepare each cornice panel section for installation by carefully sanding joints and shrinkages where blocking occurs to assure a tight flush fit.

F. Fill joints with a continuous bead of sealant, tooling finished joints to a slightly concave profile ensuring complete filling and flush installation.

G. Carefully monitor ambient temperatures at time of panel installation and observe all panel-to-panel clearances recommended by the fiberglass manufacturer.

H. Do not cut or abrade finishes, which cannot be completely restored in the field. Installer to make small inconspicuous finish repairs using manufacturer’s color matching gel fill finish. If too large of a repair is needed, return to fiberglass manufacturer for alterations or new units.

NOT FOR BIDDING

I. Use only stainless-steel connectors approved by the panel manufacturer and which will develop the strength required by fiberglass panel manufacturer's calculations. The installer shall supply these connectors.

J. Countersink all exposed fasteners. Patch all attachment holes with gel fill finish supplied by the fiberglass panel manufacturer for field application. Finish attachment points so that there is no detectable difference in the completed panel surface.

K. Clean installed panel to remove all dirt, smudges, and construction dirt. Use only those cleaning products and procedures recommended by the fiberglass manufacturer.

END OF SECTION

NOT FOR BIDDING

SECTION 06 83 16
FIBERGLASS REINFORCED PANELING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fiberglass reinforced plastic panels.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 REFERENCE STANDARDS

A. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels; 2022.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.

1.04 SUBMITTALS

A. See Section 01 30 00 - 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.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fiberglass Reinforced Plastic Panels:
   1. Crane Composites, Inc: www.cranecomposites.com/#sle.
   2. Marlite, Inc; Standard FRP S 100G (Basis-of-Design): www.marlite.com/#sle.
   3. Nudo Products, Inc: www.nudo.com/#sle.
   4. Panolam Industries International, Inc: www.panolam.com/#sle.
   5. Approved Equal
   6. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.
   1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.

B. Sealant: Type recommended by panel manufacturer; white.

PART 3 EXECUTION

3.01 INSTALLATION - WALLS

A. Install panels in accordance with manufacturer's instructions.

B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.

C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.

D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.

E. Install panels with manufacturer's recommended gap for panel field and corner joints.

F. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.

G. Remove excess sealant after paneling is installed and prior to curing.

END OF SECTION

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SECTION 07 10 00
DAMPPROOFING AND WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Application of a geocomposite drainage system.

1.02 RELATED SECTIONS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 07 21 00 – Thermal Insulation.

C. Section 07 60 00 – Flashing and Sheet Metal.

D. Section 07 92 00 – Joint Sealants.

E. Section 31 50 00 – Excavation Support and Protection.

1.03 REFERENCES

A. ASTM D1621 (modified) – Standard Test Method for Compressive Properties Of Rigid Cellular Plastics.

B. ASTM D1777 - Standard Test Method for Thickness of Textile Materials.

C. ASTM D3776 - Standard Test Methods for Mass Per Unit Area (Weight) of Fabric.

D. ASTM D3786 - Standard Test Method for Hydraulic Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method.

1. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
2. ASTM D4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
3. ASTM D4716 – Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head.
4. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile.

1.04 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.

B. Submit manufacturer's product data and application instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in a clean dry area in accordance with manufacturer's instructions.

C. Protect materials during handling and application to prevent damage or contamination.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Product not intended for uses subject to abuse or permanent exposure to the elements.

B. Protect rolls from direct sunlight until ready for use.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. W. R. MEADOWS, INC., PO Box 338, Hampshire, Illinois 60140-0338. (800) 342-5976. (847) 683-4500. Fax (847) 683-4544. Web Site www.wrmeadows.com.

B. Approved Equal.

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2.02 MATERIALS

A. Performance Based Specification: Geocomposite Drainage Board shall consist of a dimple raised core bonded to a high strength geotextile fabric. Drainage board shall consist of the following physical properties:
   1. Core
      a. Thickness, ASTM D5199: 0.44 in
      b. Core Compressive Strength, ASTM D6364 or ASTM D1621: 15,000 psf
      c. In-Plane Flow Rate, ASTM D4716: 17 gpm/ft
   2. Fabric
      a. Grab Tensile Strength, ASTM D4632: 100 lbs
      b. Grab Elongation, ASTM D4632: 65%
      c. CBR Puncture, ASTM D6241: 275 lbs
      d. Water Flow Rate, ASTM D4491: 165 gpm/ft2
      e. Permittivity, ASTM D4491: 2.4 sec-1
      f. UV Resistance, ASTM D4355: 70% 500 hrs

2.03 ACCESSORIES

A. Termination Bar: TERMINATION BAR from W. R. MEADOWS.

B. Approved Equal

C. Pointing Mastic: POINTING MASTIC from W. R. MEADOWS.

D. Approved Equal

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive membrane. Notify Architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.02 SURFACE PREPARATION

A. Protect adjacent surfaces not designated to receive drainage system.

B. Clean and prepare surfaces to receive drainage system in accordance with manufacturer's instructions.

3.03 APPLICATION

A. Vertical Application
   1. Unroll drainage board with flat, core side against the wall or waterproofing membrane. Drainage board can be fastened at the top side with a suitable mechanical fastening system that is compatible with the substrate.
   2. Adhere remainder of drainage board with mastic, compatible with this installation.
   3. Overlap the flat side core lip with second sheet of drainage board to provide a continuous drainage layer (shingle fashion). Ensure excess filter fabric is overlapped with this next sheet.

B. Horizontal Application
   1. Unroll drainage board and apply from high point to low point ensuring that overlap is in such a way so that water runs with the overlap.
   2. Add appropriate ballast as needed to hold down drainage board.

3.04 PROTECTION

A. Backfill immediately using care to avoid damaging drainage layer and to ensure permanent placement of the drainage board.

END OF SECTION

NOT FOR BIDDING

SECTION 07 13 00
SHEET WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Installation of a blindside sheet membrane.

1.02 RELATED SECTIONS

A. Section 03 30 00 – Cast-in-Place Concrete.

B. Section 07 13 26 – Self-Adhering Sheet Waterproofing.

C. Section 07 21 00 – Thermal Insulation.

D. Section 07 60 00 – Flashing and Sheet Metal.

E. Section 07 92 00 – Joint Sealants.

F. Section 31 50 00 – Excavation Support and Protection.

G. Section 33 46 00 – Subdrainage.

1.03 REFERENCES

A. ACI 302.1R.17 – Guide for Concrete Floor and Slab Construction.

B. ASTM C836 - Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course.

C. ASTM D412-06 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.

D. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting.

E. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.

F. ASTM D1434 - Standard Test Method for Determining Gas Permeability Characteristics of Plastic Film and Sheeting.

G. ASTM D1970-01 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

H. ASTM D5385-93 - Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes.

I. ASTM E96 (Method B) - Standard Test Methods for Water Vapor Transmission of Materials.

J. ASTM E154 - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

K. ASTM F2130 - Standard Test Method for Measuring Repellency, Retention, and Penetration of Liquid Pesticide Formulation Through Protective Clothing Materials.

L. GSA-PBS 07115 - General Services Administration, Public Building Service - Guide Specification for Elastomeric Waterproofing.

1.04 QUALITY ASSURANCE

A. Contractor will provide the proper equipment, manpower, and supervision at the jobsite to install the membrane in compliance with the project plans and specifications.

B. Installation must be carried out by an experienced contractor with an adequate number of skilled personnel, experienced in the application of the blindside membrane applications.

C. Maintain a record of the batch numbers of all materials supplied for this project.

1.05 PRE-CONSTRUCTION MEETING

A. Convene one week prior to commencing work of this section, in accordance with Section 1.04 - Quality Assurance, meeting with manufacturer’s technical representative, general contractor and site engineer to review the installation procedures.

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1.06 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.

B. Submit manufacturer's product data and application instructions.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in a clean, dry area in accordance with manufacturer's instructions.

C. Store adhesive at temperatures of 40 degrees F (4.4 degrees C) and above to facilitate handling.

D. Do not store at temperatures above 90 degrees F (32 degrees C) for extended periods.

E. Protect materials during handling and application to prevent damage or contamination.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Product not intended for uses subject to abuse or permanent exposure to the elements.

B. Apply membrane when conditions are dry and rain is not imminent.

C. Ensure concrete is poured within 60 days of membrane application.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. W. R. MEADOWS, INC., PO Box 338, Hampshire, Illinois 60140-0338. (800) 342-5976. (847) 683-4500. Fax (847) 683-4544. Website: www.wrmeadows.com.

B. Approved Equal.

2.02 MATERIALS

A. Blindside Waterproofing Membrane: 73 mil (1.85mm) thick, composite sheet membrane
   1. comprised of an elastomeric membrane bonded to a seven-ply plasmatic matrix and a non-woven geotextile fabric.
   2. Performance Based Spec: Blindside waterproofing membrane shall have the following properties as determined by laboratory testing:
      a. Membrane Thickness: 73 mil (1.85 mm).
      b. Low Temperature Flexibility, ASTM D1970: Pass.
      c. Resistance to Hydrostatic Head, ASTM D5385-93: 230 ft. (70 m).
      d. Elongation, ASTM D412-06: >400 percent.
      e. Tensile Strength (film), ASTM D882: 9,200 psi (63.4 MPa).
      f. Crack Cycling, ASTM C836: Pass.
      g. Puncture Resistance, ASTM E154: >210 lb. (>934 N).
      h. Peel Adhesion to Concrete, ASTM D903: 10 lb./in (1,754 N/m).
      i. Moisture Vapor Transmission, ASTM E96 (Method B): 0.0011 perms.
      j. Resistance to Penetration by Pesticides, ASTM F2130, Percentage of Penetration: 0.0 percent.
      k. Resistance to Fungi in Soil, GSA-PBS 07115 – 16 weeks: No Effect.
      l. Radon Transmittance (m/s), k124/02/95: <3.0 x 10-9.
      m. Radon Coefficient (m2/s), k124/02/95: <5.6 x 10-12.
      n. Gas Diffusion Coefficient (m2/s), ASTM E96-Procedure B, Modified (solvent-only, no water): >99 percent purity benzene, 1.24 x 10-14; >99 percent purity toluene 8.24 x 10-15; >99 percent purity ethylbenzene 1.24 x 10-15; >99 percent purity trichloroethylene 1.90 x 10-14; 99 percent tetrachloroethylene (PCE/Perc) 3.21 x 10-15; >99 percent purity xylene 1.53 x 10-15.
      o. Methane Gas Transmission Rate, mL/day·m2·atm at 74 degrees F (23 degrees C ± 15.5 C) and 50 percent RH ± 10 percent with 99.99 percent methane purity, ASTM D1434 43.
      p. Basis-of-Design Product:

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1) PRECON Blindside/Underslab Waterproofing Membrane by W. R. MEADOWS.
2) Approved Equal.

2.03 ACCESSORIES

A. Rolled Matrix Drainage System:
   1. MEL-DRAIN™ by W. R. MEADOWS.
   2. Approved Equal.

B. Liquid Membrane for Fastener Details:
   1. MEL-ROL® LIQUID MEMBRANE (two-component) by W. R. MEADOWS.
   2. BEM by W. R. MEADOWS.
   3. Approved Equal.

C. Liquid Membrane for Overlap Detail:
   1. HYDRALASTIC™ 836 by W. R. MEADOWS.
   2. Approved Equal.

D. Detail Fabric for Terminations:
   1. DETAIL FABRIC by W. R. MEADOWS.
   2. Approved Equal.

E. Detail Tape Adhesive:
   1. MEL-PRIME™ by W. R. MEADOWS.
   2. Approved Equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive membrane. Notify architect if surfaces are not acceptable. Do not begin surface preparation or installation until unacceptable conditions have been corrected.

3.02 SURFACE PREPARATION

A. Inspect all surfaces for any conditions detrimental to the proper completion of the work.

B. Ensure surfaces are structurally sound.

C. Remove debris or any other foreign material that could damage the membrane.

3.03 INSTALLATION

A. Vertical Application
   1. Install the membrane with the fabric side facing the interior side of the form to receive the concrete.
   2. Mechanically fasten membrane across the top lagging at 12 inches (310 mm) on center, ½-inch (12 mm) from the top, with fasteners approved by the manufacturer.
   3. Apply liquid membrane over the areas where the fasteners have been attached and carry over the top edge.
   4. Remove release paper on 6 inches (152.4 mm) factory edge.
   5. Mechanically fasten membrane vertically, 24 inches (620 mm) on center, into the exposed factory edge of the membrane if vertical fastening is required.
   6. Install subsequent sheet of membrane and overlap onto the 6 inches (152.4 mm) factory edge and roll press into place.
   7. For end-to-end overlap, overlap membrane 6 inches (152.4 mm).
   8. Apply liquid detail membrane in this area to be lapped and roll press membrane into this liquid detail membrane.
   9. Apply liquid detail membrane at terminations of membrane, 12 inches (310 mm) wide centered over the termination.
   10. Embed detail fabric into this wet liquid detail membrane centered over the termination, 6 inches (152.4 mm) on each side of lap edge, and roll press into place.
   11. Apply additional liquid detail membrane on all terminations of detail fabric.
   12. Inspect membrane prior to pouring of concrete for any punctures or damage.
   13. Repair damaged areas as directed by the manufacturer.

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B. Horizontal Application
   1. Prepare subgrade prior to membrane application according to ACI 302.1R.17.
   2. Ensure the fabric side of the membrane is facing up.
   3. Remove release paper on 6 inches (152.4 mm) selvedge edge and overlap edges of additional sheet. Roll press into place.
   4. For end-to-end overlap, overlap membrane 6 inches (152.4 mm).
   5. Apply liquid detail membrane in this area to be lapped and roll press membrane into this liquid detail membrane.
   6. Apply liquid detail membrane at terminations of membrane, 12 inches (310 mm) wide centered over the termination.
   7. Embed detail fabric into this wet liquid detail membrane centered over the termination, 6 inches (152.4 mm) on each side of lap edge, and roll press into place.
   8. Apply additional liquid detail membrane on all terminations of detail fabric.
   9. Inspect membrane prior to pouring of concrete for any punctures or damage.
   10. Repair damaged areas as directed by the manufacturer.

3.04 PROTECTION

A. Prior to placement of concrete on horizontal conditions, remove all nails, screws and sharp objects from the membrane.

B. Ensure membrane is not damaged prior to concrete pour.

C. Ensure concrete is poured within 60 days of membrane application.

END OF SECTION

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SECTION 07 13 26
SELF-ADHERING SHEET WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Application of rolled, self-adhering sheet waterproofing membrane system.

1.02 RELATED SECTIONS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 07 21 00 – Thermal Insulation.

C. Section 07 60 00 – Flashing and Sheet Metal.

D. Section 07 92 00 – Joint Sealants.

E. Section 33 41 23 – Drainage Layers.

1.03 REFERENCES

A. ASTM D5385 - Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes.

B. ASTM D146 - Standard Test Methods for Sampling and Testing Bitumen-Saturated Felts and Fabrics Used in Roofing and Waterproofing.

C. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.

D. ASTM D570 - Standard Test Method for Water Absorption of Plastics.

E. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.

F. ASTM D1876 – Standard Test Method for Peel Resistance of Adhesives. (T-Peel Test).

G. ASTM D1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.

H. ASTM E96 (Method B) - Standard Test Methods for Water Vapor Transmission of Materials.

I. ASTM E154 - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

J. National Roofing Contractors Association – Roofing and Waterproofing Manual.

1.04 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.

B. Submit manufacturer's product data and application instructions.

1.05 QUALITY ASSURANCE

A. Installer Qualifications:

1. Use an experienced installer and adequate number of skilled personnel who are thoroughly trained and experienced in the application of self-adhering sheet waterproofing membranes.

B. Obtain waterproofing materials from a single manufacturer regularly engaged in manufacturing the product.

C. Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOCs).

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in a clean dry area in accordance with manufacturer's instructions.

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C. Store adhesives and primers at temperatures of 40 degrees F (5 degrees C) and above to facilitate handling.

D. Store membrane cartons on pallets.

E. Do not store at temperatures above 90 degrees F (32 degrees C) for extended periods.

F. Keep away from sparks and flames.

G. Completely cover when stored outside. Protect from rain.

H. Protect materials during handling and application to prevent damage or contamination.

I. Avoid use of products which contain tars, solvents, pitches, polysulfide polymers, or PVC materials that may come into contact with waterproofing membrane system.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Product not intended for uses subject to abuse or permanent exposure to the elements.

B. Protect rolls from direct sunlight until ready for use.

C. Do not apply standard membrane when air or surface temperatures are below 40 degrees F (4 degrees C).

D. Do not apply to frozen concrete.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. W. R. MEADOWS®, INC., PO Box 338, Hampshire, Illinois 60140-0338. (800) 342-5976. (847) 683-4500. Fax (847) 683-4544. Website: www.wrmeadows.com.

B. Approved Equal.

2.02 MATERIALS

A. Rolled, Self-Adhering Sheet Waterproofing Membrane: Polymeric waterproofing membrane protected by release paper on polyethylene carrier film with exposed polymeric membrane strips on both sides protected by pull-off release strips.
   1. Performance Based Specification: Waterproofing membrane shall have the following characteristics:
      a. Compliance: AREMA Specification Chapter 29 - Waterproofing.
      b. Thickness:
         1) Carrier Film: 4 mils.
         2) Polymeric Membrane: 56 mils.
      c. Tensile Strength, ASTM D412, Die C:
         1) Carrier Film: 5900 psi (40.71 MPa), minimum.
         2) Polymeric Membrane: 460 psi (3.23 MPa), minimum.
      d. Elongation, ASTM D412, Die C: Polymeric Membrane: 971 % minimum.
      e. Peel Adhesion, ASTM D903: 11.8 lbf/in. (2068 N/m).
      f. Lap Adhesion, ASTM D1876: 8.62 lbf/in. (1508 N/m).
      g. Water Vapor Permeability, ASTM E96, Method B: 0.036 perms.
      h. Water Absorption, ASTM D570: 0.1 percent, 72 hours maximum.
      i. Resistance to Hydrostatic Head, ASTM D5385: Equivalent to 230.9 feet (70.3 m) of water.
      j. Puncture Resistance, ASTM E154: 48.2 lbf (214.6 N).
      k. Exposure to Fungi, Soil Test: Pass, 16 weeks.
      l. Color:
         1) Carrier Film: White.
         2) Polymeric Membrane: Black.

2.03 ACCESSORIES

A. Surface Conditioner:
   1. MEL-PRIME Solvent-based adhesive.

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2. MEL-PRIME W/B water-based adhesive.
3. Approved Equal.

B. Flashing and Fillets:
1. MEL-ROL LIQUID MEMBRANE.
2. Approved Equal.

C. Termination Sealant:
1. POINTING MASTIC.
2. Approved Equal.

D. Termination Bar:
1. TERMINATION BAR.
2. Approved Equal.

E. Corner and Detailing Tape:
1. DETAIL STRIP.
2. Approved Equal.

F. Waterproofing Protection Course:
1. PC-2 PROTECTION COURSE or PERMINATOR 10-mil or 15-mil.
2. Approved Equal.

G. Rolled Matrix Drainage System:
1. MEL-DRAIN Rolled Matrix Drainage System.
2. Approved Equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive self-adhering membrane. Notify Architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected. Commencement of the Work shall construe contractor acceptance of conditions.

B. Apply self-adhering sheet waterproofing to cured concrete surfaces a minimum of 3 days after removal of forms.

3.02 SURFACE PREPARATION

A. Protect adjacent surfaces not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.

C. Do not apply waterproofing to surfaces unacceptable to manufacturer.

D. Concrete surfaces must be clean, smooth and free of standing water.

E. Patch all holes and voids and smooth out any surface misalignments.

F. Apply only enough adhesive to surfaces that will be covered with self-adhering membrane within one working day. Apply adhesive in accordance with manufacturer’s recommended coverage rates.

G. Inside and Outside Corners
1. Apply fillet beads of termination sealant at inside corners and allow to cure.
2. Apply a 9-inch (23 cm)-wide strip of self-adhering detailing membrane centered over inside and outside inside corners.

H. Joint Reinforcement
1. For static cracks and cold joints, apply a 9-inch (23 cm)-wide strip of self-adhering detailing membrane centered over the joint.

I. Pipe Penetrations
1. Finger flash pipe penetrations with a minimum 6-inch (15 cm) wide detailing tape by applying 3-inch (7.6 cm) fingers onto surrounding substrate and 3-inches (7.6 cm) of tape

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onto pipe circumference, with 2-inch (5 cm) minimum overlap. Seal all edges of flashing with termination sealant. Seal all terminations with termination sealant.

J. Seal all terminations and exposed membrane edges with termination sealant.

3.03 APPLICATION

A. Primary Membrane Application
   1. Apply waterproofing membrane system in accordance with manufacturer's instructions.
   2. Remove release backing paper, then position the membrane at the lowest point. Ensure the proper overlap is maintained for all side and end laps.
   3. Pull balance of release paper off, then press into place to ensure full contact and elimination of all wrinkles. Roll press entire membrane and seams.
   4. Stagger end laps and overlap all seams at least 6 inches.
   5. Terminate top leading edge of membrane with termination bar and termination sealant as required.
   6. Seal all terminations and non-factory edges with termination sealant.
   7. Inspect membrane before covering and repair as necessary. Cover tears and inadequate overlaps with membrane, extending 6 inches (15 cm) beyond affected areas. Seal all sides of patches and repair areas with termination sealant.

3.04 PROTECTION

A. Protect membrane immediately after application with the application of rigid insulation or asphaltic sheet.

B. Backfill immediately using care to avoid damaging waterproofing membrane system.

END OF SECTION

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SECTION 07 18 00

TRAFFIC BEARING WATERPROOFING MEMBRANE

PART 1 - GENERAL

1.1 SUMMARY

A. The extent of work included in this Section is shown on the Drawings and is specified as follows:

1. Surface preparation.
2. Installation of complete liquid applied traffic coating system.

1.2 SYSTEM DESCRIPTION

A. Performance Requirements: Traffic coating system, after installation, shall be monolithic, watertight, and consistent in thickness and color. Coating system shall be resistant to excessive deterioration under normal exposure and normal traffic in applications indicated, and withstand deterioration from manufacturer recommended cleaning procedures for period of warranty. In addition, it is required that traffic coatings be resistant to deterioration from contact with motor oil, transmission fluids, and other motor vehicle operating compounds, and from exposure to normal ice/snow melting substances not specifically excluded by manufacturer's warranty.

1.3 SUBMITTALS

A. Manufacturer's Data: Submit specifications, installation instructions and general recommendations by the manufacturer of traffic coating system materials. Include manufacturer's certified test data showing compliance with the requirements.

B. Shop Drawings: Submit shop drawings showing large scale details of all edge terminations, joint treatments, penetration or projections and flashing conditions.

C. Samples: Submit complete samples of each membrane system to be used. Sample shall be applied to plywood or similar rigid material.

D. Qualification Data: For Installer.

E. Material Certificates: For each traffic coating, signed by manufacturers.

F. Maintenance Data: Upon completion of the Work and prior to final payment, submit two (2) maintenance manuals identified with the project name, location and date, types of coating systems applied and drawings indicating the types of coating systems and their location in the structure. Include a schematic drawing of each membrane type which clearly identifies the successive coats or layers of the membrane system. Identify each coat or layer by dry film thickness or application rate and by manufacturer's reference number or name which specifically identifies the product used for each coat. Include recommendations for routine care and maintenance. Provide list of contractors nearest the Project location who are qualified to perform repairs to the membrane. Identify common causes of damage and include instructions for temporary patching until permanent repairs can be made by qualified personnel.

G. Warranty: Special warranty specified in this Section.

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1.4 QUALITY ASSURANCE

A. Provide all Work of this Section, including the following components, so that there will be undivided responsibility for the performance of the entire system installed:

1. System accessories.
2. Flashings in connection with system.
3. Expansion joints in the system.
4. Fluid applied waterproofing membrane materials.
5. Traffic bearing wear coat.
6. Substrate repair materials.

B. Manufacturer Qualifications: Manufacturer shall provide evidence showing that the specified materials have been manufactured by the same source and successfully installed on a yearly basis for a minimum of ten (10) years on projects of similar scope and complexity.

C. Installer Qualifications: Installer shall demonstrate qualifications to perform the Work of this Section by submitting the following documentation:

1. Certification or license by the traffic coating system manufacturer as an applicator of the products to be used.
2. List of at least five (5) projects (with reference names and phone numbers) satisfactorily completed under the current company name, of similar scope and complexity to this Project. Previous experience submittal shall correspond to specific membrane system proposed for use by applicator.
3. A minimum of five (5) years in business under the same name.

D. VOC Requirement of Regulatory Agencies: All components of the materials used shall meet the required Federal, State and local volatile organic compound (VOC) requirements.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section “Project Management & Coordination.”

1. Before installing traffic coatings, meet with representatives of authorities having jurisdiction, manufacturer's technical representative, installer, and other concerned entities. Review requirements for traffic coatings. Notify participants at least seven (7) days before conference.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in sealed, original packages or containers bearing name and brand of manufacturer. Each container shall have manufacturer’s printed label. Store materials in a clean, dry location protected from exposure to direct sunlight. In storage areas, maintain environmental conditions within range recommended in writing by manufacturer.

B. Keep storage place neat and clean. Deposit cleaning rags and waste materials in metal containers having tight covers or remove them from the Project site each night. Every precaution shall be taken to avoid danger of fire. Provide dry chemical or carbon dioxide fire extinguishers in areas of Work. Allow no smoking or open containers or solvents. Store solvents in safety cans.

C. Empty containers used on job shall have labels canceled and shall be marked as to reuse.

1.6 PROJECT CONDITIONS

A. Specified coating shall not be applied if weather is too cold, raining, snowing or if any other conditions exist that will not permit proper application or curing of coating. Follow

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manufacturer's written directions. Humidity and temperature should not deviate from acceptable ranges during application and curing. Protection required for proper installation and curing shall be the responsibility of the Contractor and shall comply with manufacturer's recommendations.

B. Protect the building from damage resulting from spillage, dripping and dropping of materials. Prevent materials from entering and clogging drains and water conductors. Repair and restore or replace other work which is soiled or damaged in connection with the performance of the waterproofing work.

C. Proceed with the installation of waterproofing only after the substrate construction has been completed and cured and after penetrating components have been installed, so that the membrane will not be penetrated or damaged by subsequent work.

1.7 WARRANTY

A. System Manufacturer and Installation Contractor shall be jointly responsible and shall submit an affidavit signed by both parties warranting the installed system for a minimum period of five (5) years from date of Final Completion. The Installation Contractor shall repair or replace membrane which leaks water, deteriorates excessively, wears prematurely or otherwise fails to perform as required within the warranty period, due to failure of materials or workmanship. The warranty shall include an agreement to remove and replace other work which has been superimposed on elastomeric waterproofing work as required to repair or replace the waterproofing system.

PART 2 - PRODUCTS

2.1 SOURCE OF MATERIALS

A. General: The traffic coating system shall be a complete system of compatible materials, designed by the manufacturer to produce a waterproof, traffic-bearing and chemical resistance surface. The following systems are approved for use:

1. Odor and Volatile Organic Compound (VOC) Sensitive Applications: Provide one of the following:

   a. "Auto-Gard FC," as manufactured by Neogard.
   b. "Iso-Flex 760 U MVT Low Odor Coating System," as manufactured by LymTal.
   c. "Conipur II Deck Coating Systems," as manufactured by BASF Building Systems
   d. "Kelmar FWC 111" as manufactured by Technical Barrier Systems
   e. Or approved equal

B. Waterproofing Membrane (Base Coat)

1. The base coat (membrane) shall meet the following minimum performance criteria:

   a. Minimum Tensile Strength (ASTM D412): Base Coat - 1000 psi; Top Coat – 2000 psi.
   b. Minimum Elongation (ASTM D412): Base Coat - 350%.
   c. Minimum Adhesion (ASTM D903): Base Coat - 20 psi.
   d. A light application of primer compatible with the elastomeric seal coat shall be applied onto the clean, dry concrete surface. The elastomeric coating shall be applied uniformly to the primed surface. The elastomeric base coat shall be applied in strict accordance with manufacturer's requirements for the system and verified by wet mil thickness testing (minimum one test per 500 square feet). The coating shall be allowed to cure adequately. Special treatment shall be provided at

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all construction joints, cove joints and at all cracks over 1/16 inch in width. This special treatment shall be included in the bid price for the waterproofing membrane installation. The coating shall also be applied at base of columns, walls and curbs to produce a 6 inch high base.

2. Minimum System Thickness (Dry Mils): 20 mils.

C. Wearing Course

1. A compatible wearing course shall be applied over the elastomeric coating in accordance with the manufacturer's instructions. A selected aggregate shall be broadcast evenly over the surface and fall on the surface in vertical direction so as not to displace uncovered coating.
2. Aggregates should be spread to an excess thickness until surface appears dry. After the coating has sufficiently cured, the excess aggregates shall be removed and the tie coat shall be applied to the surface.

D. Leveling Course (If Required)

1. A compatible leveling course shall be applied directly onto the concrete surface after cleaning and prior to application of the primer. The leveling course is intended to fill and smooth pop-outs, scaling, depressions and pitting in the concrete surface due to abrasion, finishing problems or other existing conditions. Products listed below should be confirmed with the manufacturer's instructions.

    a. Neogard - Leveling of the concrete surface prior to membrane system application in order to achieve a suitable substrate shall be performed using a Neogard 70708/70709 epoxy and sand mixture.
    b. Lym-Tal - Leveling of the concrete surface prior to membrane system application in order to achieve a suitable substrate shall be performed using Iso-Flex 750 base coat extended with sand.
    c. Sonoguard/Conipur - Leveling of the concrete surface prior to membrane system application in order to achieve a suitable substrate shall be performed using THOROC EP35 two component, fast-setting 100% solids epoxy, extended with sand as needed
    d. Kelmar - Leveling of the concrete surface prior to membrane system application in order to achieve a suitable substrate shall be performed using Kelmar FWC 111 epoxy and sand mixture.

E. Total System Requirements

1. Minimum System Thickness without Aggregate (Dry mils) in parking areas: 40 mils
2. Minimum System Thickness without Aggregate (Dry mils) in heavy wear areas: 52 mils
3. All systems shall be wear balanced for parking stall and drive aisle applications according to the manufacturer's recommendations.
4. Color of wearing course/wearing surface shall be as selected by the Architect.

2.2 MISCELLANEOUS DECK COVERING MATERIALS

A. Aggregate: Manufacturer's standard aggregate of size and gradation recommended for application indicated. Provide granite, quartz, silicon carbide, or other weather resistant mineral with hardness of not less than 6.0 (Moh's scale).

B. Flashing Sheets, Cant Strips and Accessories: Types as recommended by deck coating manufacturer, supplied for locations indicated and for locations recommended by manufacturer.

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PART 3 - EXECUTION

3.1 CONDITION OF SUBSTRATE

A. Examine the substrate and the conditions under which the elastomeric waterproofing work is to be applied. Do not proceed with the work until unsatisfactory conditions have been corrected and approved by the manufacturer's representative.

1. Installation of products constitutes Installers and Manufacturer's acceptance of existing construction.

3.2 PREPARATION OF SUBSTRATE

A. Clean the substrate of protrusions, dust, debris, oily materials and other substances detrimental to the work, as recommended by the waterproofing system's manufacturer.

1. Water blast or shot blast horizontal surfaces to remove contaminants and to provide a clean uniform textured surface.
2. Clean vertical surfaces of column bases, spandrels, walls, protrusions, etc., to provide a clean uniform textured surface.

B. Install cant strips and similar accessories as shown and as recommended by the waterproofing manufacturer (even though not shown) in the manner recommended by the manufacturer.

3.3 FLASHINGS, PRIMERS AND JOINT CONTROL

A. Install sheet-type flashings and joint covers where shown and as recommended by the fluid applied waterproofing manufacturer (even though not shown); using the type of sheet material and installation methods recommended by the manufacturer. Embed flashing in fluid applied waterproofing.

B. Cracks/Construction Joints: At locations of possible movement in the substrate construction, including cracks which have developed and construction joints, prepare the substrate to increase the fluid applied waterproofing capability for bridging the movement without failure. Use only products which have been determined to be compatible with the elastomeric waterproofing.

C. Fill voids and non-moving cracks and joints in the substrate with sealant or other compounds as recommended by the waterproofing manufacturer for compatibility. Fill rough areas of substrate (rough within limitations specified by the manufacturer) with a feathered-out coating of elastomeric waterproofing, squeegee-applied to form a smooth top surface.

D. Prime substrate as recommended by the waterproofing system's manufacturer.

E. Mask off adjoining surfaces not to receive fluid applied waterproofing, to effectively prevent the spillage or migration of materials outside the membrane area.

3.4 INSTALLATION, GENERAL

A. General: Comply with manufacturer's instruction, except where more stringent requirements are shown or specified, and except where project conditions require extra precautions or provisions to ensure satisfactory performance of the work.

B. Manufacturer's Technical Representative: Start the installation of elastomeric waterproofing membrane only in the presence and with the advice of the system manufacturer's technical representative. A series of four (4) wet mil gage tests shall be conducted for every 1000 sq. ft. on the first day of installation in the presence of the representative to ensure proper coverage rate.

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C. Mix separately packaged components in accordance with manufacturer's instructions.

D. Apply the elastomeric membrane to the primed deck within the time specified by the manufacturer.

E. Apply a uniform coating of cold applied elastomeric waterproofing to the substrate and adjoining surfaces indicated to receive the membrane.

1. Apply coating by hand, complying with manufacturer's recommendations regarding horizontal and vertical surfaces.
2. Provide waterproof membrane at base of columns, spandrels, to produce a 6 inch high base. Curb surfaces shall be considered floors and waterproofed unless otherwise noted.

F. Wearing Surface: Apply top coat in one or two applications to achieve the specified dry film thicknesses.

1. While coating is still fluid, uniformly broadcast aggregate over the surface at the rate specified.
2. After top coat has cured, remove all excess aggregate from the deck surface.
3. Apply a tie coat to the cured surface to encapsulate the top layer of aggregate.

G. Permit cold applied membrane to cure without delay, and under conditions which will not contaminate or deteriorate the fluid applied waterproofing material. Block off traffic and protect membrane from physical damage.

3.5 INSTALLATION OF SPECIFIED SYSTEMS

A. Systems:

1. "Auto-Gard FC" (Neogard): Apply epoxy primer to cleaned concrete surface at a minimum rate of 300 square feet per gallon no more than 24 hours prior to base coat application; apply polyurethane base coat to an average thickness of 20 mils dry (26 mils wet). Apply polyurethane wearing coat at an average thickness of 8 mils dry (11 mils wet) with aggregate broadcast at a rate of 10 to 15 lbs. per 100 sq. ft. Apply second polyurethane wearing coat at an average thickness of 12 mils dry (16 mils wet). For heavy traffic areas such as drive aisles, steep or spiraling ramps, ticket booths and turning areas, broadcast aggregate at a rate of 10 to 15 lbs. per 100 sq. ft. into a second coat of polyurethane applied at an average thickness of 12 mils dry (16 mils wet). Apply third finish coat of polyurethane at an average thickness of 12 mils dry (16 mils wet).
2. "Iso-Flex 760U MVT Low Odor Coating System" (LymTal): Apply solvent-free epoxy primer to cleaned concrete surface at a rate of 200 feet per gallon no more than 24 hours prior to base coat application; apply polyurethane base coat to an average thickness of 25 mils dry (35 mils wet). Apply polyurethane wearing coat at an average thickness of 15 mils dry (20 mils wet) with aggregate broadcast at the rate of 6 to 8 lbs. per 100 sq. ft. Install "Iso-Flex 760U HVT" system in drive aisles and heavy traffic areas, which is identical to the "MVT" system with an additional top coat with aggregate. Comply with manufacturer's written instructions for appropriate finish coat material depending on degree of exposure to sunlight.
3. "Conipur II Deck Coating Systems," as manufactured by BASF Building Systems. Apply 100% solids polyurethane primer (Conipur 78) at a minimum rate of 300 square feet per gallon. Apply Conipur 265z Base Coat (2 component polyurethane 100% solids) at a rate of 25 mils dry (25 mils wet). Allow base to cure and then apply Conipur 295 Top Coat (2 component polyurethane 100% solids) at a rate of 15 mils dry (15 mils wet) and broadcast 16/30 mesh silica sand at a rate of 20 to 25 pounds per 100 square feet in parking stall areas. In drive aisles and heavy traffic areas, the Conipur 275 mid coat is applied at 15 mils dry (15 mils wet) and broadcast with silica sand at a rate of 50 to 60 pounds per 100 square feet, then apply Conipur 295 top coat at 10 mils dry (10 mils wet).

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4. "Kelmar FWC 111" as manufactured by Technical Barrier Systems. Apply a solvent or water based epoxy primer to the cleaned surface at a rate of 250-300 square feet per gallon. The base coat is the NEO V II C latex neoprene applied to the primed concrete surface at a rate of 20 mils dry (32 mils wet). The wearing coat is 100% solids coal tar epoxy applied at 20 mils wet/dry in parking stalls then broadcast with sand to saturation. In drive aisles, apply one 30 mil wet/dry coat with aggregate broadcast to saturation. At cashier booths and steep helix type ramps, apply one 40 mil wet/dry with aggregate broadcast to saturation. Finally, apply top finish coat of single component, water based acrylic latex emulsion at 250 to 300 square feet per gallon.

3.6 CLEAN-UP

A. Upon completion of work, carefully examine entire installation. Correct all defective or damaged work.

B. Upon completion, or at such other times as directed, remove all surplus materials, cartons, rubbish and debris resulting from these operations and legally dispose of off-site.

3.7 PROTECTION

A. Provide protection to ensure that work will be without damage or deteriorations at time of final acceptance.

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SECTION 07 19 11

CLEAR PENETRATING CONCRETE SEALERS

PART 1 - GENERAL

1.1 SUMMARY

A. The extent of work included in this Section is shown on the Drawings and is specified as follows:

1. Concrete penetrating sealer system on all slabs on grade, supported horizontal concrete deck surfaces, and 6-inch high application on all vertical concrete surfaces adjacent to horizontal deck surfaces.

1.2 SUBMITTALS

A. Submit manufacturer's product, application and surface preparation specifications, testing data and warranty for approval prior to sealing concrete decks.

B. As a condition for payment of the sealer application, the contractor must submit an invoice indicating the delivery and site receipt of the quantity of material calculated and designated for this Project. In addition to the calculated quantity, the invoice shall also reflect the Project address, or be designated for use on this Project, if delivered to the Contractor's address. No leftover material from previous projects will be permitted for use on this Project.

C. Manufacturer Certificates: Signed by manufacturers certifying that water repellents comply with requirements.

1.3 QUALITY ASSURANCE

A. Codes and Standards

1. Specified products shall comply with the provision of the following specification and standards, except as otherwise noted.

a. NCHRP 244 procedure - Series II & IV.
b. Scaling Resistance of Concrete (ASTM C672) - No Scaling.
c. Alberta Department of Transportation and Utilities Penetrating Sealer for Traffic Bearing Surfaces Type 1B - Water Repellency after Abrasion (minimum) 86.0%.
d. VOC Requirements: Application contractors and manufacturers shall ensure that all components of specified products do not exceed volatile organic compound 400 grams/liter as required by local, state or federal authorities having jurisdiction.

B. Field Testing Acceptance

1. Meet or exceed the following requirements for this Project based on testing performed on a minimum of three, 3 inch diameter (or larger) core samples removed from the treated area.

a. Repellency Rating (Waterproofing Performance) –85% or better, based on comparison of untreated versus treated samples. Test procedure for waterproofing performance shall be according to ASTM D6489, "Standard Test Method for Determining the Water Absorption of Hardened Concrete Treated with a Water Repellent Coating."
b. Penetration (1 application) minimum 1/4 inch, based on the average of a series of measurements on the split face of core samples.

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C. Sealer Coordination

1. Review other Sections of these Specifications in which curing compounds or paints are to be provided on concrete surfaces to be sealed to ensure compatibility with the concrete sealer. Submit certification letter stating that any curing compounds or paints to be used by the contractor are compatible with this section.

D. Warranty

1. The system manufacturer shall furnish the Owner a written single-source performance warranty that the concrete penetrating sealer system will be free of defects related to workmanship or material deficiency and meet or exceed the specified requirements for a ten (10) year period from the date of substantial completion of the Work provided under this Section of the Specification.
2. Any required repairs under the warranty shall be made by the system manufacturer. The required written warranty shall be provided by the system manufacturer.

1.4 PROJECT CONDITIONS

A. Environmental Requirements

1. Do not proceed with application of materials if ambient temperature is below 20 deg. F or if ice or frost is covering the substrate.
2. Do not proceed with application if surface temperature exceeds 100 deg. F.
3. Do not proceed with application of materials in rainy conditions or if rain is anticipated within 8 hours after application. Materials shall not be applied to damp substrates. The surface should be sufficiently dry to observe the spray pattern during application.

PART 2 - PRODUCTS

2.1 SEALER MATERIAL

A. Provide a clear liquid “silane” type sealing compound 100 percent solids content, which will penetrate the concrete to provide a surface which is resistant to salts, de-icer chemicals, moisture, gasoline, oil and acids. Sealer material shall not permanently alter the appearance or surface texture of concrete surfaces.

B. Sealer material shall be one of the products offered by the manufacturer’s listed below. Substitute materials or manufacturers will not be allowed.

1. Sealers (VOC limit of 400 grams/liter):

a. Evonik Degussa Corporation – Protectosil BHN. Apply at an application rate of 200 sf/gal.
b. BASF Building Systems Inc. - Hydrozo 100. Apply at an application rate of 200 sf/gal.
c. LymTal International – ISO-FLEX 618-100 CRS. Apply at an application rate of 200 sf/gal.
d. Or approved equal.

C. All applied penetrating sealers shall contain fugitive dye to demonstrate complete and thorough application to surface.

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PART 3 - EXECUTION

3.1 PREPARATION

A. Examine surfaces to receive sealer to assure that conditions are acceptable for application of materials. Concrete shall be cured a minimum of 28 days.

B. Remove dirt, dust and materials that will interfere with the proper and effective application of the water repellent coating.

C. All caulking, patching and joint sealants should be installed prior to application of this product.

D. Test for pH level, according to water-repellent manufacturer's written instructions, to ensure chemical bond to silicate minerals.

3.2 INITIAL TEST APPLICATION AND TESTING

A. Test Procedure

1. Prior to full scale surface preparation and application of selected material, a trial application shall be conducted. Test sizes shall be 11 feet by 11 feet in size for products applied at 125 square feet per gallon, 13 feet 3 inches by 13 feet 3 inches for products applied at 175 square feet per gallon and 14 feet by 14 feet for products applied at 200 square feet per gallon, at locations determined by the Architect. The preferred location will be on a sloping ramp.
2. The trial area shall be cleaned according to manufacturer’s recommendations in the same manner as planned for the entire Project. This may include sweeping and cleaning with compressed air, water cleaning under pressure or shotblasting. For the purposes of this test only, sandblasting is an acceptable substitute for shotblasting.
3. Upon completion of surface preparation, a core will be removed from the cleaned surface and tested for water absorption. This is the Untreated Water Absorption value. The test area will then be treated with one gallon of the selected material. From the treated area, two core samples shall be removed. Both cores are to be tested for Treated Water Absorption and split with a chisel and dye tested for depth of sealer penetration. The repellency rating is calculated on the basis of untreated and treated water absorption values.
4. Once field test results are obtained which meet or exceed specified requirements, the Contractor will be authorized to perform full scale surface preparation and application of the selected material. Do not proceed with application unless directed in writing by the Architect and material manufacturer.
5. Cost of trial area application and testing shall be included in the Contractor’s price for sealer installation. Additional quality control testing, if desired by the Owner in other areas or subsequent to the installation to determine warranty performance, shall be paid for by the Owner.

3.3 APPLICATION

A. Product shall be applied at a rate as specified above. Do not dilute or alter the material

B. Preferred method of application is with low pressure (15 psi) airless spray equipment or with a heavily-saturated brush or roller. Spray equipment should be equipped with solvent resistant gaskets and hoses.

C. When applying by brush or roller, care will be taken to ensure that sufficient material is being applied to thoroughly saturate the treatment surfaces maintaining the appropriate square foot coverage rate required.

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1. Product shall be applied to horizontal surfaces in a single saturating application.
2. Sufficient material shall be applied so that treated surfaces remain wet for a few minutes before penetration into the surface.
3. Surface residues, pools and puddles shall be broomed out thoroughly until they completely penetrate into the surface.
4. Treated surfaces shall be protected from rain and other surface water for a period of not less than eight (8) hours after application.
5. Treated surfaces shall be protected from excessive foot and vehicular traffic for a period of not less than eight (8) hours after application.

3.4 CLEAN-UP

A. When the work of this Section is complete, and at such other times as directed, remove surplus and waste materials, debris, rubbish, equipment, and implements from the site, and leave the work in a clean, neat and acceptable condition, as approved by the Architect.

END OF SECTION

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SECTION 07 21 00
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation at cavity wall construction, underside of floor slabs, over roof deck, and internal gutter.

B. Batt insulation in exterior wall and ceiling construction.

1.02 RELATED REQUIREMENTS

A. Section 07 27 00 - Air Barriers: Separate air barrier materials.

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.

B. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2018.

C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.

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 E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.

G. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2023.

1.05 SUBMITTALS

A. See Section 01 30 00 - 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.

1.06 QUALITY ASSURANCE

1.07 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

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PART 2 PRODUCTS

2.01 APPLICATIONS

A. Insulation Under Concrete Slabs: Extruded polystyrene (XPS) board.

B. Insulation in Metal Framed Walls: Batt insulation with integral vapor retarder.

C. Insulation Above Ceilings: Batt insulation with no vapor retarder.

2.02 FOAM BOARD INSULATION MATERIALS

A. Expanded Polystyrene (EPS) Board Insulation: Comply with ASTM C578.
   1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   3. Complies with fire resistance requirements indicated on drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
   4. Board Size: 48 inch by 96 inch.
   5. Board Thickness: 1-1/2 inch.
   6. Board Edges: Square.
   7. Type and Compressive Resistance: Type XI, 5 psi (35 kPa), minimum.
   8. Type and Water Absorption: Type XI, 4.0 percent by volume, maximum, by total immersion.
   9. Type and Thermal Resistance, R-value: Type XI, 3.1 (0.55), minimum, per 1 inch thickness at 75 degrees F mean temperature.

B. Extruded Polystyrene (XPS) Board Insulation: Comply with ASTM C578 with either natural skin or cut cell surfaces.
   1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   3. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88), minimum, per 1 inch thickness at 75 degrees F mean temperature.

2.03 MINERAL FIBER BLANKET INSULATION MATERIALS

A. Mineral Wool Blanket Thermal Insulation: Flexible or semi-rigid preformed insulation, complying with ASTM C665.
   1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
   2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
   3. Provide foil facing on one side, at locations indicated on drawings.
   4. Products:
      a. Johns Manville; Mineral Wool TempControl Batts: www.jm.com/#sle.
      b. ROCKWOOL; COMFORTBATT: www.rockwool.com/#sle.
      c. Approved Equal.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 ACCESSORIES

A. Tape: Reinforced polyethylene film with acrylic pressure sensitive adhesive.
   1. Application: Sealing of interior circular penetrations, such as pipes or cables.
   2. Width: Are required for application.

PART 3 EXECUTION

3.01 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.

3.02 BATT INSTALLATION

A. Install insulation and vapor retarder in accordance with manufacturer's instructions.

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B. Install in exterior wall and roof 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.

E. Install with factory-applied vapor retarder membrane facing warm side of building spaces. Lap ends and side flanges of membrane over framing members.

F. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

3.04 PROTECTION

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SECTION 07 25 00
WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water-resistive barriers.

1.02 RELATED REQUIREMENTS

A. Section 07 42 13 - Metal Wall Panels

B. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with weather barriers.

1.03 DEFINITIONS

A. Weather Barriers: Materials or assemblies forming water-resistive barriers, air barriers, vapor retarders, or combination of one or more assemblies.

B. Water-Resistive Barriers: Materials or assemblies installed behind exterior wall coverings; designed to prevent liquid water from further penetration into exterior wall assembly.

1.04 REFERENCE STANDARDS

A. AATCC Test Method 127 - Test Method for Water Resistance: Hydrostatic Pressure; 2018, with Editorial Revision (2019).

B. ASTM D779 - Standard Test Method for Determining the Water Vapor Resistance of Sheet Materials in Contact with Liquid Water by the Dry Indicator Method; 2016.

C. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.

D. ASTM E2357 - Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies; 2023a.

E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

F. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.

G. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers; 2016, with Editorial Revision (2021).

I. ICC-ES AC148 - Acceptance Criteria for Flexible Flashing Materials; 2017, with Editorial Revision (2021).

J. ICC-ES AC212 - Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers over Exterior Sheathing; 2015, with Editorial Revision (2020).

K. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2023.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on material characteristics, performance criteria, and limitations.

1.06 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by materials manufacturers before, during, and after installation.

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PART 2 PRODUCTS

2.01 WATER-RESISTIVE BARRIERS

A. Description: Materials installed behind exterior wall coverings; designed to prevent liquid water from further penetration into exterior wall assembly. Primary materials include mechanically applied sheets; accessory materials include flashings and seam tapes.

B. Regulatory Requirements: For use in ICC (IBC) construction Types I, II, III, and IV buildings greater than 40 feet in height.
   1. Comply with NFPA 285 wall assembly requirements in accordance with local building code and authorities having jurisdiction (AHJ).

C. Water-Resistive Barrier Building Wrap: Mechanically fastened building wrap.
   1. Hydrostatic Pressure Resistance: Greater than 200 inches when tested in accordance with AATCC Test Method 127.
   2. Water Resistance: Exceeds 1 hour when tested in accordance with ASTM D779.
   3. Water Vapor Permeance: 9 to 15 perms when tested in accordance with ASTM E96/E96M, Procedure A.
   4. Products:
      a. DuPont Tyvek CommercialWrap.
      b. Approved Equal.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

D. Water-Resistive Barrier Coating: Fluid-applied air and water-resistive coating for various exterior substrates; vapor permeable.
   1. Air Permeance, Building Assembly Air Leakage Rate: Not greater than 0.04 cfm/sq ft when tested at 1.57 psf in accordance with ASTM E2357.
   2. Air Permeance, Building Material Air Leakage Rate: 0.004 cfm/sq ft maximum leakage when tested at 1.57 psf pressure difference in accordance with ASTM E2178.
   3. Water-Resistive Barrier over Sheathing Compliance: Complying with ICC-ES AC212.
   4. Water Vapor Permeance: Tested in accordance with ASTM E96/E96M.
      a. Procedure A: Greater than 5 perms.
      b. Procedure B: Greater than 14 perms.
   5. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 120 days of weather exposure.
   6. System Accessory Products: As recommended by coating manufacturer.

2.02 ACCESSORIES

A. Seal and Perimeter Tapes: As recommended by water-resistive barrier manufacturer.

B. Flashings and Sealants: As recommended by water-resistive barrier manufacturer for application.

C. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrates and weather barrier materials.
   1. Application: Apply at 30 to 40 mil, 0.030 to 0.040 inch nominal thickness.
   2. Color: Green.

D. Flexible Flashing: Self-adhering sheet flashing complying with ASTM D1970/D1970M; waive slip resistance requirement if not installed on roof.
   1. Width: 4 inches.
   2. Products:
      a. DuPont de Nemours, Inc; FlexWrap: www.dupont.com/building/#sle.
      b. Approved Equal.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

E. Liquid Flashing: One part, fast curing, nonsag, elastomeric, gun grade, trowelable liquid flashing.

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2.03 FASTENERS

A. Fasteners for Attaching Water-Resistive Barriers to Substrates: As recommended by barrier manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions comply with requirements of this section.

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. Install continuous water-resistive barriers where indicated on drawings, with sheets lapped to shed water.

C. Apply sealants within recommended temperature range in accordance with manufacturer's installation instructions.

D. Mechanically Fastened Sheets:
   1. Install sheets in shingle fashion to shed water; align horizontally.
   2. Overlap seams as recommended by manufacturer, 6 inches, minimum.
   3. Overlap at outside and inside corners as recommended by manufacturer, 12 inches, minimum.
   4. Attach to framed construction with fasteners extending through sheathing into framing, and space fasteners at 12 to 18 inches on center along each framing member supporting sheathing.
   5. Where stud framing rests on concrete or masonry substrate, extend lower edge of barrier sheets at least 4 inches below bottom of framing and seal to substrate with sealant or approved mounting tape.
   6. Install water-resistive barrier over jamb flashings.
   7. Install head flashings under water-resistive barrier.
   8. At framed openings with frames having nailing flanges, extend sheet into opening and over flanges; at head of opening, seal sheet over flange and flashing.

E. Fluid-Applied Sheets:
   1. Prepare substrate in accordance with coating manufacturer's installation instructions; treat joints in substrate and between dissimilar materials as indicated.
   2. Apply flashing to seal with adjacent construction and to bridge joints in coating substrate.

F. Openings and Penetrations in Exterior Water-Resistive Barriers:
   1. Install flashing over sills, covering entire sill framing member, and extend at least 5 inches onto water-resistive barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
   2. At openings filled 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 wide; do not seal sill flange.
   3. At openings filled with nonflanged frames, seal water-resistive barrier to each side of framing at opening using flashing at least 9 inches wide, and covering entire depth of framing.
   4. At head of openings, install flashing under water-resistive barrier extending at least 2 inches beyond face of jambs; seal water-resistive barrier to flashing.
   5. At interior face of openings, seal gaps between window and door frames and rough framing using appropriate joint sealant over backer rod.

NOT FOR BIDDING

6. Service and Other Penetrations: Form flashing around penetrating items and seal to surface of water-resistive barrier.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Do not cover installed water-resistive barriers until required inspections have been completed.

3.05 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

NOT FOR BIDDING

SECTION 07 31 39

SYNTHETIC SLATE SHINGLES

(ALTERNATE NO. 3)

PART 1 GENERAL

2.01 SUMMARY

A. Section Includes:
   1. Synthetic slate shingles, underlayment, flashings, fasteners, and accessories.

B. Related Requirements:
   1. Division 01 - General Requirements: Administrative, procedural, and temporary work requirements.
   2. Section 07 62 00 - Sheet Metal Flashing and Trim.
   3. Section 07 72 53 - Snow Guards.
   4. Section 07 92 00 - Joint Sealants.

2.02 REFERENCES

A. American Society for Testing and Materials (ASTM) (www.astm.org):
   1. D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
   2. D3161/D3161M - Standard Test Method for Wind-Resistance of Asphalt Shingles (Fan-Induced Method).
   3. D3462/D3462M - Standard Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules.
   4. E108 - Standard Test Methods for Fire Tests of Roof Coverings.
   5. G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

B. National Research Council Canada, Canadian Construction Materials Centre (NRCC CCMC) (www.nrc-cnrc.gc.ca) - Evaluation Report 14094-R.

C. Underwriters Laboratories (UL) (www.ul.com):
   1. 790 - Standard for Standard Test Methods for Fire Tests of Roof Coverings.
   2. 2218 - Standard for Impact Resistance of Prepared Roof Covering Materials.

D. International Code Council (ICC) (www.iccsafe.org) - ES Acceptance Criteria AC07 Section 4.9.

2.03 ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference:
   1. Convene at Project site 2 weeks prior to beginning work of this Section.
   2. Attendance: Architect, Contractor, Owner, installer, and related trades.
   3. Review and discuss:
      a. Installation procedures and manufacturer's recommendations.
      b. Safety procedures.
      c. Coordination with installation of other work.
      d. Availability of materials.
      e. Preparation and approval of substrate and penetrations through roof.
      f. Other items related to successful execution of work.

2.04 SUBMITTALS

A. See Section 01 33 00 - Submittal Procedures for submittal procedures.

B. Action Submittals:
   1. Delegated Design: Submit design details and calculations, including design criteria, demonstrating compliance with IBC 2021 and ASCE 7-16 wind load requirements. Design shall be completed by a structural engineer licensed in the State of Delaware. Submittal shall be sealed by responsible engineer.

NOT FOR BIDDING

2. Shop Drawings: Show shingle layout, method of attachment, flashings, trim, conditions at eaves, intersections with adjacent materials, and other installation details.
3. Product Data: Manufacturer's data sheets on each product including:
   a. Shingles, underlayment, flashings, fasteners, and accessories:
      1) Indicate composition, properties, and dimensions.
      2) Show compliance with specified requirements.
   b. Preparation instructions and recommendations.
   c. Storage and handling requirements and recommendations.
   d. Installation methods.
4. Samples:
   a. Selection Samples: Two sets of color chips representing manufacturer's full range of available colors and surface textures.
   b. Verification Samples: After selection, submit two samples representing actual product, color, and texture.

C. Maintenance Material Submittals: Provide 100 square feet of extra shingles.

2.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture of synthetic shingles with ten years experience.

B. Installer Qualifications: Minimum five years experience in work of this Section.
1. Contractor shall be certified by the roof system manufacturer and meet the manufacturer's requirements for the specified warranty.

C. Mockup:
1. Provide mockup of shingles, underlayment, and related flashings.
2. Size: Minimum 8 x 8 feet.
3. Locate where directed.
4. Approved mockup may remain as part of the Work.

2.06 DELIVERY, STORAGE AND HANDLING

A. Ship shingles in bundles:
1. Collate in sequence of widths and colors as required for selected color blend.
2. Assemble bundles so that sorting at job site is not required.

B. Deliver shingles to site in manufacturer's unopened, labeled bundles.
1. Verify quantities and condition upon delivery.
2. Remove damaged products from site.

C. Store products in protected environment, off ground, protected moisture, traffic, and construction activities.

D. Store shingles flat. Do not store on site for prolonged period.

E. Store products at temperature between 40 and 120 degrees F.

F. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of authorities having jurisdiction.

2.07 SITE CONDITIONS

A. Environmental Requirements:
1. Observe manufacturer’s temperature, humidity, and moisture limits.
2. Do not install products under environmental conditions outside manufacturer's absolute limits.

2.08 WARRANTIES

A. Furnish manufacturer’s 50 years warranty against breakage and deterioration resulting in leaks under normal weather and use conditions.

B. Furnish installer's 2 years total roof system warranty against water penetration, including underlayment, flashings, trim, and other roof components.

NOT FOR BIDDING

PRODUCTS

3.01 MANUFACTURERS

A. Basis of Design Manufacturer: DaVinci Roofscapes, LLC, 800-DAVINCI, www.davinciroofscapes.com.

B. Available Manufacturers: Subject to requirements of the drawings and specifications, products from the following manufacturers may be provided:
   1. Boral Inspire Roofing Products.
   2. EcoStar LLC.
   3. DaVinci Roofscapes, LLC.
   4. Or approved equal.

3.02 PERFORMANCE

A. Performance Requirements:
   1. Fire resistance: Class A, tested to ASTM E 108.
   2. Water absorption: 0.18 percent by weight, tested to ASTM D471.
   3. Impact resistance: Class 4, tested to UL 2218.
   4. Nail pull through resistance: 138 foot-pounds at 72 degree F and 166 foot-pounds at 32 degrees F , tested to ASTM D3462/D3462M.
   5. Freeze-thaw resistance: No crazing, cracking, delamination of coating, or other deleterious surface changes after one month exposure with temperature cycled from minus 40 to plus 180 degrees F (0 degrees in 22 hours, tested to ICC ES Acceptance Criteria AC07 Section 4.9.
   6. Accelerated weathering: Little change after 2,500 hours exposure to ultraviolet radiation, elevated temperature, moisture, and thermal shock.
   7. Fungus resistance: No algae growth when inoculated with blue green algae in warm, damp environment for 4 to 6 weeks, tested to ASTM G21.
   8. Approved by NRCC CCMC.
   9. Method of attachments designed to adequately resist wind uplift for roof configuration and Project location.
   10. Wind Load Design: IBC-2009 and ASCE 7-16.
      a. Basic Design Wind Speed: V = 115 mph, nominal design 3-second wind speed.
      b. Risk Category: II.
      c. Exposure: C.

3.03 MATERIALS

A. Synthetic Slate Shingles:
   1. Description: Lightweight, synthetic slate shingles with appearance, color, texture, and thickness of quarried shakes.
   2. Material: Engineered polymer designed to provide the look of natural slate.
   3. Profile:
      a. Rectangular shape with exposed-to-view upper surface and edges textured to resemble natural slate.
      b. Underside formed with reinforcing ribs.
   4. Size:
      a. Thickness: Varies from 1/8 inch at top to 1/2 inch at bottom.
      b. Length: 18 inches.
      c. Width: 12 inches.
      d. Exposure: 6 inches.
   5. Shingle pattern:
      a. Basis-of-Design Color: Castle Gray
      b. Coursing: Straight.

3.04 ACCESSORIES

A. Underlayment: Fire-resistant roof deck protection in compliance with ASTM D226.

NOT FOR BIDDING

1. Basis-of-Design: GAF VersaShield.
2. Or approved equal.

B. Flashing:
1. Fabricate from sheet to profiles and dimensions indicated on Drawings and approved Shop Drawings, in accordance with Section 07 60 00.
2. Material: 18 gage, 0.050 inch, terne coated stainless steel.
3. Linear components: Form in longest possible lengths, 8 feet minimum.
4. Counterflashings: Extend minimum 4 inches up vertical surfaces and minimum 4 inches under shingles.
5. Valley flashings: Minimum 24 inches wide, extending minimum 10 inches from valley center line.
6. Eave flashings: Fabricate with bottom edge formed outward 1/4 inch and hemmed to form drip.

C. Fasteners:
1. Underlayment Fasteners: Hot-dip galvanized steel roofing nails, 11-gauge, 0.12-inch diameter, sharp pointed with barbed shanks, minimum 3/8-inch diameter head, and of length sufficient to penetrate 3/4 inch into solid substrate or completely through sheathing
2. Tile Fasteners: Stainless steel ring shank nails, 10 gauge, 0.134 inch diameter, with minimum 3/8-inch diameter head, of sufficient length to penetrate 3/4 inch into solid substrate or completely through sheathing

PART 3 EXECUTION

4.01 EXAMINATION

A. Inspect roof framing and substrate.
1. Verify that roof is complete, rigid, and braced, and that deck members are securely fastened.
2. Ensure that proper ventilation has been provided for roof space.
3. Verify that roof deck is clean, dry, and ready to receive shingles.
4. Remove dirt, loose fasteners, and protrusions from roof surface.

4.02 INSTALLATION - GENERAL

A. Install self-adhered waterproof sheet membrane on eaves. Cover waterproof sheet membrane and remaining portions of roof with approved underlayment. Install waterproof sheet membrane in valleys, along walls, and around projections terminating on top of underlayment.

B. Underlayment:
1. Install self-adhered waterproof sheet membrane over full roof area.
a. Apply waterproof sheet membrane at temperatures of 40 degrees F or higher.
b. Adhere and attach as recommended by manufacturer of waterproof sheet membrane.
c. Start underlayment installation at lower edge of roof. Install perpendicular to roof slope with minimum 4 inch side laps and minimum 6 inch end laps.
d. Extend underlayment minimum 4 inches up vertical wall intersections.
e. Do not leave underlayment membrane exposed in excess of time limit required by manufacturer. Do not puncture or tear underlayment.

4.03 FLASHING INSTALLATION

A. Install drip edge on eaves, gable ends, and metal flashings at valleys, ridges, hips, roof curbs, penetrations, and intersections with vertical surfaces, in accordance with Section 07 62 00.

B. Weather lap joints minimum 2 inches and seal with sealant as specified in Section 07 92 05.

C. Secure in place with clips, nails, or other fasteners.

4.04 SHINGLE INSTALLATION

A. Install shingles in accordance with manufacturer's instructions and approved Shop Drawings.

B. Spacing: Provide 3/16 to 3/8 inch gap between shingles.

C. Eaves:

NOT FOR BIDDING

1. Install row of starter shingles at eaves as base layer.
2. Project eave shingles approximately 1 inch, as required to allow water to drain, or 1/8 inch past overhanging drip edge.

D. Gables: Project shingles approximately 3/4 inch beyond gable rakes or 1/8 inch past overhanging drip edge.

E. Ridges and Hips:
1. After field shingle installation is complete, install double row of shingles over 6 inch wide metal flashing.
2. Ridges: Use 7 inch wide shingles with 6 inch exposure. Start ridge shingles at leeward end. Face shingle laps away from prevailing wind.
3. Hips: Use 7 inch wide shingles with 6 inch exposure. Start hip course at eave.

F. Fastening: Attach each shingle to deck with two nails:
1. Place nails at locations indicated on shingles.
2. Ensure full penetration but do not overdrive nails.
3. Do not nail at an angle.
4. Ensure that nail head is flush with shingle surface.
5. At valleys do not nail shingles within 5 inches of valley center line.

4.05 SNOW GUARD INSTALLATION

A. Coordination:
1. Coordinate installation of snow guards with installation of synthetic slate shingle system.
2. Installation of snow guards must proceed with installatioin of shingles.

B. Install in accordance with manufacturer's written instructions.

4.06 FIELD QUALITY CONTROL

A. Inspect units as they are installed. Do not install cracked, broken, twisted, curled, or otherwise damaged units.

B. As work progresses, exercise care not to scratch or mar installed shingles. Replace damaged shingles.

C. After approximately 200 units have been installed, inspect roof from ground. Verify proper layout and appearance. Repeat inspection every 200 shingles.

D. Visually inspect completed installation for weathertight condition.

4.07 PROTECTION

A. Protect installed roofing until completion of Project.

B. Do not allow traffic on completed roof.

4.08 ADJUSTING

A. Replace damaged shingles prior to Substantial Completion.

END OF SECTION

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SECTION 07 32 16
CONCRETE ROOF TILES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete roof tiles.

B. Underlayment with ice dam protection.

C. Metal roof flashing.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Material requirements for attachment members.

B. Section 07 62 00 - Sheet Metal Flashing and Trim: Roof flashing.

C. Section 07 72 53 - Snow Guards.

1.03 REFERENCE STANDARDS

A. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction; 2022.

B. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2023.

C. ASTM C1492 - Standard Specification for Concrete Roof Tile; 2022.

D. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2018).

E. NRCA (RM) - The NRCA Roofing Manual; 2023.

F. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on tile and underlayment, indicating material characteristics, installation instructions, and limitations and precautions.

C. Shop Drawings: For metal flashings and counterflashings, indicate overall configurations and thicknesses, details at complex intersections, jointing methods and locations, and fastening details.

D. Selection Samples: Submit color chips representing manufacturer's full range of available tile colors and finishes.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture of roofing systems similar to those required for this project, with not less than 5 years of documented experience.

B. Installer Qualifications: Company specializing in installing concrete roof tiles, with at least 3 years of documented experience.

1.06 MOCK-UPS

A. Provide a mock-up for evaluation of concrete roof tile installation workmanship, including typical eave, rake, valley, and ridge detail.

1. Size of Mock-Up: 4 feet by 4 feet, minimum.

1.07 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.

B. Deliver and store materials with labels intact in manufacturer's unopened packaging until ready for installation.

C. When storing roofing materials on roofing system ensure that no damage occurs to supporting members and other materials.

NOT FOR BIDDING

1.08 FIELD CONDITIONS

A. Do not install roof tiles, eave protection membrane or underlayment when surface, ambient air, or wind chill temperatures are below 45 degrees F.

1.09 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Concrete Roof Tiles:
   1. Basis-of-Design Manufacturer: Bartile Premium Roof Tiles: www.bartile.com
   2. Boral Roofing: www.boralamerica.com/#sle.
   3. Eagle Roofing Products: www.eagleroofing.com/#sle.
   4. Vande Hey-Raleigh Manufacturing, Inc: www.vrmtile.com/#sle.
   5. Westile Roofing Products: www.westile.com/#sle.
   6. Approved Equal.
   7. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ROOF TILES

A. Concrete Roof Tiles:
   1. Basis-of-Design Product: Yorkshire Straight Brush
   2. Match existing tile as closely as possible.
   3. Comply with requirements of ASTM C1492, including certification for passing the freeze-thaw testing, and with nail holes made before curing.
   4. Weight: Normal weight tile, using ASTM C33/C33M aggregates.
   5. Tile Size: 15" Slate Straight Brush. Add 4" and 6.5" (50% each) only Yorkshire Parts to be mixed randomly in field at 2-9 ratio..
   6. Eave Tile Riser: 12"
   7. Color: Custom Color #709.

B. Special Shapes and Fittings: Supply special shapes and fittings of same material and finish as adjacent tile, factory-formed, as indicated on drawings or as required for specific project conditions, including but not limited to hip caps, ridge caps, rake edges, and termination caps.

2.03 SHEET MATERIALS

A. Underlayment: Fire-resistant roof deck protection in compliance with ASTM D226.
   1. Basis-of-Design: GAF VersaShield.
   2. Or approved equal.

2.04 METAL FLASHING

A. Metal Flashings: Provide as indicated and required for watertight roofing system, including eave edge, gable edge, open valley, and dormer flashing.
   1. Form flashings to profiles indicated, or as required to shed water and protect building from water damage.
   2. Form sections square, flat, and accurate to profile, in maximum possible lengths, free from distortion or other defects detrimental to function or appearance.
   3. Hem exposed edges of flashings minimum 1/4 inch on underside.
   4. Coat concealed surfaces of flashings with bituminous paint.

B. Copper Flashing: ASTM B370, cold rolled 16 oz/sq ft, 24-gauge, 0.0216-inch minimum copper thickness; natural finish.

2.05 ACCESSORIES

A. Fasteners:
   1. Underlayment Fasteners: Hot-dip galvanized steel roofing nails, 11-gauge, 0.12-inch diameter, sharp pointed with barbed shanks, minimum 3/8-inch diameter head, and of length sufficient to penetrate 3/4 inch into solid substrate or completely through sheathing.

NOT FOR BIDDING

2. Tile Fasteners: Stainless steel ring shank nails, 10 gauge, 0.134 inch diameter, with minimum 3/8-inch diameter head, of sufficient length to penetrate 3/4 inch into solid substrate or completely through sheathing.

B. Adhesive: Asphalt plastic roof cement complying with ASTM D4586/D4586M, Type II, non-asbestos, heavy body mastic comprising asphalt and other mineral ingredients.

C. Attachment Members:
1. Battens: 1 inch by 2 inches nominal, spaced as required per Manufacturer for ventilation.
2. Nailers: Nominal 2-inch thick members, height as required for specific conditions.

D. Snow Guards: See Section 07 72 00.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine structural roof deck for compliance with specified requirements, and verify that roof penetrations and roof openings are correctly installed in proper locations.

B. Do not begin installation of tile roofing until substrates have been properly prepared, and if substrate preparation is responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Prepare roof deck surfaces using methods recommended by tile manufacturer for achieving best results under project conditions.

B. Seal roof deck joints wider than 1/16 inch with deck tape.

C. Install eave edge and gable edge flashings tight with fascia, in accordance with SMACNA (ASMM), lap joints at least 2 inches and seal with plastic cement.

3.03 INSTALLATION

A. Install concrete tile roofing system in accordance with manufacturers recommendations and NRCA (RM) applicable requirements.

B. Underlayment:
1. Roof Slopes from 4:12 to 20:12: Install two layers of underlayment over entire roof area, perpendicular to roof slope, with ends and edges weather lapped a minimum of 4 inches, staggering end laps of each layer, and nail in place.

C. Metal Valley Flashings:
1. Open Valleys: Install minimum 24-inch wide flashing over valley protection membrane, centered over valley and crimped to guide water. Fasten to deck with cleats; overlap end joints minimum 8 inches, blind nailing upper end of each sheet; do not solder joints.

D. Sheet Metal Flashing: Install flashing at other locations as indicated and as required by project conditions.

E. Attachment Members:
1. Nailers: Install nailers at ridge and hips, directly over underlayment, and protect with additional layer of underlayment before installing ridge and hip tiles and accessories.
2. Battens: Install battens horizontally, fastening securely to deck through underlayment.

F. Concrete Tile:
1. Install first row of tile at eaves with minimum projection of 1 inch.
2. Lay tile square with building lines and parallel with roof slope, and install filler, closure, and mitered pieces as required.
3. Unless otherwise indicated or recommended by tile manufacturer, install tile with minimum of 3-inch headlaps.
4. Nail tiles by driving nails to point where nail heads just clear surface of tile, so tiles hang on nails; do not overdrive nails, putting pressure on underlying tile, and do not underdrive nails, putting strain on overlying tile.

NOT FOR BIDDING

5. At valleys and other areas with metal flashing, use wire ties for tile support as required to avoid nailing in vulnerable areas.
6. Cut and fit tiles neatly around vents, pipes, and other projections.
7. Install accessories in accordance with manufacturer's details and recommendations.

3.04 CLEANING

A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.

B. Clean exposed work upon completion of installation; remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to finish.

3.05 PROTECTION

A. Minimize traffic over finished roof surface, and where walking on roof is absolutely necessary, wear soft-soled shoes and walk on abutting tiles to avoid breakage.

B. Remove and replace damaged or broken tile before Date of Substantial Completion.

END OF SECTION

NOT FOR BIDDING

SECTION 07 42 13
METAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured metal panels for exterior wall panels and soffit panels, with related flashings and accessory components.

1.02 RELATED REQUIREMENTS

A. Section 05 40 00 - Cold-Formed Metal Framing: Wall panel substrate.

B. Section 07 25 00 - Weather Barriers: Weather barrier under wall panels.

C. Section 07 92 00 - Joint Sealants: Sealing joints between metal wall panel system and adjacent construction.

1.03 REFERENCE STANDARDS

A. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.

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 01 30 00 - 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, and methods of anchorage.

D. Samples: Submit two samples of wall panel and soffit panel, 12 inches by 12 inches 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.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.06 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 74 19 - 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.

1.07 FIELD CONDITIONS

A. Do not install wall panels when air temperature or relative humidity are outside manufacturer's limits.

NOT FOR BIDDING

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Finish Warranty: Provide 15-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 2-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 MANUFACTURERS

A. Metal Wall Panels - Concealed Fasteners:
1. ATAS International, Inc; Opaline OPF (Basis-of-Design): www.atas.com/#sle.
2. Berridge Manufacturing Company: www.berridge.com/#sle.
3. Centria, a Nucor Company: www.centria.com/#sle.
4. Construction Metal Products, Inc: www.cmpmetalsystems.com/#sle.
5. Drexel Metals Inc: www.drexmet.com/#sle.
6. Elevate: www.holcimelevate.com/#sle.
7. Englert, Inc: www.englertinc.com/#sle.
8. Fabral: www.fabral.com/#sle.
9. Lumabuilt: www.lumabuilt.com/#sle.
10. MBCI: www.mbci.com/#sle.
11. McElroy Metal: www.mcelroymetal.com/#sle.
12. Metal Roofing Systems, Inc; M-16 Wall Panels: www.metalroofingsystems.biz/#sle.
13. Morin Corporation: www.morincorp.com/#sle.
14. Nelson Industrial, Inc: www.nelsonii.com/#sle.
15. Petersen Aluminum Corporation: www.pac-clad.com/#sle.
16. Petersen Aluminum Corporation: www.pac-clad.com/#sle.
17. Sheffield Metals International: www.sheffieldmetals.com/#sle.
18. Taylor Metal Products: www.taylormetal.com/#sle.
19. Approved Equal.
20. Substitutions: See Section 01 60 00 - Product Requirements.

B. Metal Soffit Panels:
1. ATAS International, Inc; Wind-Lok Soffit MPS120 and MPV120 (Basis-of-Design): www.atas.com/#sle.
2. Berridge Manufacturing Company: www.berridge.com/#sle.
3. Englert, Inc: www.englertinc.com/#sle.
4. Fabral: www.fabral.com/#sle.
5. Lumabuilt: www.lumabuilt.com/#sle.
6. McElroy Metal: www.mcelroymetal.com/#sle.
7. Metal Roofing Systems, Inc: www.metalroofingsystems.biz/#sle.
8. Morin Corporation: www.morincorp.com/#sle.
9. Petersen Aluminum Corporation: www.pac-clad.com/#sle.
10. Sheffield Metals International: www.sheffieldmetals.com/#sle.
11. Taylor Metal Products: www.taylormetal.com/#sle.
12. Approved Equal.
13. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 METAL WALL PANEL SYSTEM

A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.
1. Provide exterior wall panels and soffit panels.
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.

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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 returns.
10. Provide continuity of weather barrier seal at building enclosure elements in accordance with requirements; see Section 07 25 00.

B. Exterior Wall Panels:
1. Profile: Vertical; style as indicated.
2. Side Seams: Double-interlocked, tight-fitting, sealed with continuous gaskets.
3. Material: Precoated aluminum sheet, 20 gauge, 0.032 inch minimum thickness.
4. Panel Width: 6 inches.
5. Color: As selected by Architect from manufacturer's standard line.

C. Soffit Panels:
1. Profile: Style as indicated, with venting provided.
2. Material: Precoated aluminum sheet, 20 gauge, 0.032 inch minimum thickness.
3. Color: As selected by Architect from manufacturer's standard line.

D. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.

E. Expansion Joints: Same material, thickness and finish as exterior sheets; 20 gauge, 0.032 inch thick; manufacturer's standard brake formed type, of profile to suit system.

F. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

G. Anchors: Stainless steel.

2.03 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.

2.04 FINISHES

A. Exposed Surface Finish: Panel manufacturer's standard polyvinylidene fluoride (PVDF) coating, top coat over epoxy primer.

B. Panel Backside Finish: Panel manufacturer's standard siliconized polyester wash coat.

2.05 ACCESSORIES

A. Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant.

B. Concealed Sealants: Non-curing butyl sealant or tape sealant, see Section 07 92 00

C. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.

D. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers, stainless steel. 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.

NOT FOR BIDDING

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building framing members are ready to receive panels.

B. Verify weather barrier, see Section 07 25 00, has been installed over wall panel substrate; see Section 05 40 00.

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.

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, minimum.

F. Use concealed fasteners unless otherwise indicated by Architect.

G. 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, maximum.

3.05 CLEANING

A. Remove site cuttings from finish surfaces.

B. Remove protective material from wall panel surfaces.

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

NOT FOR BIDDING

SECTION 07 53 23
EPDM THERMOSET SINGLE-PLY ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Adhered roof system with ethylene propylene diene monomer (EPDM) roofing membrane.

B. Insulation, flat and tapered.

C. Vapor retarder.

D. Deck sheathing.

1.02 REFERENCE STANDARDS

A. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2023a.

B. ASTM D4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method; 1983 (Reapproved 2018).

C. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane; 2015, with Editorial Revision (2022).

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.
   1. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's written information listed below.
   1. Product data indicating membrane materials, flashing materials, insulation, vapor retarder, surfacing, and fasteners.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements.

C. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, and paver layout.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.

F. Warranty:
   1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
   2. Submit installer's certification that installation complies with all warranty conditions for the waterproof membrane.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum twenty (20) years of documented experience.

B. Installer Qualifications: Company specializing in performing work of this section:
   1. With minimum five years documented experience.
   2. Approved by membrane manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.

B. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.

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C. Protect products in weather protected environment, clear of ground and moisture.

D. Protect foam insulation from direct exposure to sunlight.

E. Keep Safety Data Sheets (SDS) at the project site at all times during transportation, storage, and installation of materials.

F. Comply with requirements from Owner to prevent overloading or disturbance of the structure when loading materials onto the roof.

1.07 FIELD CONDITIONS

A. Do not apply roofing membrane during unsuitable weather. Refer to manufacturer's written instructions.

B. Do not apply roofing membrane when ambient temperature is below 40 degrees F or above 100 degrees F.

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 in quantities greater than can be weatherproofed the same day.

E. Proceed with work so new roofing materials are not subject to construction traffic as work progresses.

F. Do not allow grease, oil, fats, or other contaminants to come into direct contact with membrane.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. System Warranty: Provide manufacturer's system warranty agreeing to repair or replace roofing that leaks or is damaged due to wind or other natural causes.
   1. Warranty Term: 20 years.
   2. For repair and replacement include costs of both material and labor in warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Carlisle SynTec Systems: www.carlisle-syntec.com/#sle.

B. Johns Manville: www.jm.com

C. Elevate: www.holcimelevate.com

D. Approved Equal

E. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ROOFING APPLICATIONS

A. EPDM Membrane Roofing: One ply membrane, fully adhered, over insulation.

B. Roofing Assembly Performance Requirements and Design Criteria:

2.03 ROOFING MEMBRANE AND ASSOCIATED MATERIALS

A. Single Source Responsibility: Provide and install products from single source.

B. Membrane:
   1. Material: Ethylene propylene diene monomer (EPDM); ASTM D4637/D4637M, Type I (non-reinforced).
   2. Thickness: 60 mil, 0.060 inch, minimum.
   3. Sheet Width: Factory fabricated into largest sheets possible.
   4. Color: Black.

C. Seaming Materials: As recommended by membrane manufacturer.

D. Membrane Fasteners: As recommended and approved by membrane manufacturer.

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E. Vapor Retarder: Material approved by roof manufacturer complying with requirements of fire rating classification; compatible with roofing and insulation materials.
   1. Fire-retardant adhesive.

F. Flexible Flashing Material: Same material as membrane.

G. Base Flashing: Provide waterproof, fully adhered base flashing system at all penetrations, plane transitions, and terminations.

2.04 DECK SHEATHING AND COVER BOARDS

2.05 INSULATION

A. Polyisocyanurate (ISO) Board Insulation: ASTM C1289, Type II, Class 1 - Faced with glass fiber reinforced cellulosic felt facers on both major surfaces of the core foam; Grade 1.

2.06 ACCESSORIES

A. Prefabricated Roofing Expansion Joint Flashing: Sheet butyl over closed-cell foam backing seamed to galvanized steel flanges.

B. Prefabricated Flashing Accessories:
   1. Corners and Seams: Same material as membrane, in manufacturer's standard thicknesses.
   2. Penetrations: Same material as membrane, with manufacturer's standard cut-outs, rigid inserts, clamping rings, and flanges.
   3. Sealant Pockets: Same material as membrane, with manufacturer's standard accessories, in manufacturer's standard configuration.

C. Membrane Adhesive: As recommended by membrane manufacturer.

D. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.

E. Sealants: As recommended by membrane manufacturer.

F. Cleaner: Manufacturer's standard, clear, solvent-based cleaner.

G. Primer: Manufacturer's recommended product.

H. Edgings and Terminations: Manufacturer's standard edge and termination accessories.

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, GENERAL

A. Clean substrate thoroughly prior to roof application.

B. Do not begin work until other work that requires foot or equipment traffic on roof is complete.

C. Apply manufacturer's recommended vapor retarder or temporary roof before roof installation.

3.03 CONCRETE DECK PREPARATION

A. Fill surface honeycomb and variations with latex filler.

B. Confirm dry deck by moisture meter with 12 percent moisture maximum when tested per ASTM D4263.

3.04 INSTALLATION - GENERAL

A. Perform work in accordance with manufacturer's instructions.

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B. Do not apply roofing membrane during unsuitable weather.

C. Do not apply roofing membrane when ambient temperature is outside the temperature range recommended by manufacturer.

D. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

E. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

3.05 VAPOR RETARDER INSTALLATION

A. Apply vapor retarder to deck 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.

3.06 INSULATION APPLICATION

A. Attachment of Insulation: Embed insulation in adhesive in full contact, in accordance with roofing and insulation manufacturer's instructions.

B. Lay subsequent layers of insulation with joints staggered minimum 6 inches from joints of preceding layer.

C. Lay boards with edges in moderate contact without forcing, and gap between boards no greater than 1/4 inch. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

D. Do not apply more insulation than can be completely waterproofed in the same day.

3.07 MEMBRANE APPLICATION

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 at manufacturer's recommended rate. Fully embed membrane in adhesive except in areas directly over or within 3 inches 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. Seal permanently waterproof.

E. At intersections with vertical surfaces:
   1. Extend membrane over cant strips and up a minimum of 4 inches onto vertical surfaces.
   2. Fully adhere flexible flashing over membrane and up to nailing strips.

F. Install roofing expansion joints where indicated, and ensure joints are watertight.

G. Install prefabricated joint components in accordance with manufacturer's instructions.

H. Coordinate installation of roof drains and sumps and related flashings, locate field splices away from low areas and roof drains, and lap upslope sheet over downslope sheet.

I. Daily Seal: Install daily seal per manufacturer's instructions at the end of each workday. Prevent infiltration of water at incomplete flashings, terminations, and at unfinished membrane edges.

3.08 CLEANING

A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.

B. Remove wrappings, empty containers, paper, and other debris from the roof daily. Dispose of debris in compliance with local, State, and Federal regulations.

C. Remove bituminous markings from finished surfaces.

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D. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.

E. Repair or replace defaced or damaged finishes caused by work of this section.

3.09 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

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SECTION 07 61 10

COPPER ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Flat locked and soldered (flat seam soldered) roofing.

B. Related Requirements:
1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
2. Division 05 Sections for structural and light-gauge framing.
3. Section 07 62 00 – Sheet Metal Flashing and Trim: Flashing and other trim not part of roofing.
4. Division 07 92 00 - Joint Sealants for field-applied panel sealants.
5. Wood framing and decking is specified in a Division 06 Section.

1.2 COORDINATION

A. Coordinate copper roofing with rain drainage work, flashing, gutters, downspouts, trim and construction of decks, parapets, walls, and other adjoining work to provide permanently watertight, secure, and noncorrosive installation.

1.3 PERFORMANCE REQUIREMENTS

A. Installation Requirements: Fabricator is responsible for installing system, including anchorage to substrate and necessary modifications to meet specified and drawn requirements and maintain visual design concepts in accordance with Contract Documents and following installation methods as stipulated in the "Copper in Architecture" handbook published by the Copper Development Association Inc. (CDA)
1. Drawings are diagrammatic and are intended to establish basic dimension of units, sight lines, and profiles of units.
2. Make modifications only to meet field conditions and to ensure fitting of system components.
3. Obtain Architect's approval of modifications.
4. Provide concealed fastening wherever possible.
5. Attachment considerations: Account for site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening and fracturing connection between units and building structure or between components themselves.
6. Obtain Architect's approval for connections to building elements at locations other than indicated in Drawings.
7. Accommodate building structure deflections in system connections to structure.

B. Performance Requirements:
1. System shall accommodate movement of components without buckling, failure of joint seals, undue stress on fasteners, or other detrimental effects when subjected to seasonal temperature changes and live loads.
2. Design system capable of withstanding building code requirements for negative wind pressure.

C. Interface With Adjacent Systems:
1. Integrate design and connections with adjacent construction.
2. Accommodate allowable tolerances and deflections for structural members in installation.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.

B. Product data including metal manufacturer's specifications, installation instructions, and general recommendations for roofing applications. Include certification or other data substantiating that materials comply with requirements.

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C. Shop drawings showing manner of forming, joining, and securing copper roofing, and pattern of seams. Show expansion joint details and waterproof connections to adjoining work and at obstructions and penetrations.

D. Samples consisting of 6-inch (150 mm) or 12-inch (300 mm) square specimens of specified copper roofing material.

E. Certificates: Fabricator's certification that products furnished for Project meets or exceeds specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Provide maintenance data in Operations and Maintenance manual for maintaining applied coatings on copper panels.

1.6 QUALITY ASSURANCE

A. Fabricator’s Qualifications: Company specializing in copper sheet metal roofing work with three years’ experience in similar size and type of installations.

B. Installer: A firm with 3 years of successful experience with installation of copper roofing of type and scope equivalent to Work of this Section.

C. Industry Standard: Except as otherwise shown or specified, comply with applicable recommendations and details of the "Copper in Architecture” handbook published by the Copper Development Association (CDA). Conform to dimensions and profiles shown.

D. Wind Uplift: Provide roof assemblies meeting wind uplift ratings as required by code.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading: Protect finish panel faces.

B. Acceptance at Site: Examine each panel and accessory as delivered and confirm that finish is undamaged. Do not accept or install damaged panels.

C. Storage and Protection:
1. Stack pre-formed material to prevent twisting, bending, and abrasions.
2. Provide ventilation.
3. Prevent contact with materials which may cause discoloration or staining.

1.8 WARRANTY

A. Warrant installed system and components to be free from defects in material and workmanship for period of 2 years.

B. Include coverage against leakage and damages to finishes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering materials that may be incorporated in the Work include, but are not limited to, the following:
1. Hussey Copper, Ltd.
2. KME America
3. Aurubis Buffalo, Inc.
4. PMX Industries Inc.
5. Revere Copper Products, Inc.
6. Approved Equal.

2.2 MATERIALS

A. Copper Roofing Sheets: Cold-rolled copper sheet complying with ASTM B370 temper H00, unless otherwise indicated, and as follows:

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1. Weight: 20 oz. per sq. ft. (0.0270-inch thick) (0.69 mm) unless otherwise indicated.

B. Miscellaneous Materials: Provide materials and types of fasteners, solder, protective coatings, separators, sealants and accessory items as recommended by copper sheet manufacturer for copper roofing work, except as otherwise indicated.

C. Accessories: Except as indicated as work of another specification Section, provide components required for a complete roof system, including trim, copings, fascias, ridge closures, cleats, seam covers, battens, flashings, gutters, louvers, sealants, gaskets, and closure strips. Match materials and finishes of roof.
   1. Sealing Tape: Pressure-sensitive 100 percent solids polyisobutylene compound sealing tape with release paper backing. Provide permanently elastic, non-sag, nontoxic, non-staining tape.
   2. Joint Sealant: One-part, copper compatible elastomeric polyurethane, polysulfide, butyl or silicone rubber sealant as tested by sealant manufacturer for copper substrates. Refer to Division 07.
   3. Cleats
      a. Concealed type as indicated in the "Copper in Architecture" handbook published by the Copper Development Association (CDA) for flat-seam flat lock seam spaced on 12-inch (300 mm) centers.
      b. Fabricate cleats to allow thermal movement of copper roof panels while preventing copper panel distortion due to wind uplift forces.
   4. Trim, Closure Pieces, and Accessories:
      a. Same material, thickness, and finish as adjacent copper roof panels, brake formed to required profiles.
      b. Comply with standards conforming to recognized industry standard sheet metal practice.

D. Bituminous Coating: SSPC - Paint 12, Cold-Applied Asphalt Mastic (Extra Thick Film), nominally free of sulfur, compounded for 15-mil dry film thickness per coat.

E. Roofing Felt Underlayment: Asphalt saturated felt weighing not less than 30 lbs per 100 square feet.

F. Paper Slip Sheet: Minimum 4-lb. red rosin-sized building paper.

G. Nails for Wood Substrates: Copper or hardware bronze, 0.109 inch minimum not less than 7/8-inch (22 mm) long barbed with large head.

H. Screws & Bolts: Copper, bronze, brass, or passivated stainless steel (300 Series) of sufficient size and length to sustain imposed stresses.

I. Cleats: 16 or 20 oz ounce cold rolled copper, as required to sustain loads 2-inch (50 mm) wide x 3-inch (75 mm) long.

J. Solder: ASTM B32; Provide 50-50 tin/lead- or lead-free alternative of similar or greater strength solder.

K. Flux: Muriatic acid neutralized with zinc or approved brand of soldering flux.

L. Rivets:
   1. Pop Rivets: 1/8-inch (3 mm) to 3/16-inch (4.5 mm) diameter, with solid brass mandrels.
   2. Provide solid copper rivet (tinner's rivets) where structural integrity of seam is required.

2.3 FABRICATION

A. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with details shown and with applicable requirements of the "Copper in Architecture" handbook published by the Copper Development Association (CDA) and other recognized industry practices. Fabricate for waterproof and weather-resistant performance with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work. Form work to fit substrate. Comply with material manufacturer's instructions and recommendations for forming material. Form exposed copper work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.
   1. Fabricate to allow for adjustments in field for proper anchoring and joining.
   2. Form sections true to shape, accurate in size, square, free from distortion and defects.

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3. Cleats: Fabricate cleats and starter strips of same material as sheet, interlockable with sheet in accordance with CDA recommendations.
4. Tin edges of copper sheets and cleats at soldered joints for flat lock and soldered system.
5. Flat Locked and Soldered (Flat Seam Soldered) Panel Seams:
   a. Fabricate flat seam roofing from pans 18 inches (450 mm) by 24 inches (600 mm) in size.
   b. Fold two adjacent edges over 180 degrees for width of 3/4 inch and other two adjacent edges under 3/4 inch (19 mm). Refer to CDA "Copper in Architecture Handbook".
   c. Tin edges of panels at least 1 ½ inch prior to forming seams, and as soon as possible prior to installation.
   d. Fabricate seams for panels to be installed in overlapped, interlocking shingle manner for locked down engaged seams.
6. Standing Seam Panels:
   a. Fabricate pans to interlock standing seam with center-to-center seam spacing as indicated on Drawings.
   b. Fabricate interlocking seams to heights and patterns indicated.
   c. Form overlapping and interlocking transverse joints.

B. Seams: Fabricate nonmoving seams in copper sheet with flat-lock seams. Tin edges and cleats to be soldered, form seams, and solder.

C. Expansion Provisions: Where lapped or bayonet-type expansion provisions in work cannot be used, or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1-inch (25 mm) deep, filled with mastic sealant (concealed within joints).

D. Sealant Joints: Where movable, non-expansion-type joints are indicated or required for proper performance of work, form copper to provide for proper installation of elastomeric sealant, in compliance with the "Copper in Architecture" handbook published by the Copper Development Association (CDA).

E. Separations: Provide for separation of copper from noncompatible metal or corrosive substrate by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.

F. Solder:
1. Solder and seal non-moving copper joints on slopes up to 3:12, except those indicated or required to be expansive type joints.
2. After soldering, remove flux. Wipe and wash solder joints clean. Refer to CLEANING Article in PART 3.

2.4 FINISHES

A. Natural weathering mill finished copper. No applied finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General: Examine conditions and proceed with work when substrates are ready.

B. Confirm that substrate system is even, smooth, sound, clean, dry, and free from defects.

C. Verify roof openings, pipes, sleeves, ducts, and vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.

3.2 PREPARATION

A. Clean surfaces to receive copper roofing. Substrate to be smooth and free of defects. Drive all projecting nails or other fasteners flush with substrate.

B. Roofing Felt Underlayment:
1. Install underlayment over solid substrates with horizontal overlaps and end laps staggered.
2. Lay parallel to ridge line with 2-1/2 inch (63 mm) side laps and 6 inch (150 mm) end laps.
3. Start application at low point, working up deck laying plies in shingle fashion.

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4. Fasten underlayment with copper roofing nails spaced on 12-inch (300 mm) centers maximum.

C. Install underlayment and paper slip sheet on substrate under copper roofing to greatest extent possible unless otherwise recommended by manufacturer of sheet metal. Paper slip sheets must be installed over the underlayment. Use adhesive for temporary anchorage, where possible, to minimize use of mechanical fasteners under copper roofing. Lap joints 2-inch (50 mm) minimum.

3.3 INSTALLATION

A. Manufacturer's Recommendations: Except as otherwise shown or specified, comply with recommendations and instructions of manufacturer of copper being fabricated and installed.

B. General:
1. Separate dissimilar metals by painting each metal surface in area of contact with a bituminous coating, by applying rubberized asphalt or butyl underlayment to each metal surface, or by other permanent separation as recommended by manufacturers of dissimilar metals.
2. Form and fabricate sheets, seams, strips, cleats, valleys, ridges, edge treatments, integral flashings, and other components of copper roofing to profiles, patterns, and drainage arrangements shown and as required for permanently leakproof construction. Provide for thermal expansion and contraction of the work, as indicated. Seal joints as shown and as required for leakproof construction. Shop-fabricate materials to greatest extent possible.
3. Sealant-Type Joints: Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1-inch (25 mm) into sealant. Form joints to conceal sealant completely. When ambient temperature is moderate at time of installation, 40 degrees to 70 degrees F (4 degrees to 21 degrees C), set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher or lower ambient temperatures. Do not install sealant-type joints at temperatures below 40 degrees F (4 degrees C). Comply with requirements of Division 07 "Joint Sealant" Sections for handling and installing sealants.
4. Fabricate and install work with lines and corners of exposed units true and accurate. Form exposed faces flat and free of buckles, excessive waves, and avoidable tool marks considering temper and reflectivity of metal. Provide uniform, neat seams with minimum exposure of solder, and sealant. Except as otherwise shown, fold back sheet metal to form a hem on concealed side of exposed edges.
5. Conceal fasteners and expansion provisions where possible in exposed work, and locate so as to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
6. Tin uncoated copper surfaces and cleats at edges of flat seam panel sheets to be soldered, for a width of 1-1/2 inch (38 mm), using solder recommended for copper work.

C. Flat Lock Soldered (“Flat Seam Soldered”) Seam Roofing:
1. Install copper work in accordance with CDA "Copper in Architecture Handbook".
2. Flat Seam Metal Roof Panels: Fasten system to substrate with concealed metal cleats and screws at spacings required by fabricator to resist code required wind uplift.
3. Align, level, and plumb system with structure.
4. Fasten cleats or nails using cleats mated to folded flat seams and fastener pattern to resist design loads with screws or barbed nails of sufficient length to penetrate substrate.
5. Tin and prepare panels as described in specification Section 2.3 “Fabrication”.
6. Only install the number of panels in a day that can be field soldered before the end of the day’s work. Install overnight protection on the unsoldered tinned edges of panel seams to prevent contamination before the start of the next work day.
7. Fully seat adjacent panel to on two sides to achieve continuous engagement of seam joint.
8. Mallet or dress down engaged seams.
9. Apply flux and fully sweat seams with solder to achieve watertight installation.
10. Install expansion battens at 25 to 30 feet (7500 mm to 9000 mm) in both directions.

D. Coordinate installation of panels with adjacent construction to ensure watertight enclosure.

3.4 CLEANING

A. Remove protective film (if any) from exposed surfaces of copper roofing promptly upon installation. Strip with care to avoid damage to finishes.

NOT FOR BIDDING

B. Upon completion of each area of soldering, carefully remove flux and other residue from surfaces. Neutralize acid flux by washing with baking soda solution, and then flushing clear water rinse. Use special care to neutralize and clean crevices.

C. Clean exposed metal surfaces of substances that would interfere with uniform oxidation and weathering.

3.5 PROTECTION

A. Provide final protection in a manner acceptable to installer that ensures that copper roofing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

NOT FOR BIDDING

SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, and exterior penetrations.

B. Sealants for joints within sheet metal fabrications.

1.02 REFERENCE STANDARDS

A. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction; 2022.

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

C. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2018).

D. CDA A4050 - Copper in Architecture - Handbook; current edition.

E. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

C. Samples: Submit two samples, 2 by 2 inches in size, illustrating material of typical standing seam.

D. Samples: Submit two samples, 2 by 2 inches in size, illustrating metal finish color.

1.04 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

PART 2 PRODUCTS

2.01 MANUFACTURERS

2.02 SHEET MATERIALS

A. Copper: ASTM B370, cold rolled 16 oz/sq ft, 24 gauge, 0.0216 inch thick; natural finish.

2.03 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch; miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18-inch long legs; seam for rigidity, seal with sealant.

F. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.

2.04 ACCESSORIES

A. Fasteners: Galvanized steel, with soft neoprene washers.

B. Primer Type: Zinc chromate.

C. Concealed Sealants: Non-curing butyl sealant.

D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

E. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.

NOT FOR BIDDING

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch.

3.03 INSTALLATION

A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.

B. Apply plastic cement compound between metal flashings and felt flashings.

C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

D. Connect downspouts to downspout boots, and grout connection watertight.

END OF SECTION

NOT FOR BIDDING

SECTION 07 62 20

COPPER DOWNSPOUTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes shop and field formed copper roofing accessories and trim, such as:
   1. Downspouts (rain drainage).
   2. Conductor heads.

B. Related Requirements:
   1. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to work of this Section.
   2. Roofing accessories installed integral with roofing membrane are specified in roofing system sections as roofing work.
   3. Section 07 62 00 – Sheet Metal Flashing and Trim
   4. Section 07 92 00 - Joint Sealants.

1.2 COORDINATION

A. Coordinate work of this section with interfacing and adjacent work for proper sequencing. Ensure weather resistance and durability of work and protection of materials and finishes.

1.3 PERFORMANCE REQUIREMENTS

A. Installation Requirements: Fabricator is responsible for installing system, including anchorage to substrate and necessary modifications to meet specified and drawn requirements and maintain visual design concepts in accordance with Contract Documents and following installation methods as stipulated in the "Copper in Architecture" handbook published by the Copper Development Association (CDA).
   1. Drawings are diagrammatic and are intended to establish basic dimension of units, sight lines, and profiles of units.
   2. Make modifications only to meet field conditions and to ensure fitting of system components.
   3. Obtain Architect's approval of modifications.
   4. Provide concealed fastening wherever possible.
   5. Attachment considerations: Account for site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening and fracturing connection between units and building structure or between components themselves.
   6. Obtain Architect's approval for connections to building elements at locations other than indicated in Drawings.
   7. Accommodate building structure deflections in system connections to structure.

B. Performance Requirements:
   1. System shall accommodate movement of components without buckling, failure of joint seals, undue stress on fasteners, or other detrimental effects when subjected to seasonal temperature changes and live loads.
   2. Design system capable of withstanding building code requirements for negative wind pressure.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.

B. Product data for gutters, downspouts, and accessories: Manufacturer's technical product data, installation instructions and general recommendations for each specified sheet material and fabricated product.

C. Shop drawings showing layout, profiles, expansion provisions, gutter slopes, methods of joining, and anchorage details, including downspout strainers, and conductor head, and attachments to built-in plumbing drain lines, scuppers, and conductor head systems.

NOT FOR BIDDING

D. Samples of the following flashing, sheet metal, and accessory items:
   1. 6-inch (150 mm) or 12-inch (300 mm) long samples of fabricated products exposed as finished work. Provide complete with specified finish.

1.5 CLOSEOUT SUBMITTALS

A. Provide maintenance data in Operations and Maintenance manual for maintaining applied coatings on copper panels.

1.6 QUALITY ASSURANCE

A. Fabricator's Qualifications: Company specializing in copper gutter and downspout work with three years' experience in similar size and type of installations.

B. Installer: A firm with 3 years of successful experience with installation of copper gutter and downspout work of type and scope equivalent to Work of this Section.

C. Industry Standard: Except as otherwise shown or specified, comply with applicable recommendations and details of the "Copper in Architecture" handbook published by the Copper Development Association (CDA). Conform to dimensions and profiles shown.

D. Mock-Up: Before proceeding with final purchase of materials and fabrication of copper gutter and downspout work components, prepare a mock-up of work. Incorporate materials and methods of fabrication and installation identical with project requirements. Install mock-up at location directed by Architect. Retain accepted mock-up as quality standard for acceptance of completed copper work. If accepted, mock-up may be incorporated as part of copper work.
   1. Provide mock-up of sufficient size and scope to show typical pattern of seams, fastening details, edge construction, and finish texture and color.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading: Protect finish metal faces.

B. Acceptance at Site: Examine each component and accessory as delivered and confirm that material and finish is undamaged. Do not accept or install damaged materials.

C. Storage and Protection:
   1. Stack pre-formed material to prevent twisting, bending, and abrasions.
   2. Provide ventilation.
   3. Prevent contact with materials which may cause discoloration or staining.

1.8 WARRANTY

A. Warrant installed gutters, downspouts, and trim components to be free from defects in material and workmanship for period of 2 years.

B. Include coverage against leakage and damages to finishes.

PART 2 - PRODUCTS

2.1 DOWNSPOUT MATERIALS

A. Copper: ASTM B370; minimum temper H00 (cold-rolled) except where temper 060 is required for forming;
   1. Downspouts: 16 oz. per sq. ft. (0.0216-inch thick) (0.55 mm) except as otherwise indicated.

2.2 ACCESSORIES

A. Solder: ASTM B32; Provide 50-50 tin/lead- or lead-free alternative of similar or greater strength solder.

B. Flux: Muriatic acid neutralized with zinc or approved brand of soldering flux.

C. Fasteners: Same metal as flashing/sheet metal or other non-corrosive metal as recommended by sheet manufacturer. Match finish of exposed heads with material being fastened.

NOT FOR BIDDING

D. Bituminous Coating: SSPC - Paint 12, Cold-Applied Asphalt Mastic (Extra Thick Film), nominally free of sulfur, compounded for 15-mil dry film thickness per coat.

E. Joint Sealant: One-part, copper compatible elastomeric polyurethane, polysulfide, butyl or silicone rubber sealant as tested by sealant manufacturer for copper substrates. Refer to Division 07.

F. Metal Accessories: Provide cleats, straps, hangers, anchoring devices, and similar accessory units as required for installation of work, noncorrosive, size and gage required for performance.

G. Rivets:
1. Pop Rivets: 1/8-inch (3 mm) to 3/16-inch (4.5 mm) diameter, with solid brass mandrels.
2. Provide solid copper rivet (tinner's rivets) where structural integrity of seam is required.

2.3 FABRICATION

A. General Metal Fabrication: Shop-fabricate work to greatest extent possible. Comply with details shown and with applicable requirements of Copper Development Association (CDA) "Copper in Architecture" handbook and other recognized industry practices. Fabricate for waterproof and weather-resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work. Form work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed copper work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.
1. Fabricate to allow for adjustments in field for proper anchoring and joining.
2. Form sections true to shape, accurate in size, square, free from distortion and defects.
3. Cleats, Spacers, Straps, and Hanger Brackets: Fabricate of same material as gutters and downspouts, interlockable with sheet in accordance with CDA recommendations.
4. Fabricate corners from one piece with minimum 18 inch (450 mm) long returns; solder corners for rigidity.

B. Seams: Fabricate nonmoving seams with 1 inch (25 mm) lapped riveted and soldered seams. Tin edges to be seamed, lap seams, rivet seams, and solder.

C. Expansion Provisions: Follow CDA Copper in Architecture Handbook guidance and provisions to accommodate expansion and contraction of gutter systems.

D. Separations: Provide for separation of metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.

E. Solder
1. Solder metal joints except those indicated or required to be movement type joints in accordance with the "Copper in Architecture" handbook published by the Copper Development Association (CDA).
2. Tin edges of copper sheets and cleats at soldered joints.
3. After soldering, remove flux. Wipe and wash solder joints clean with fresh water and baking soda to neutralize flux.

F. Copper Thickness: Comply with CDA recommendations for copper size and shape.

G. Downspouts:
1. Fabricate as indicated on Drawings and in accordance with the "Copper in Architecture" handbook published by the Copper Development Association (CDA).
2. Fabricate front edge at least 1 inch (25 mm) lower than back edge.
3. Transverse Seams in Gutter Liners: lapped, riveted and soldered for watertight gutter condition.
4. Provide spacers, hanger brackets and straps, and fasteners as indicated and as recommended by CDA.
5. Fabricate gutters and downspouts to sizes and profiles shown on Drawings.

H. Conductor Head: As indicated on Drawings and in accordance with CDA "Copper in Architecture" handbook. Coordinate with Section 07 62 00 for connection to downspout.
1. Basis of Design: Churchill Conductor Head in Copper by K&M Sheet Metal.
2. Approved Equal.

NOT FOR BIDDING

2.4 FINISHES

A. Natural weathering mill finished copper. No applied finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General: Examine conditions and proceed with work when substrates are ready.

B. Confirm that substrate system is even, smooth, sound, clean, dry, and free from defects.

3.2 INSTALLATION

A. General: Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations and with the "Copper in Architecture" handbook published by the Copper Development Association (CDA). Anchor units of work securely in place by methods indicated, providing for thermal expansion of units; conceal fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.
   1. Install units plumb, level, square, and free from warp or twist while maintaining dimensional tolerances and alignment with surrounding construction; except install gutters with required slope.
   2. Apply asphalt mastic on copper surfaces of units in contact with cementitious materials and dissimilar metals.
   3. Fit gutters to downspouts and flashings for watertight connections. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
   4. Miter, lap seam and close corner joints with solder. Seal seams and joints watertight with solder
   5. Install expansion joints at frequency recommended by the CDA "Copper in Architecture" handbook. Do not fasten moving seams such that movement is restricted.
   6. Coordinate with installation of roofing system and roof accessories.

B. Downspouts:
   1. Flash and seal gutter to downspout.
   2. Slope gutters not less than 1/8 inch per foot (1:100).
   3. Provide expansion joints at 48'-0" (14 400 mm) maximum, not more than 24 feet (7200 mm) from corners.
   4. Hang gutter with copper straps spaced 30 inches (750 mm) centers maximum. Closer spacing may be required to handle system loads.
   5. Integrate gutter flashing conditions with requirements of adjacent roofing for watertight installation.

C. Install counterflashing as indicated to prevent water from migrating behind gutter system.

D. Conductor Heads: Flash and seal conductor head to scupper.

3.3 CLEANING

A. Remove protective film (if any) from exposed surfaces of copper promptly upon installation. Strip with care to avoid damage to finishes. Do not allow protective film to fuse to copper.

B. Clean exposed copper surfaces, removing substances that might cause abnormal discoloration of metal.

C. Upon completion of each area of soldering, carefully remove flux and other residue from surfaces. Neutralize acid flux by washing with baking soda solution, and then flushing clear water rinse. Use special care to neutralize and clean crevices.

D. Clean exposed metal surfaces of substances that would interfere with uniform oxidation and weathering.

NOT FOR BIDDING

3.4 PROTECTION

A. Advise Contractor of required procedures for surveillance and protection of flashings and sheet metal work during construction to ensure that work will be without damage or deterioration other than natural weathering at time of Substantial Completion.

END OF SECTION

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SECTION 07 71 00
ROOF SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured roof specialties, including copings, fascias, and gravel stops.

1.02 REFERENCE STANDARDS

A. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems; 2022.

B. NRCA (RM) - The NRCA Roofing Manual; 2023.

C. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.03 SUBMITTALS

A. See Section 01 30 00 - 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.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Roof Edge Flashings and Copings:
1. Architectural Products Co: www.archprod.com/#sle.
2. ATAS International, Inc; Rapid-Loc SL Coping (Basis-of-Design): www.atas.com/#sle.
3. Drexel Metals Inc: www.drexmet.com/#sle.
4. Hickman Edge Systems: www.hickmanedgesystems.com/#sle.
5. Metal-Era Inc: www.metalera.com/#sle.
6. Metal Roofing Systems, Inc: www.metalroofingsystems.biz/#sle.
7. Approved Equal.
8. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 COMPONENTS

A. 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 thick, minimum.
7. Lightning Protection Bracket: Prvode lightning protection brackets by the same Manufacturer as indicated on the Drawings.
8. Color: As selected by Architect from manufacturer's standard range.

END OF SECTION

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SECTION 07 72 53
SNOW GUARDS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Pad-type, flat-mounted snow guards.

1.02 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include roof plans showing layouts and attachment details of snow guards.
   1. Include calculation of number and location of snow guards based on snow load, roof slope, roof type, components, spacings, and finish.

C. Samples.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Performance Requirements: Provide snow guards that withstand exposure to weather and resist thermally induced movement without failure, rattling, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
   1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surface.

B. Structural Performance:
   1. Snow Loads: As indicated on Drawings.

2.02 PAD-TYPE SNOW GUARDS

A. Flat-Mounted Metal Snow Guard Pads:
   1. Basis of Design:
      a. Basis-of-Design Manufacturer: Berger Building Products, 805 Pennsylvania Blvd., Feasterville, PA 19053
      b. Basis-of-Design Product: Berger No. 100 Snow Guard Assembly, Copper (SGC100).
      c. Approved equal.
   2. Material: Copper – Strap, hood and gusset are 16 oz copper.
   3. Finish: Mill finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, snow guard attachment, and other conditions affecting performance of the Work.

3.02 INSTALLATION

A. Install snow guards according to manufacturer's written instructions for patterns as indicated on the Drawings.

B. Attachment for Shingle Roofing:
   1. Flat-Mounted, Snow Guard Pads: Mechanically anchored through predrilled holes concealed by the shingles.

END OF SECTION

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SECTION 07 92 00
JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Self-leveling pourable joint sealants.

C. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions: Additional requirements for sealants and primers.

1.03 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015 (Reapproved 2022).

B. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).

C. ASTM C834 - Standard Specification for Latex Sealants; 2017 (Reapproved 2023).

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

E. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2023.

F. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).

G. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2022.

H. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2019 (Reapproved 2020).

I. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).

J. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2016.

1.04 SUBMITTALS

A. See Section 01 30 00 - 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. Backing material recommended by sealant manufacturer.
   4. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   5. Substrates the product should not be used on.
   6. Substrates for which use of primer is required.
   7. Substrates for which laboratory adhesion and/or compatibility testing is required.
   8. Installation instructions, including precautions, limitations, and recommended backing materials and tools.

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.

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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. 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.

J. Installation Log: Submit filled-out log for each length or instance of sealant installed.

K. Executed warranty.

1.05 QUALITY ASSURANCE

A. Maintain one copy of each referenced document covering installation requirements on site.

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 with at least three years of documented experience.

D. 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. Allow sufficient time for testing to avoid delaying the work.
   4. Deliver sufficient samples to manufacturer for testing.
   5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.

E. 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. Installation Log Form: Include the following data fields, with known information filled out.
      a. Date of installation.
      b. Name of installer.
      c. Actual joint width; provide space to indicate maximum and minimum width.
      d. Actual joint depth to face of backing material at centerline of joint.
      e. Air temperature.

F. 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. Copy of test method documents.
      c. Age of sealant upon date of testing.
      d. Test results, modeled after the sample form in the test method document.
      e. Indicate use of photographic record of test.

G. 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.

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3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
4. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
5. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Owner.
6. 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.

H. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.
1. Sample: At least 18 inches 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 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.

1.06 WARRANTY

A. See Section 01 78 00 - 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.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Nonsag Sealants:
1. Bostik Inc; _____: www.bostik-us.com/#sle.
2. Henry Company; _____: www.henry.com/#sle.
3. Pecora Corporation; _____: www.pecora.com/#sle.
4. Sika Corporation; _____: www.usa.sika.com/#sle.
5. Tremco Commercial Sealants & Waterproofing; ____: www.tremcosealants.com/#sle.
6. W.R. Meadows, Inc; _____: www.wrmeadows.com/#sle.
7. Substitutions: See Section 01 60 00 - Product Requirements.

B. Self-Leveling Sealants:
1. Bostik Inc; _____: www.bostik-us.com/#sle.
2. Pecora Corporation; _____: www.pecora.com/#sle.
3. Sika Corporation; _____: www.usa.sika.com/#sle.
4. Tremco Commercial Sealants & Waterproofing; ____: www.tremcosealants.com/#sle.
5. W.R. Meadows, Inc; _____: www.wrmeadows.com/#sle.
6. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 JOINT SEALANT APPLICATIONS

A. Scope:
1. Exterior Joints:
   a. Seal the following joints:
      1) Wall expansion and control joints.
      2) Joints between doors, windows, and other frames or adjacent construction.
      3) Joints between different exposed materials.
2. Interior Joints:
   a. Do not seal gaps and openings in gypsum board and suspended ceilings
   b. Seal the following joints:
      1) Joints between door frames and window frames and adjacent construction.

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2) In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, and piping penetrations.

3. Do Not Seal:
   a. Intentional weep holes in masonry.
   b. Joints indicated to be covered with expansion joint cover assemblies.
   c. Joints where sealant installation is specified in other sections.

B. Exterior Joints: Use nonsag nonstaining silicone sealant, unless otherwise indicated.
   1. Type ___ - Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane traffic-grade sealant.

C. Type ___ - Interior Joints: Use nonsag polyurethane sealant, unless otherwise indicated.
   1. Type ___ - Other Floor Joints: Self-leveling polyurethane traffic-grade sealant.

D. Interior Wet Areas: Bathrooms; fixtures in wet areas include plumbing fixtures and other similar items.

2.03 JOINT SEALANTS - GENERAL

A. Sealants and Primers: Provide products with acceptable levels of volatile organic compound (VOC) content; see Section 01 61 16.

2.04 NONSAG JOINT SEALANTS

A. Nonstaining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus ____ percent, minimum.
   2. Nonstaining to Porous Stone: Nonstaining to light-colored natural stone when tested in accordance with ASTM C1248.
   3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.

B. Silicone Sealant: ASTM C920, Grade NS, Use T; single component, explicitly approved by manufacturer for traffic exposure when recessed below traffic surface; not expected to withstand continuous water immersion.
   1. Movement Capability: Plus 100 percent and minus 50 percent, minimum.
   2. Color: To be selected by Architect from manufacturer's standard range.

C. Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 25 percent, minimum.
   2. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
   3. Color: To be selected by Architect from manufacturer's standard range.
   4. Cure Type: Single component, neutral moisture curing.
   5. Service Temperature Range: Minus 65 to 180 degrees F.

D. Polymer Sealant: ASTM C920; single component, cured sealant is paintable and mold/mildew resistant, low odor and VOC, and ultraviolet (UV) resistant.
   1. Adheres to wet surfaces.
   2. Color: White.

E. Two Component Polyurethane Non-Sag Sealant:
   1. Federal Specification TT-S-00227E, Type II, Class A, Corporation of Consultants CRD-C-506-72; ASTM C-920-98, Type M, Grade NS, Class 25; proprietary two component primerless sealant.
   2. Products offered by manufacturers to comply with the requirements include the following:
      a. Dynatred"; Pecora Corporation
      b. Vulkem 227"; Tremco Mfg. Company
      c. Sonolastic NP2"; BASF Building Systems
      d. Isoflex 881 NS Sealant"; LymTal International, Inc.
      e. Sikaflex-2c NS," Sika Corporation.
      f. Or approved Equal.

F. Immersible, Two-Component Polyurethane Self-Leveling Sealant:

NOT FOR BIDDING

1. Polyurethane-based, 2-part elastomeric sealant, complying with ASTM C920, Type M, Grade P, Class 25, Use T, NT, M, A and I.
2. Products offered by manufacturers to comply with the requirements include the following:
   a. Urexpan NR-200"; Pecora Chemical Corp.
   b. Sonolastic SL2"; BASF Building Systems
   c. Vulkem 245/255 or THC-900"; Tremco Mfg. Co.
   d. Isoflex 880GB Sealant"; LymTal International, Inc.
   e. Sikaflex-2c SL"; Sika Corporation.
   f. Or approved Equal.

G. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, nonstaining, nonbleeding, nonsagging; not intended for exterior use.
1. Color: To be selected by Architect from manufacturer's standard range.
2. Grade: ASTM C834; Grade 0 Degrees F (Minus 18 Degrees C).

2.05 SELF-LEVELING JOINT SEALANTS

A. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multicomponent; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion .
1. Movement Capability: Plus and minus 25 percent, minimum.
2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
3. Color: To be selected by Architect from manufacturer's standard range.
4. Service Temperature Range: Minus 40 to 180 degrees F.

B. Self-Leveling Polyurethane Sealant for Continuous Water Immersion: Polyurethane; ASTM C920, Grade P, Uses M and A; single component; explicitly approved by manufacturer for traffic exposure and continuous water immersion.
1. Movement Capability: Plus and minus 25 percent, minimum.
2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
3. Color: To be selected by Architect from manufacturer's standard range.
4. Service Temperature Range: Minus 40 to 180 degrees F.

2.06 ACCESSORIES

A. Sealant Backing Materials, General: Materials placed in joint before applying sealants; assists sealant performance and service life by developing optimum sealant profile and preventing three-sided adhesion; type and size recommended by sealant manufacturer for compatibility with sealant, substrate, and application.

B. Overlay Extrusion for Glazing System Joint Protection: Rubber profiled extrusions placed over joints in glazing system and provided with watertight seal.
1. Profile: As required to match existing metal glazing cap requirements.
2. Color: As required to match existing conditions.
3. Durometer Hardness, Type A: 65, minimum, when tested in accordance with ASTM D2240.
4. Tensile Strength: 1,139 psi, in accordance with ASTM D412.

C. Preformed Extruded Silicone Joint Seal: Pre-cured low-modulus silicone extrusion, in sizes to fit applications indicated on drawings, combined with a neutral-curing liquid silicone sealant for bonding joint seal to substrates.
1. Size: 1 inch wide, in rolls 100 feet long.
2. Thickness: 0.78 inch, with ridges along outside bottom edges for bonding area.
3. Color: As selected by Architect..
4. Durometer Hardness, Type A: 26 to 32, minimum, when tested in accordance with ASTM D2240.
5. Tensile Strength: 218 psi, in accordance with ASTM D412.
6. Elongation at Break: 554 percent, in accordance with ASTM D412.

NOT FOR BIDDING

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

D. 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

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 width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

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.

END OF SECTION

NOT FOR BIDDING

SECTION 07 92 10

CAULKING, SEALING AND JOINT FILLERS FOR CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. The extent of work included in this Section is shown on the Drawings and is specified as follows:

1. Two component polyurethane non-sag sealant at vertical and horizontal joints.
2. Two component polyurethane self-leveling sealant at joints subject to traffic conditions.
3. Polyurethane joint fillers at expansion joints shown to be caulked.
4. Bituminous joint fillers at concrete installations not required to be caulked.

1.2 PRECONSTRUCTION TESTING

A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use ASTM C1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit not fewer than eight pieces of each kind of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each application indicated below:
   a. Each kind of sealant and joint substrate indicated.
3. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
   a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
      1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
4. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
5. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

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1.3 SUBMITTALS

A. Manufacturer's Data: Submit manufacturer's specifications, recommendations and installation instructions for sealant, caulking compound and associated miscellaneous material required. Include manufacturer's published data, or letter of certification, or certified test laboratory report indicating that each material complies with the requirements and is intended generally for the applications shown.

B. Samples: Submit color samples of caulking from which the Architect will select color.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.

D. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

E. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Field-Adhesion Testing" Article.

F. Field-Adhesion Test Reports: For each sealant application tested.

G. Warranties: Sample of special warranties.

1.4 QUALITY ASSURANCE

A. Obtain elastomeric materials from only manufacturers who will, if required, send a qualified technical representative to project site, for the purpose of advising the installer of proper procedures and precautions for the use of the materials.

B. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.5 PROJECT CONDITIONS

A. Examine all surfaces to receive work of this Section and report to the Architect any condition which is not acceptable. Commencement of work on any continuous run constitutes acceptance of conditions and places the responsibility of a sound installation on this section.

B. Weather Conditions: Proceed with the work only when forecasted weather conditions are favorable for proper cure and development of high early bond strength. Wherever joint width is affected by ambient temperature variations, install elastomeric sealants only when temperatures are in the lower third of manufacturer's recommended installation temperature range, so that sealant will not be subjected to excessive elongation and bond stress at subsequent low temperatures. Coordinate time schedule to avoid delay of project. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.

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4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Materials shall be delivered and stored in original, unopened manufacturer's containers with brand marked clearly thereon. Materials shall be stored in a dry location, protected from adverse conditions.

1.7 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. 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.

B. VOC Content of Interior Sealants: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 CAULKING/SEALANT

A. Two Component Polyurethane Non-Sag Sealant:

1. Federal Specification TT-S-00227E, Type II, Class A, Corporation of Consultants CRD-C-506-72; ASTM C-920-98, Type M, Grade NS, Class 25; proprietary two component primerless sealant.
2. Products offered by manufacturers to comply with the requirements include the following:
   a. “Dynatred”; Pecora Corporation
   b. “Vulkem 227”; Tremco Mfg. Company
   c. “Sonolastic NP2”; BASF Building Systems
   d. “Isoflex 881 NS Sealant”; LymTal International, Inc.
   e. “Sikaflex-2c NS,” Sika Corporation.
   f. Or approved equal

B. Immersible, Two-Component Polyurethane Self-Leveling Sealant:

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1. Polyurethane-based, 2-part elastomeric sealant, complying with ASTM C920, Type M, Grade P, Class 25, Use T, NT, M, A and I.
2. Products offered by manufacturers to comply with the requirements include the following:
   a. “Urexpan NR-200”; Pecora Chemical Corp.
   b. “Sonolastic SL2”; BASF Building Systems
   c. “Vulkem 245/255 or THC-900”; Tremco Mfg. Co.
   d. “Isoflex 880GB Sealant”; LymTal International, Inc.
   e. “Sikaflex-2c SL”; Sika Corporation.
   f. Or approved equal

2.3 AUXILIARY MATERIALS

A. Joint Cleaner: Provide the type of joint cleaning compound recommended by the sealant or caulking compound manufacturer, for the joint surfaces to be cleaned.

B. Joint Primer/Sealer: Provide the type joint primer/sealer recommended by the sealant manufacturer, for the joint surfaces to be primed or sealed.

C. Bond Breaker Tape: Polyethylene tape or other plastic tape as recommended by the sealant manufacturer, to be applied to sealant-contact surfaces where bond to the substrate or joint filler must be avoided for proper performance of sealant. Provide self-adhesive tape wherever applicable.

D. Sealant Backer Rod: Compressible rod stock polyethylene foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable non-absorptive material as recommended for compatibility with sealant by the sealant manufacturer. Provide size and shape of rod which will control the joint depth for sealant placement, break bond of sealant at bottom of joint, form optimum shape of sealant bead on back side, and provide a highly compressible backer to minimize the possibility of sealant extrusion when joint is compressed.

E. Masking Tape: Provide non-staining, nonabsorbent type compatible with joint sealants and to surfaces adjacent to joints.

2.4 CELLULAR FOAM EXPANSION JOINT FILLERS

A. Expanded Polyethylene Joint Filler:

1. Provide flexible, compressible, closed-cell polyethylene of not less than 10 psi compression deflection (25%); except provide higher compression deflection strength as may be necessary to withstand installation forces and provide proper support for sealants; surface water absorption of not more than 0.1 lbs. per sq. ft.
2. Products offered by manufactured to comply with the requirements include the following:
   a. “Ethafoam SB”: Dow Chemical Co.
   b. “Sonofoam; BSF” Building Systems.
   c. “Expand-O-Foam”; Williams Products, Inc.
   d. Or approved equal

2.5 CONCRETE CONTROL-EXPANSION JOINT FILLERS

A. Bituminous and Fiber Joint Filler:

1. Provide resilient and non-extruding type premolded bituminous impregnated fiberboard units complying with ASTM D1751 and AASHTO M213.
2. Products offered by manufacturers to comply with the requirements include the following:
   a. “Flexcell”; Celotex Corporation
   b. “Cane Fiber 1290”; W. R. Grace & Co.
   c. “Fibre Lite”; W. R. Meadows, Inc.

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d. Or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CAULKING/SEALANT APPLICATION

A. Joint Surface Preparation: Clean joint surfaces immediately before installation of sealant or caulking compound. Remove dirt, insecure coatings, moisture and other substances which would interfere with bond of sealant or caulking compound.

1. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.
    d. Exterior cement plaster finish systems.
2. Remove laitance and form-release agents from concrete.
3. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Glazed surfaces of ceramic tile.
4. For elastomeric sealants, do not proceed with installation of sealant over joint surfaces which have been painted, lacquered, waterproofed or treated with water repellent or other treatment or coating unless preconstruction testing has successfully demonstrated that sealant bond is not impaired by the coating or treatment. If laboratory test has not been performed, or shows bond interference, remove coating or treatment from joint surfaces before installing sealant.
5. Etch concrete and masonry joint surfaces to remove excess alkalinity, unless sealant manufacturer's printed instructions indicate that alkalinity does not interfere with sealant bond and performance.

B. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

C. Installation: Comply with sealant manufacturer's printed instructions except where more stringent requirements are shown or specified and except where manufacturer's technical representative directs otherwise.

1. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

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2. Prime or seal the joint surfaces wherever shown or recommended by the sealant manufacturer. Do not allow primer/sealer to spill or migrate onto adjoining surfaces.
3. Install sealant backer rod for liquid elastomeric sealants, except where recommended to be omitted by sealant manufacturer for the application shown.
4. Install bond breaker tape wherever required by manufacturer's recommendations to ensure that elastomeric sealants will perform properly and where sealant backings are not used between sealants and backs of joints.
5. Employ only proven installation techniques, which will ensure that sealants will be deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of the joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, per Figure 8A in ASTM C1193, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.
6. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
7. Install sealants to depths as recommended by the sealant manufacturer but within the following general limitations, measured at the center (thin) section of the bead.
    a. For pavements and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75% of joint width, but not more than 5/8 inch deep or less than 3/8 inch deep.
    b. For normal moving joints sealed with elastomeric sealants, but not subject to traffic, fill joints to a depth equal to 50 percent of joint width, but not more than 1/2 inch deep or less than 1/4 inch deep.
8. Spillage: Do not allow sealants or compounds to overflow or spill onto adjoining surfaces. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces, by either the primer/sealer or the sealant/caulking compound.
9. Remove excess and spillage of compounds promptly as the work progresses. Clean the adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage, without damage to the adjoining surfaces or finishes.
10. Cure sealants and caulking compounds in compliance with manufacturer’s instructions and recommendations to obtain high early bond strength , internal cohesive strength and surface durability.

3.3 JOINT FILLERS

A. Set units at proper depth or position in the joint to coordinate with other work, including the installation of bond breakers, backer rods and sealants. Do not leave voids or gaps between the ends of joint filler units.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:
    a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
    b. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.
2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C1521.
    a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

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3. Inspect tested joints and report on the following:
   a. Whether sealants filled joint cavities and are free of voids.
   b. Whether sealant dimensions and configurations comply with specified requirements.
   c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.
4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

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SECTION 07 95 10

EXPANSION JOINT SEAL

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide expansion joint seal as shown on the drawings and specified herein:

1. Horizontal deck joint seals at supported slabs.

1.2 QUALITY ASSURANCE

A. Manufacturer's Instructions: In addition to the requirements of these specifications, comply with manufacturer's instructions and recommendations for all phases of the work, including preparation of substrate, application of materials, and protection of installed units.
   1. The manufacturer will verify that the expansion joint system is properly sized for the movement expected in the structure.

   2. The manufacturer will verify or make recommendations regarding the size of concrete block-outs to receive the expansion joint system taking into consideration climate conditions at the time concrete is placed and shrinkage of concrete.

   3. The manufacturer will insure that the expansion joint system is set at the proper width to account for variations in the concrete joint opening due to temperature conditions at the time of installation.

   4. The manufacturer and approved applicator shall guarantee the expansion joint system for a period of five (5 years). Any type of failure of the new joint system which occurs within the specified warranty period shall be repaired or replaced by the Contractor at no cost to the Owner.

   5. Consult the Manufacturer's representative and establish the minimum provisions required to ensure satisfactory work.

   6. The expansion joint system shall meet or exceed any fire rating requirements set forth by the local building code requirements.

   7. The expansion joint system shall conform to Americans with Disabilities Accessibility (ADA) guidelines.

B. Installation: The installer shall be licensed by the manufacturer of the joint system.

1.3 SUBMITTALS

A. Manufacturer's Data: Submit specifications, installation instructions and general recommendations from the expansion joint material manufacturer, for the type of product required.

B. Shop Drawings: Submit shop drawings for installation of expansion joints. Include plans and details of sections and connections. Show anchorage and accessory items.

C. Samples: Submit sample of expansion joint, not less than 6 inches long.

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1.4 DELIVERY, STORAGE AND HANDLING

A. All materials shall be delivered on the job and stored in a place protected from damage, moisture and exposure to the elements in exact accordance with manufacturer's instructions.

1.5 JOB CONDITIONS

A. Weather Conditions: Do not proceed with installation of expansion joints and sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations for installation. Proceed with the work only when forecasted weather conditions are favorable for proper cure and strength development of the adhesive materials.

1.6 WARRANTY

A. The Contractor shall guarantee the expansion joint system for a period of five (5) years. The Contractor will repair or replace work which leaks water, deteriorates excessively or otherwise fails to perform as required due to failures of materials, adhesion or workmanship. The guarantee shall include an agreement to remove and repair other work which has been superimposed on the elastic expansion joint work, to the extent required to repair or replace the elastic expansion joint work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The expansion joint seal system shall be a complete system of compatible materials designed by the manufacturer to produce a waterproof, traffic-bearing expansion joint seal.

B. The gland elements shall be a continuous, factory extruded unit for the entire straight run length of the joint. Changes in direction or elevation shall be accomplished by factory molded elbows, tees, crosses and the like. The seal shall be turned up a minimum of 6 inches (vertically) unless otherwise shown on plans. The seal element shall not be mitered/jointed unless approved by the Consultant in writing.

C. Expansion joint systems approved for use in one or more applications are provided in the list below. Due to variations in specific details of the locations, expected movement, expected traffic exposure, all systems are not suitable for one particular condition. The Contractor shall reference the specific expansion joint detail and approved products shown on the drawings, including gland size, etc. for the respective condition.

D. Approved Products

1. “Wabocrete/Membrane system,” model as applicable, manufactured by Watson Bowman Acme, A Division of Degussa (800) 677-4922.

2. “Iso-Flex Winged Expansion Joint Sealing System”, seal type JXX as applicable, as manufactured by LymTal International, Inc. (810) 373-8100.

3. “Emseal Thermaflex TCR System,” model as applicable, manufactured by Emseal Joint Systems, Ltd. (508) 836-0280.

4. “Lokcrete Membrane System (LMS Series)”, model as applicable, manufactured by MM Systems Corporation (866) 506-6929.

5. Or approved equal.

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E. Contractor shall review specific details on drawings regarding products and model numbers approved for use.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Preparatory Work

1. The block-out shall be provided to the specified dimensions as indicated on the drawing and acceptable to the manufacturer. Any edge raveling at the joint opening or spalls shall be repaired with a suitable compound to provide a solid, square block-out.

2. The block-out substrate shall be sandblasted clean of all contaminants and impurities immediately prior to the system installation to assure proper adhesion.

3. The membrane gland element shall be unpackaged and laid in a relaxed position to relieve any temporary set from shipment packaging prior to placement. The pre-molded element shall be wiped clean with a solvent solution such as toluene.

4. It is recommended that adjacent deck surfaces be taped off and protected to assure a clean, neat professional installation.

B. Installation

The entire installation shall be made in strict accordance with the manufacturer's written instruction.

1. Follow standard manufacturer’s recommendation for installation of the material, taking into account block-out dimensions, joint width and ambient temperature conditions.

3.2 TESTING

All expansion joint seals shall be tested by applying water at a minimum of 30 psi pressure and by flooding for a minimum of 24 hours. Any leaking observed shall be rectified by the Contractor and the joint shall be re-tested until no leakage is observed. It is the responsibility of the Contractor to absolutely make certain that the joints are totally waterproofed.

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SECTION 08 11 13
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 08 71 00 - Door Hardware.

B. Section 09 91 00 - Painting.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (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; 2022.

C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2023.

D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2020.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.

F. 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; 2016.

G. 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; 2017.

H. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.

I. ASTM C476 - Standard Specification for Grout for Masonry; 2023.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.

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 805 - Recommended Selection and Usage Guide for Hollow Metal Doors and Frames; 2012.

O. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

P. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.

Q. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2017.

R. NAAMM HMMA 860 - Guide Specifications for Hollow Metal Doors and Frames; 2018.

S. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

T. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

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.

NOT FOR BIDDING

1.04 SUBMITTALS

A. See Section 01 30 00 - 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.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

B. Maintain at project site copies of reference standards relating to installation of products specified.

1.06 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:
1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
2. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
3. Steelcraft, an Allegion brand: www.allegion.com/#sle.
4. Approved Equal.
5. Substitutions: See Section 01 60 00 - 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. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
4. Door Edge Profile: Manufacturers standard for application indicated.
5. Typical Door Face Sheets: Flush.
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.

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.

NOT FOR BIDDING

B. Exterior Doors: Thermally insulated.
   1. Based on NAAMM HMMA Custom Guidelines:
      a. Comply with guidelines of NAAMM HMMA 860 for Hollow Metal Doors and Frames.
      b. Performance Level 3 - Heavy Duty, in accordance with NAAMM HMMA 805.
      c. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
      d. Door Face Metal Thickness: 18 gauge, 0.042 inch, minimum.
      e. Zinc Coating: G90/Z275 galvanized coating; ASTM A653/A653M.
   2. Door Core Material: Polystyrene, 1 lbs/cu ft minimum density.
      a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.
   3. Door Thermal Resistance: R-Value of 6.0 minimum, for installed thickness of polystyrene.
   4. Door Thickness: 1-3/4 inches, nominal.
   5. Weatherstripping: Refer to Section 08 71 00.

C. 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 1 - Full Flush.
      d. Door Face Metal Thickness: 18 gauge, 0.042 inch, minimum.
      e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
   2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
   3. Door Thickness: 1-3/4 inches, nominal.

D. Fire-Rated Doors:
   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 1 - Full Flush.
      d. Door Face Metal Thickness: 18 gauge, 0.042 inch, minimum.
      e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
   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, 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. 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: 18 gauge, 0.042 inch, minimum.
   3. Frame Finish: Factory primed and field finished.
   4. Weatherstripping: Separate, see Section 08 71 00.

C. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
   1. Frame Metal Thickness: 18 gauge, 0.042 inch, minimum.
   2. Frame Finish: Factory primed and field finished for exterior frames at all locations.

D. Door Frames, Fire-Rated: Full profile/continuously welded type.
   1. Fire Rating: Same as door, labeled.

E. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.

NOT FOR BIDDING

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard for exterior applications at all frames.

2.06 ACCESSORIES

A. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.

B. 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.

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 08 71 00.

F. Coordinate installation of electrical connections to electrical hardware items.

3.04 TOLERANCES

A. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

END OF SECTION

NOT FOR BIDDING

SECTION 08 11 16
ALUMINUM DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glazed aluminum doors.

B. Aluminum frames.

1.02 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Sealing joints between door frames and adjacent construction.

B. Section 08 71 00 - Door Hardware: Hardware for aluminum doors.

C. Section 08 80 00 - Glazing: Glazing materials for aluminum doors and frames.

1.03 REFERENCE STANDARDS

A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights; 2022.

B. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.

C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.

D. AAMA 701/702 - Performance Specification for Pile Weatherstrips (AAMA 701) and Polymer Weatherseals (AAMA 702); 2023.

E. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

F. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

G. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors; 2002 (Reapproved 2018).

H. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's descriptive literature for each type of door; include information on fabrication methods.

C. Shop Drawings: Include elevations of each opening type and details at each wall type.

D. Test Report: Certified test reports from qualified independent testing agency indicating doors comply with specified performance requirements.

1.05 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 type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver aluminum components in manufacturer's standard protective packaging, palleted, crated, or banded together.

B. Inspect delivered components for damage and replace. Repaired components will not be accepted.

C. Store components in clean, dry, indoor area, under cover in manufacturer's packaging until installation.

NOT FOR BIDDING

D. Protect materials and finish from damage during handling and installation.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Manufacturer Warranty: Provide 10-year manufacturer warranty for defects in workmanship and materials. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Glazed Aluminum Doors:
1. Arcadia, Inc; WS512 Standard Wide Stile (Basis-of-Design): www.arcadiainc.com/#sle.
2. Kawneer
3. CDF Doors
4. Avalon International Aluminum LLC: www.avalonint.com/#sle.
5. Manko Window Systems, Inc: www.mankowindows.com/#sle.
6. Reynaers Aluminum: www.reynaers.com/#sle.
7. Terra Universal, Inc: www.terrauniversal.com/#sle.
8. Or approved Equal.
9. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DOORS AND FRAMES

A. Accessibility: Comply with ICC A117.1 and ADA Standards.

B. Dimensions and Shapes: As indicated on drawings; dimensions indicated are nominal.
1. Provide vision lites as indicated on drawings.

2.03 COMPONENTS

A. Vision Lites: Extruded aluminum framed, gasket glazed.
1. Glazing: See Section 08 80 00.

B. Additional Door Hardware: See Section 08 71 00.

C. Replaceable Weatherstripping: AAMA 701/702 wool pile.

2.04 PERFORMANCE REQUIREMENTS

A. Provide door assemblies that have been designed and fabricated in compliance with specified performance requirements.

2.05 FINISHES

A. Class I Color Anodized Finish: Electrolytically deposited colored anodic coating; AAMA 611 AA-M12C22A44, minimum dry film thickness (DFT) of 0.7 mils, 0.0007 inch.

B. High Performance Organic Coatings: Multiple coats, thermally cured fluoropolymer system with minimum dry film thickness (DFT) of 1.2 mils, 0.0012 inch over aluminum extrusions and panels; AAMA 2604.

C. Color: White.

D. Touch-Up Materials: As recommended by coating manufacturer for field application.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and approved shop drawings.

B. Set frames plumb, square, level, and aligned to receive doors. Anchor frames to adjacent construction in strict accordance with manufacturer's recommendations and within specified tolerances.

NOT FOR BIDDING

C. Where aluminum surfaces contact metals other than stainless steel, zinc, or small areas of white bronze, protect from direct contact by painting dissimilar metal with heavy coating of bituminous paint.

D. Hang doors and adjust hardware to achieve specified clearances and proper door operation.

E. Install door hardware. See Section 08 71 00.

F. Comply with glazing installation requirements. See Section 08 80 00.

3.02 CLEANING

A. Upon completion of installation, thoroughly clean door and frame surfaces in accordance with AAMA 609 & 610.

B. Do not use abrasive, caustic, or acid cleaning agents.

3.03 PROTECTION

A. Protect products of this section from damage caused by subsequent construction until Date of Substantial Completion.

B. Replace damaged or defective components that cannot be repaired to a condition indistinguishable from undamaged components.

END OF SECTION

NOT FOR BIDDING

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SECTION 08 30 00

HIGH SPEED ROLLING DOORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. High-speed roll-up doors.

B. Wiring from electric circuit disconnect to operator to control station.

1.02 RELATED SECTIONS

A. Section 08 71 00 – Door Hardware

B. Section 26 05 33.13 Conduit: Conduit from electric circuit to door operator and from door operator to control station.

C. Section 26 05 83 - Wiring Connections: Power to disconnect.

1.03 REFERENCES

A. NEMA - National Electrical Manufacturers Association.

B. LED - Light Emitting Diode.

1.04 SYSTEM DESCRIPTION

A. Motor type: AC drive, and variable speed with soft acceleration and braking. Mechanical release lever on side column allows door to be easily opened in the event of a power failure.

1.05 SUBMITTALS

A. Submit the following:

1. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.

2. Product Data: Provide general construction, component connections and details, and electrical equipment, operation instructions, and information.

3. Samples: Submit samples of door slat material.

4. Manufacturer's Installation: Indicate installation sequence and procedures, adjustment, and alignment procedures.

1.06 MAINTENANCE DATA

A. Scheduled maintenance program available to include lubrication requirements and frequency, periodic adjustments required, scheduled maintenance suggested, manufacturer’s data sheets, and equipment inter-connection diagrams.

1.07 REGULATORY REQUIREMENTS

A. Electrical components UL listed.

NOT FOR BIDDING

B. Electrical control panel NEMA approved.

1.08 QUALITY ASSURANCE

A. Furnish high-speed roll doors and all components and accessories by one manufacturer.

B. Specific door model used must have a proven track record of successful installations in similar applications of no less than 3 years. References to be provided upon request.

1.09 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on shop drawings.

1.10 COORDINATION

A. Coordinate the work with installation of electric power and locations and sizes of conduit.

1.11 WARRANTY

A. 500,000 Cycle Warranty: Three years or 500,000 cycles, whichever comes first, from date of shipment, against defects in material and workmanship, on mechanical components, operator and control panel.

B. Two-year warranty on workmanship.

PART 2 - PRODUCTS

2.01 PRODUCTS

A. Basis-of-Design Product: Cookson Company Extreme EPD 300

B. Rytec Corporation Spiral Door

C. Hormann Steel Ranger 9000.

D. Cornell

E. Clopay Building Products

F. Approved Equal.

2.02 MATERIALS

A. Basis-of-Design Finish CycleShield™ (Stock Colors): Powder coating system with low coefficient of friction wear-resistance to include a galvanized base coat consistent with ASTM A-653, Zirconium treated and bonderized for prime coat adhesion, with a white baked-on polyester powder coat rust inhibiting paint with a minimum 2 mils (0.0508 mm) cured film thickness.

B. Door Panel: Minimum 22 gauge, interconnected strip steel slats conforming to ASTM A-653, Total Slat Thickness: 5/8 inch (24 mm). Integral rubber weatherseal between each of the panels. Door slats are connected by hinge system to provide additional rigidity and security to door panel. Door curtain does not require a tensioning system for additional wind/pressure resistance. Doors which require the use of a tensioning system for additional wind/pressure resistance will not be accepted.

NOT FOR BIDDING

C. Safety Systems: Door shall include Advanced Detection and Alert system consisting of:
- Two sets of emitter and receiver light curtain strips with integrated multi-color high intensity LED lights. 16 high intensity amber/red LED lights strip creating (4) four, 5-foot-long multifunction warning lights at each corner of the doorway. Lights and lenses shall be designed to allow for 180 degrees of visibility.
- LED strips shall be visible on right and left sides of door with door open or closed, both inside and out, and allow for a variety of animation such as cascading downward when door is closing as well as multiple flashing rates.
- Exterior units equipped with stainless steel cable jacketing for superior protection and long-lasting finish.
- SmartSurround profile size: L x W x D = 65.5” x 0.58” x 0.58” (1665mm x 14.5mm x 14.5mm); Outside set (field installed) projects less than ¾” from jamb of building.
- IP67 rating (dust/waterproof)
- CAN Bus communication and connection technology providing easy connection via quick-connect cables allows for extensive data and integration between SmartSurround system and System 4® door controller.
- 16 photo electric light beams with range up to 30ft. Beams shall sense when object has entered the SmartSurround protected area. SmartSurround and System 4 controller software shall be integrated so as to allow for various specific reactions to obstructions as well as normal and abnormal traffic patterns or use.

D. Bottom Bar
1. Configuration
    i. Structural Steel Angles: Minimum two 2x2x1/8 inch structural steel angles
2. Finish: Match Curtain Slats.

E. Endlocks
1. Fabricate interlocking sections with malleable steel endlocks on continuous slats each secured two ¼” rivets. Windlock material as required based on system description and manufacturer’s recommendation. Provide windlocks as required to meet specified wind load.

F. Guides:
1. Fabrication:
    i. Structural Steel Angle: Minimum 3/16” thick ASTM A36 structural steel angles bolted together with 3/8” fasteners to form a channel for the curtain to travel. Sealing, self lubricating UHMW anti-wear strips and block materials provided. The wall angle portion shall be continuous and fastened to the surrounding structure with either minimum 3/8” fasteners or ¼” welds, both on 24” centers maximum.
2. Finish:
    i. Match Curtain Slats

G. Shaft Assembly
1. Barrel: Minimum 6” steel tubing capable of supporting curtain load with maximum deflection of 0.03 inches per foot (2.5 mm per meter) of width.
2. Springless Design: System shall be designed to operate safely without the use of a counterbalance system. Door designed with springs is not acceptable.

H. Brackets
1. Configuration:
    i. Constructed of steel not less that ¼” thick and shall be bolted to the wall angle with minimum ½” fasteners. Both drive and idler brackets are to be furnished with precision ball bearings.
2. Finish:
    i. Match Curtain Slats

NOT FOR BIDDING

I. Hood: 24 gauge steel with reinforced top and bottom edges
    1. Finish:
        i. Steel: Match Curtain Slats

J. Perimeter Sealing:
    1. Bottom Bar: Provide neoprene astragal extending full width of door bottom bar.

K. Drive system: Minimum 2 HP motor with variable speed AC drive which allows for soft acceleration and braking. Doors using a motor with a clutch or pump will not be accepted.
    1. Supply Voltage: 480V, 3-phase.

L. Travel Speed: Opens at up to 60 inches per second and closes at 24 inches per second.

M. Electrical Controls
    1. Controller housed in a UL/cUL Listed NEMA 4X-rated enclosure with factory set parameters. System 4 controller shall be housed within the head structure of the door assembly.
    2. All electrical components and connections shall be factory installed and connected with only minimal plug-type connections required at time of installation.
    3. All electrical components and connections shall be factory tested in the assembled locations and validated for proper connection and operation.
    4. Door shall be provided with provision to connect main power supply without accessing the door controller. Provisions shall include minimum of 4 feet of flexible conduit and connection junction box which can be field mounted to a wall.
    5. Door shall be provided with provision to connect accessory devices such as activation without accessing the door controller. Provision shall include minimum of 4 feet of flexible conduit and connection junction box which can be field mounted to wall.
    6. Door shall include a remote HMI with full text display, open, close, stop and night switch buttons located at working/accessible height from finished floor.
    7. End User shall be able to specify location for remote HMI; integrated in lefts side frame assembly, integrated in right side frame assembly, field installed remotely from door frame.
    8. Parameter changes and all door configurations can be made from the face of the control box, no exposure to high voltage. Control panels that require opening of the control box and reaching inside to make parameter changes will not be accepted.
    9. Controls include a variable speed AC drive system capable of infinitely variable speed control in both directions.
    10. Programmable inputs and outputs accommodate special control applications (traffic lights, horns, actuation devices, timing sequences, etc.) without the need for additional electrical components.
    11. Self-diagnostic scrolling two-line vacuum fluorescent display provides expanded informational messages for straightforward installation, control adjustments and error reporting.
    12. All errors have a time and date stamp for reference.

N. Door to use rotary absolute encoder to regulate door travel limits. Limits to be self-adjusting, without the use of tools, from floor level at the control panel. Doors using mechanical limits switches or doors that require tools to set the limits will not be accepted.

O. Windload: Door testing indicates the door is capable of withstanding winds up to 50 mph. (10 PSF).

NOT FOR BIDDING

P. All components factory finished.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that opening sizes, tolerances, and conditions are acceptable.

3.02 INSTALLATION

A. Install door unit assembly in accordance with manufacturer's instructions.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Fit and align assembly including hardware; level to plumb to provide smooth operation.
   1. Coordinate installation of electrical service. Complete wiring from disconnect to unit components.

3.03 ADJUSTING

A. Adjust door and operating assemblies.

B. Test and adjust door(s), if necessary, for proper operation.

3.04 CLEANING

A. Clean door and components.

END OF SECTION

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SECTION 08 31 00
ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall- and ceiling-mounted access units.

1.02 RELATED REQUIREMENTS

A. Section 09 91 00 - Painting: Field paint finish.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

B. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021.

C. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

PART 2 PRODUCTS

2.01 ACCESS DOORS AND PANELS ASSEMBLIES

A. Wall-Mounted Units in Wet Areas:
   1. Size: 12 by 12 inches. Unless otherwise noted on Drawings.
   2. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
   3. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.

B. Fire-Rated Ceiling-Mounted Units:
   1. Ceiling Fire-Rating: 1 hour.
   2. Panel Material: Steel.
   3. Size: 16 by 16 inches.
   4. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.

2.02 WALL- AND CEILING-MOUNTED ACCESS UNITS

A. Manufacturers:
   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. BAUCO Access Panel Solutions Inc: www.bauco.com/#sle.
   5. Best Access Doors: www.bestaccessdoors.com/#sle.
   6. Cendrex, Inc: www.cendrex.com/#sle.
   7. Elmdor: www.elmdor.com/#sle.
   8. FF Systems, Inc: www.ffsystemsinc.com/#sle.
   9. Karp Associates, Inc: www.karpinc.com/#sle.
   10. MIFAB, Inc: www.mifab.com/#sle.
   11. Nystrom, Inc: www.nystrom.com/#sle.
   12. Studco Building Systems: www.studcosystems.com/#sle.
   13. The Williams Brothers Corporation of America; WB EXT 1350 (Basis-of-Design for exterior access panel): www.wbdoors.com/#sle.
   14. Approved Equal.
   15. Substitutions: See Section 01 60 00 - Product Requirements.

NOT FOR BIDDING

PART 3 EXECUTION

3.01 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings, and secure units rigidly in place.

C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

NOT FOR BIDDING

SECTION 08 34 10

ROLLING GRILLES

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The extent of rolling grilles is shown on the drawings. Provide complete operating door assemblies including door curtains, guides, counterbalance mechanism, operators and installation accessories. The following types of rolling grilles are specified in this Section:

1. Aluminum rolling grilles.

1.02 QUALITY ASSURANCE

A. Furnish each rolling grille as a complete unit produced by one manufacturer, including hardware, accessories, mounting and installation components.

B. Furnish all rolling grille units by one manufacturer for the entire project.

C. Insert and Anchorages:

1. Furnish inserts and anchoring devices which must be set in concrete or built into masonry for the installation of the units. Provide setting drawings, templates, instructions and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.

2. See concrete and masonry Sections of these specifications for installation of inserts and anchorage devices.

1.03 SUBMITTALS

A. Manufacturer's Data:

1. Submit manufacturer's product data roughing-in diagrams, and installation instructions for each type and size of rolling grille. Include operating instructions and maintenance information data. Indicate by transmittal form that installer has received a copy of diagrams and installation instructions.

B. Shop Drawings:

1. Submit shop drawings for special components and installations which are not fully dimensioned or detailed on manufacturer's data sheets.

PART 2 - PRODUCTS

2.01 DOOR CURTAIN MATERIALS AND CONSTRUCTION

NOT FOR BIDDING

A. Door Curtain:

1. Rolling grille curtain construction to be a brick or straight pattern and all exposed material to be aluminum. Continuous horizontal steel core rods spaced 2" o.c. are to be covered with aluminum tube spacers. End links are to be furnished of design to prevent curtain from leaving side guides, maintain alignment and resist lateral movement. Bottom of curtain is to be provided with extruded aluminum tube reinforced for wider openings. Bottom member shall house keyed locking devices at both ends.

B. Curtain Jamb Guides:

1. Fabricate curtain jamb guides of steel angles, or channels and angles with sufficient depth and strength to retain the curtain loading.

2. Secure continuous wall angle to wall framing by 3/8-inch minimum bolts at not more than 30 inches on center, unless otherwise recommended by door manufacturer. Extend wall angles above door opening head to support coil brackets, unless otherwise shown. Place anchor bolts on exterior wall guides so that they are concealed when door is in closed position. Provide removable stops on guides to prevent over-travel of curtain, and continuous bar for holding windlocks.

2.02 COUTERBALANCING MECHANISM

A. Counterbalance doors by means of an adjustable steel helical torsion spring, mounted around a steel shaft and mounted in a spring barrel and connected to the door curtain with the required barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel:

1. Fabricate spring barrel of hot-formed structural quality carbon steel, welded or seamless pipe, of sufficient diameter and wall thickness to support the roll-up of curtain without distortion of slats and limit barrel deflection to not more than 0.03 inches per ft. of span under full load.

2. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance the weight of the curtain, with uniform adjustment accessible from outside barrel. Provide cast steel barrel plugs to secure ends of springs to the barrel and the shaft.

3. Fabricate torsion rod for counterbalance shaft of case-hardened steel, or required size to hold the fixed spring ends and carry the torsional load.

C. Brackets:

1. Provide mounting brackets of manufacturer's standard design, either cast iron or cold-rolled steel plate with bell mouth guide groove for curtain.

NOT FOR BIDDING

D. Hood:

1. Form an entirely enclosed coiled curtain and operating mechanism at opening head, and act as a weather seal. Contour to suit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface-mounted hoods, and any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sag.
   a. Fabricate steel hoods for doors of not less than 24 gage hot-dip galvanized steel sheet with G90 zinc coating, complying with ASTM A525. Phosphate treat before fabrication.

2.03 PAINTING

A. Shop clean and prime ferrous metal and galvanized surfaces, exposed and unexposed, except faying and lubricated surfaces, with door manufacturer's standard rust inhibitive prime drying to a flat sheen.

2.04 ELECTRIC DOOR OPERATORS

A. General: Furnish electric door operator assembly of the size and capacity recommended and provided by the door manufacturer: complete with key-operated electric motor and factory-prewired motor controls, gear reduction unit, solenoid operated brake, clutch, remote control stations, control devices, conduit and wiring from controls to motor and central stations, and accessories required for proper operation.

1. Provide a hand-operated disconnect or a mechanism for automatically engaging a sprocket and chain operation. Mount disconnect and operator so that they are accessible from floor level. Include an interlock device to automatically prevent the motor from operating when emergency operator is engaged.

2. Design operator so that motor may be removed without disturbing the limit-switch adjustment and without affecting the emergency auxiliary operator.

B. Door Operator Type:

1. Provide wall or bracket-mounted door operator units consisting of an electric motor, a worm gear drive from motor to reduction box to a gear wheel mounted on the counterbalance shaft, and a quick-clutch disconnect-release for manual operation. Provide motor, clutch, and drive assembly of horsepower and design as determined by the door manufacturer for the size of door required and as herein specified.

C. Electric Motors:

1. Provide high-starting torque, reversible, constant duty, class A insulated electric motors with overload protection, sized to move door in either direction, from any position, at not less than 2/3 foot nor more than 1 foot per second.
   a. Coordinate wiring requirements and current characteristics of motors with the building electrical system: see Division 16 Sections of the specifications.
   b. Furnish open-drip-proof type (NEMA Type 1), unless otherwise indicated.

NOT FOR BIDDING

D. Keyed Control Station:

1. Unless otherwise shown, provide momentary-contact, 3-button control station with push button controls labeled "open", "close" and "stop".
   a. Provide exterior units: full-guarded type, standard duty, surface-mounted, weatherproof type, NEMA Type 4 enclosure, key-operated.

E. Automatic Reversing Control:

1. Furnishing each door with an automatic safety switch, extending full width of door bottom, and located within a U-shaped neoprene or rubber astragal mounted to the bottom door rail. Contact with switch before fully closing will immediately stop the downward travel and reverse direction to the fully opened position. Connect to the control circuit through a retracting safety cord and reel.

2.05 MANUFACTURERS

A. Manufacturers offering products to comply with requirements for rolling grilles include the following:
1. Apton Metal Products Corp.
2. Atlas Steel Products Co.
3. The Cookson Co.
4. Cornell Iron Works, Inc.
5. Kinnear Div., Harsco Corp.
6. Mahon Rolling Door Div., RCM Corp.
7. Overhead Door Corp.
8. Pacific Rolling Doors.
9. Southwestern Steel Rolling Door Co.
10. J. G. Wilson Corp.
11. Windsor Door Co. Div., Ceco Corporation.
12. Or approved equal.

PART 3 - EXECUTION

3.01 CONDITION OF SUBSTRATE

A. Examine the substrates and conditions under which the rolling grille units are to be installed. Do not proceed with the work until satisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install door and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports in accordance with final shop drawings, manufacturer's instructions, and as specified herein.

B. Upon completion of installation including work by other trades, lubricate, test, and adjust doors to operate easily, free from warp, twist or distortion and fitting weathertight for the entire perimeter.

END OF SECTION

NOT FOR BIDDING

SECTION 08 43 13
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.

B. Weatherstripping.

1.02 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Steel attachment devices.

B. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.

C. Section 08 71 00 - Door Hardware: Hardware items other than specified in this section.

D. Section 08 80 00 - Glazing: Glass and glazing accessories.

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 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.

E. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

G. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

H. 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.

I. 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).

1.04 SUBMITTALS

A. See Section 01 30 00 - 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, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.

D. Samples: Submit two samples 2" by 2" inches in size illustrating finished aluminum surface, glass, infill panels, glazing materials.

E. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

F. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

G. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

NOT FOR BIDDING

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.06 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.

1.07 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Aluminum-Framed Storefronts:
1. Arcadia, Inc: www.arcadiainc.com/#sle.
2. Boyd Aluminum: www.boydaluminum.com/#sle.
3. Coral Architectural Products, a division of Coral Industries, Inc: www.coralap.com/#sle.
4. Kawneer North America; (Basis-of-Design): www.kawneer.com/#sle.
5. Manko Window Systems, Inc: www.mankowindows.com/#sle.
6. Oldcastle BuildingEnvelope: www.oldcastlebe.com/#sle.
7. Pittco Architectural Metals Inc: www.pittcometals.com/#sle.
8. Tubelite, Inc: www.tubeliteinc.com/#sle.
9. Trulite Glass & Aluminum Solutions, LLC: www.trulite.com/#sle.
10. YKK AP America, Inc: www.ykkap.com/commercial/#sle.
11. Approved Equal.
12. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 BASIS OF DESIGN -- FRAMING FOR MONOLITHIC GLAZING

A. Center-Set Style:
1. Basis of Design: Kawneer, Trifab Versaglaze 451.
2. Vertical Mullion Dimensions: 2" sightline with 4-1/2" depth..

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. Finish: High performance powder 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.
2. Finish Color: White.
3. 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.
4. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.

NOT FOR BIDDING

5. 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.
6. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
7. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
8. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

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.
   b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
2. Air Leakage: 0.06 cfm/sq ft maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf 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. Glazing Stops: Flush.

B. Glazing: See Section 08 80 00.

C. Applied Muntins: Prefabricated simulated divided lite grid assembly with perimeter surround; designed to be adhered and fastened to storefront framing members and glazing.
1. Material: Extruded aluminum.
2. Profile: Manufacturer's standard, as detailed on drawings.
3. Finish: Same as storefront.
4. Mounting: Anchor pins at perimeter.
5. Pin Hole Filler: Manufacturer's standard, matching color of muntin grid.

D. Swing Doors: Glazed aluminum.
1. Thickness: 1-3/4 inches.
2. Top Rail: 5 inches wide.
3. Vertical Stiles: 5 inches wide.
4. Bottom Rail: 10 inches wide.
5. Glazing Stops: Square.
6. Finish: Same as storefront.

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.

2.06 FINISHES

A. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils thick.

B. Color: White.

2.07 HARDWARE

A. For each door, include weatherstripping and sill sweep strip.

NOT FOR BIDDING

B. Other Door Hardware: See Section 08 71 00.

C. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.

D. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.

E. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all doors.

PART 3 EXECUTION

3.01 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.

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. Where fasteners penetrate 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 applied muntin grid assembly 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 non-cumulative or 0.06 inch per 10 feet, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - 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 indicated on drawings.
   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.

3.04 ADJUSTING

A. Adjust operating hardware and sash for smooth operation.

3.05 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.06 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

NOT FOR BIDDING

SECTION 08 51 13

ALUMINUM WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Impact resistant, non-glazed windows.

B. Fixed Windows.

1.02 RELATED SECTIONS

A. Section 07 92 00: Joint Sealers.

B. Section 08 80 00: Glazing.

1.03 REFERENCES

A. AAMA/WDMA/CSA 101/I.S.2/A440 - Voluntary Specification for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors.

B. AAMA 907 - Voluntary Specification for Corrosion Resistant Coatings on Carbon Steel Components.

C. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test/Consumer Products Safety Commission CPSC 16 CFR 1201.

D. ASTM E 330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.

1.04 SUBMITTALS

A. 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. Installation methods.
   4. Shop Drawings:
      a. Elevation for each style window specified indicating its size, glazing type, muntin type and design.
      b. Manufacturer's head, jamb and sill details and section views for each window type specified.
   5. Schedules:
      a. Provide a window schedule indicating the type, size, color, and operation of each unit specified. Coordinate with window mark types found in the Contract Drawings.
   6. Verification Samples: For each finish product specified, two samples representing actual product, color, and patterns. Samples may be subsequently installed on the project.

1.05 SYSTEM DESCRIPTION

A. Test Units:
   1. Air, water and structural test unit shall conform to requirements set forth in AAMA/WDMA/CSA 101/I.S.2/A440.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: All windows and window hardware specified in this section will be supplied by a single manufacturer with a minimum of ten (10) years' experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation in accordance with manufacturer's recommendations.

B. Protect units against damage from the elements, construction activities and other hazards before, during, and after installation.

NOT FOR BIDDING

1.08 WARRANTY

A. At project closeout, provide to Owner or Owners Representative an executed copy of the manufacturer's standard limited warranty against manufacturing defect, outlining its terms, conditions, and exclusions from coverage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Manufacturer: Winco Window Co., 6200 Maple Ave., St. Louis, MO 63130-3305. ASD. Toll Free: 800-525-8089. Tel: 314-725-8088. Fax: 314-725-1419. Web: www.wincowindow.com.

B. Arcadia, Inc.

C. Boyd Aluminum

D. ES Windows

E. Manko Window Systems

F. Wausau Window and Wall Systems

G. Approved Equal.

H. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

2.02 MATERIALS

A. Aluminum:
   1. Frame: Extruded aluminum, 6063-T6 alloy and temper, tensile strength of 25,000 psi.
   2. Ventilator: Extruded tubular aluminum, 6063-T6 alloy and temper, tensile strength of 25,000 psi.

2.03 PRODUCTS

A. Basis-of-Design Product:
   1. Winco 4410S Series: 4 inch Single Hung Window. (Dormer Windows)
   2. Winco 1150S Series: 2 inch Heavy Commercial Window (Parking Garage Windows)
   3. Approved Equal.

B. Basis-of-Design Head/Jamb Profile: D14-455

C. Performance: AAMA/WDMA/CSA 101/I.S.2/A440.
   1. Architectural Window: AW-60.
   2. Water Resistance, ASTM E 547: 10 psf (478 Pa) for AW rated windows.
   3. Air Infiltration, ASTM E 283 at static air pressure of 6.24 psf: 0.21 cfm/sf.
   4. Uniform Load Structural Test, ASTM E 330: 90 psf (4309.2 Pa).
   5. Forced Entry Resistance, ASTM F 588: Grade 10.

D. Frame:
   1. Wall Thickness: 0.090 inches (2.3 mm).
   2. Pan Receptor: D14-456 (Basis-of-Design)
   3. Frame Depth: 4 inches (101.6 mm).
   4. Sill Wall Thickness: 0.125 inches (3.175 mm).
   5. Corners: Closely fit and mechanically fastened with screws. Must be sealed using AAMA approved sealants in a multi-step process to provide sealant redundancy.
   6. Leg: Provide equal leg frame.
   7. Bevel: The bevel on the perimeter frame must be an integral part of the main frame. Drop in grid will not be accepted.

2.04 TRIM AND PANS

A. Provide trim and pans as indicated.

B. Sub Frame and Closure Plate.

C. Sill Starter.

NOT FOR BIDDING

D. Basis-of-Design Sill Extension: 2 1/2 inch (Winco# D14-456).

2.05 MULLIONS AND GRIDS

A. Non-Removable Grid Frames: Exterior Applied Sloped (Basis-of -Design: Winco D4-324 profile)
   1. Provide vandal resistant mullions reinforced with steel cabling.

2.06 FINISH

A. A. Paint Finish: Finish all exposed areas of aluminum windows and components with the following:
   1. 70 percent Kynar in accordance with AA-M12-C42-R1X, AAMA 2605-98
   2. Color: White.

2.07 GLAZING

A. Garage Windows: No glazing.

B. Spandrel Glazing: Refer to Section 08 80 00: Glazing.

C. Tempered, Non-insulated Glazing: Refer to Section 08 80 00: Glazing

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 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.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Final operating adjustment shall be made after glazing work is complete. Operating sash and ventilator shall operate smoothly and shall be weathertight when in locked position
   1. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

NOT FOR BIDDING

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SECTION 08 71 00
DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for aluminum, and hollow metal doors.
B. Hardware for fire-rated doors.
C. Electrically operated and controlled hardware.
D. Lock cylinders for doors with balance of hardware specified in other sections.
E. Thresholds.
F. Smoke and draft control seals.
G. Weatherstripping and gasketing.

1.02 RELATED REQUIREMENTS

A. Section 01 25 00 – Substitution Procedures.
B. Section 08 11 13 - Hollow Metal Doors and Frames.
C. Section 08 43 13 – Aluminum-Framed Storefronts.
D. Section 08 71 13 – Power Door Operators.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2017.
B. BHMA A156.1 - Standard for Butts and Hinges 2021.
C. BHMA A156.2 - Bored and Preassembled Locks and Latches 2017.
D. BHMA A156.3 - Exit Devices 2020.
E. BHMA A156.4 - Door Controls - Closers 2019.
F. BHMA A156.8 - Door Controls - Overhead Stops and Holders 2021.
G. BHMA A156.13 - Mortise Locks & Latches Series 1000 2017.
H. BHMA A156.16 - Auxiliary Hardware 2018.
I. BHMA A156.18 - Materials and Finishes 2020.
J. BHMA A156.21 - Thresholds 2019.
K. BHMA A156.25 - Electrified Locking Devices 2018.
L. BHMA A156.26 - Standard for Continuous Hinges 2021.
M. BHMA A156.28 - Recommended Practices For Mechanical Keying Systems 2018.
N. BHMA A156.115 - Hardware Preparation In Steel Doors And Steel Frames 2016.
O. BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames 2006.
P. DHI (H&S) - Sequence and Format for the Hardware Schedule 2019.
Q. DHI (KSN) - Keying Systems and Nomenclature 2019.
R. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
S. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.
T. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
U. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives 2022.

NOT FOR BIDDING

V. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2022.

W. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.

B. Sequence installation to ensure facility services connections are achieved in an orderly and expeditious manner.

C. Keying Meeting: Convene a keying meeting prior to commencing work on site; require attendance by affected installers and the following:
   1. Hardware Installer.
   2. Owner's Security Consultant.

D. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.

C. Shop Drawings - Door Hardware Schedule: A detailed listing that includes each item of hardware to be installed on each door.
   1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
   2. Comply with DHI (H&S) using door numbering scheme and hardware set numbers as indicated in Contract Documents.
      a. Submit in vertical format.
   3. List groups and suffixes in proper sequence.
   4. Include complete description for each door listed.
   5. Include manufacturers and product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
   6. Include account of abbreviations and symbols used in schedule.
   7. Diagrams: Include point-to-point wiring diagrams that show each device in door opening system with related colored wire connections to each device.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
   1. Include manufacturer's parts lists and templates.

F. Keying Schedule:
   1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.

G. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

H. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.

I. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

NOT FOR BIDDING

1.06 QUALITY ASSURANCE

A. Standards for Fire-Rated Doors: Maintain one copy of each referenced standard on site, for use by Architect and Contractor.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.

D. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC) to assist in work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide manufacturer warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion. Complete forms in Owner's name and register with manufacturer.
   1. Closers: Ten years, minimum.
   2. Exit Devices: Five years, minimum.
   3. Locksets and Cylinders: Ten years, minimum.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.

B. Provide individual items of single type, of same model, and by same manufacturer.

C. Locks: Provide a lock for each door, unless it's indicated that lock is not required.
   1. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's Series. As indicated in hardware sets.
   2. Trim: Provide lever handle or pull trim on outside of each lock, unless otherwise indicated.
   3. Strikes:
      a. Finish: To match lock or latch.
      b. Curved-Lip Strikes: Provide as standard, with extended lip to protect frame, unless otherwise indicated.
      c. Center Strike at Pairs of Doors: 7/8-inch lip.

D. Closers:
   1. Provide door closer on each exterior door, unless otherwise indicated.
   2. Provide door closer on each fire-rated and smoke-rated door.
   3. Spring hinges are not an acceptable self-closing device, unless otherwise indicated.

E. Overhead Stops and Holders (Door Checks):.
   1. Provide stop for every swinging door, unless otherwise indicated.
   2. Overhead Stop is not required if positive stop feature is specified for door closer; positive stop feature of door closer is not an acceptable substitute for a stop, unless otherwise indicated.
   3. Overhead stop is not required if a floor or wall stop has been specified for the door.

F. Drip Guards: Provide at head of out swinging exterior doors unless protected by roof or canopy directly overhead.

G. Thresholds:
   1. Exterior Applications: Provide at each exterior door, unless otherwise indicated.

NOT FOR BIDDING

H. Smoke and Draft Control Seals:
   1. Provide gasketing for smoke and draft control doors that complies with local codes, requirements of assemblies tested in accordance with UL 1784.

I. Weatherstripping and Gasketing:
   1. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated.
   2. Provide door bottom sweep on each exterior door, unless otherwise indicated.

J. Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with NFPA 70.

K. Fasteners:
   1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
      a. Aluminum fasteners are not permitted.
      b. Provide Phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
   2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
      a. Self-drilling (Tek) type screws are not permitted.
   3. Provide stainless steel machine screws and lead expansion shields for concrete and masonry substrates.
   4. Provide wall grip inserts for hollow wall construction.
   5. Fire-Resistance-Rated Applications: Comply with NFPA 80.
      a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
      b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.

2.02 PERFORMANCE REQUIREMENTS

A. Provide door hardware products that comply with the following requirements:
   1. Applicable provisions of federal, state, and local codes.
      a. NFPA 101.
   2. Accessibility: ADA Standards and ICC A117.1.
   3. Fire-Resistance-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
   4. Hardware on Fire-Resistance-Rated Doors: Listed and classified by UL (DIR), ITS (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for application indicated.
   5. Hardware for Smoke and Draft Control Doors: Provide door hardware that complies with local codes, and requirements of assemblies tested in accordance with UL 1784.
   6. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
   7. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.
   8. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.

2.03 HINGES

A. Manufacturers: Conventional butt hinges.
   1. BEST; dormakaba Group:
   2. Mckinney; ASSA Abloy
   3. Ives Hardware; Allegion
   4. Approved Equal.

B. Properties:

NOT FOR BIDDING

1. Butt Hinges: As applicable to each item specified.
   a. Standard Weight Hinges: Minimum of two (2) permanently lubricated non-detachable bearings.
   b. Heavy Weight Hinges: Minimum of four (4) permanently lubricated bearings on heavy weight hinges.
   c. Template screw hole locations.
   d. Bearings: Concealed fully hardened bearings.
   e. UL 10C listed for fire-resistance-rated doors.
2. Continuous Hinges: As applicable to each item specified.
3. Manufactures: Best Access, Roton, Select Hardware, Approved Equal.
   a. Geared Continuous Hinges: As applicable to each item specified.
      1) Non-handed.
      2) Anti-spinning through-fastener.
      3) UL 10C listed for fire-resistance-rated doors.
         (a) Metal Door Installation: Rated up to 90 minutes.
         (b) Wood Door Installation: Rated up to 60 minutes.
      4) Sufficient size to permit door to swing 180 degrees

C. Sizes: See Door Hardware Schedule.
   1. Hinge Widths: As required to clear surrounding trim.
   2. Sufficient size to allow 180-degree swing of door.

D. Finishes: See Door Hardware Schedule.
   1. Fully polish hinges; front, back, and barrel.

E. Grades:
   1. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.
   2. Comply with BHMA A156.18 Materials and Finishes.
   3. Continuous Hinges: Comply with BHMA A156.26, Grade 1.

F. Material: Base metal as indicated for each item by BHMA material and finish designation.

G. Types:
   1. Butt Hinges: Include full mortise hinges.
   2. Continuous Hinges: Include geared hinges.

H. Options: As applicable to each item specified.

I. Quantities:
   1. Butt Hinges: Three (3) hinges per leaves up to 90 inches (2286 mm) in height. Add one (1) for each additional 30 inches (762 mm) in height or fraction thereof.
      a. Hinge weight and size unless otherwise indicated in hardware sets:
         1) For doors up to 36 inches (914 mm) wide and up to 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.134 inch (3.4 mm) and a minimum of 4-1/2 inches (114 mm) in height.
         2) For doors from 36 inches (914 mm) wide up to 42 inches (1067 mm) wide and up to 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.145 inch (3.7 mm) and a minimum of 4-1/2 inches (114 mm) in height.
         3) For doors from 42 inches (1067 mm) wide up to 48 inches (1219 mm) wide and up to 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.180 inch (4.6 mm) and a minimum of 5 inches (127 mm) in height.
         4) For doors greater than 1-3/4 inches (44.5 mm) thick provide hinges with a minimum thickness of 0.180 inch (4.6 mm) and a minimum of 5 inches (127 mm) in height.
   2. Continuous Hinges: One per door leaf.

J. Applications: At swinging doors.
   1. Provide non-removable pins at out-swinging doors with locking hardware and all exterior doors.

NOT FOR BIDDING

K. Products:
1. Butt Hinges:
a. Ball Bearing, Five (5) Knuckle.
2. Continuous Hinges:
a. Aluminum geared hinges.

2.04 BOLTS

A. Manufacturers:
1. Trimco.
2. Hiawatha.
3. Burns.
4. Approved Equal.

B. Properties:
1. Dustproof Strikes: For bolting into floor, provide except at metal thresholds.

C. Options:
1. Extension Bolts: In leading edge of door, one bolt into floor, one bolt into top of frame.
2. Lever extensions: Provide for top bolt at oversized doors.

2.05 EXIT DEVICES

A. Manufacturers:
1. Precision Apex 2000 Series
2. Sargent 19GL80 Series.
3. Von Duprin XP98 Series
4. Approved Equal.

B. Properties:
1. Touchpads: 'T" style metal touchpads and rail assemblies with matching chassis covers end caps.
2. Latch Bolts: Stainless steel deadlocking with 3/4 inch (19 mm) projection using latch bolt.
3. Lever Design: Match project standard lockset trims.
4. Cylinder: Include where cylinder dogging or locking trim is indicated.
5. Strike as recommended by manufacturer for application indicated.
6. Dogging:
a. Non-Fire-Resistance-Rated Devices: Cylinder 1/4 inch (6 mm) hex key dogging.
b. Fire-Resistance-Rated Devices: Manual dogging not permitted.
7. Touch bar assembly on wide style exit devices to have a 1/4 inch (6.3 mm) clearance to allow for vision frames.
8. All exposed exit device components to be of architectural metals and “true” architectural finishes.
9. Handing: Field-reversible.
10. Fasteners on Back Side of Device Channel: Concealed - exposed fasteners not allowed.
11. Vertical Latch Assemblies' Operation: Gravity, without use of springs.

C. Grades: Complying with BHMA A156.3, Grade 1.
1. Provide exit devices tested and certified by UL or by a recognized independent laboratory for mechanical operational testing to 10 million cycles minimum with inspection confirming Grade 1 Loaded Forces have been maintained.

D. Standards Compliance:
1. UL Listed for Panic and Fire for Class II Circuitry.
2. Provide UL (DIR) listed exit device assemblies for fire-resistance-rated doors.
3. Comply with UL 10C.

E. Code Compliance: As required by authorities having jurisdiction in the State in which the Project is located.

NOT FOR BIDDING

1. Listed by UL as a Controlled Exit Device (FULA) and Special Locking Arrangements (FWAX) category.

F. Options:
1. Electrified Devices:
2. Internally mounted switch used to signal other components.
3. Internally mounted switch that monitors the position of the latchbolt.
4. ELR: Electric latch retraction.

G. Products:
1. Apex 2000.
2. Approved Equal.

2.06 ELECTRIC STRIKES

A. Manufacturers:
1. RCI
2. HES.
3. Allegion.
4. Approved Equal.

B. Properties:
1. Provide UL 1034 compliant devices.
2. Provide UL 10C compliant devices.
3. Include transformer and rectifier as necessary for complete installation.

C. Installation: Connect electric strikes into fire alarm where non-rated doors are scheduled to release with fire or sprinkler alarm condition.

2.07 LOCK CYLINDERS

A. Manufacturers:
1. BEST
2. Sargent.
3. Schlage
4. Approved Equal.

B. Material:
1. Manufacturer's standard corrosion-resistant brass alloy.

C. Types: As applicable to each item specified.
1. Patented small format interchangeable core (SFIC) type cylinders, with seven pin cores.

2.08 CYLINDRICAL LOCKS

A. Manufacturers:
1. BEST 9K Series
2. Schlage ND Series.
3. Sargent 10 Line Series
4. Approved Equal.

B. Properties:
1. Mechanical Locks:
a. Fitting modified ANSI A115.2 door preparation.
b. Door Thickness Fit: 1-3/8 inches (35 mm) to 2-1/4 inches (57 mm) thick doors.
c. Construction: Hub, side plate, shrouded rose, locking pin to be a one-piece casting with a shrouded locking lug.
1) Through-bolted anti-rotational studs.
d. Cast stainless steel latch retractor with roller bearings for exceptionally smooth operation and superior strength and durability.
e. Bored Hole: 2-1/8 inch (54 mm) diameter.
f. Backset: 2-3/4 inches (70 mm) unless otherwise indicated.

NOT FOR BIDDING

g. Latch: Single piece tail-piece construction.
1) Latchbolt Throw: 9/16 inch (14.3 mm), minimum.
h. Cylinders:
1) Cylinder Core Types: Locks capable of supporting manufacturers' cores, as applicable.
i. Lever Trim:
1) Style: See Door Hardware Schedule.
2) Outside Lever Sleeve: Seamless one-piece construction.
2. Electrified Locks: Same properties as standard locks, and as follows:
a. Function: Electrically locked (Fail Safe) or unlocked (Fail Secure), as indicated for each lock in Door Hardware Schedule.

C. Finishes: See Door Hardware Schedule.
1. Core Faces: Match finish of lockset.

D. Grades: Comply with BHMA A156.2, Grade 1, Series 4000, Operational Grade 1, Extra Heavy Duty.

E. Material: Manufacturer's standard for specified lock.

F. Products: Cylindrical locks, including mechanical and electrified types.
1. 9K (Grade 1).

2.09 DOOR PULLS AND PUSH PLATES

A. Manufacturers:
1. Trimco
2. Hiawatha.
3. Burns.
4. Approved Equal.

B. Material: Stainless steel, unless otherwise indicated.

2.10 CLOSERS

A. Manufacturers:
1. Dorma 8900 Series
2. LCN 4040XP Series.
3. Sargent 351 Series
4. Approved Equal.

B. Properties:

C. Grades:
1. Closers: Comply with BHMA A156.4, Grade 1.
a. Underwriters Laboratories Compliance:
1) Product Listing: UL (DIR) and ULC for use on fire-resistance-rated doors.
(a) UL 228 - Door Closers-Holders, With or Without Integral Smoke Detectors.

D. Installation:
1. Mounting: Includes surface mounted installations.
2. Mount closers on non-public side of door and stair side of stair doors unless otherwise noted in hardware sets.
3. At out swinging exterior doors, mount closer on interior side of door.
4. Provide adapter plates, shim spacers, and blade stop spacers as required by frame and door conditions.
5. Where an overlapping astragal is included on pairs of swinging doors, provide coordinator to ensure door leaves close in proper order.

2.11 SWINGING DOOR OPERATORS

A. Manufacturers:
1. dormakaba; dormakaba Group: www.dormakaba.com/us-en/#sle.

NOT FOR BIDDING

B. Properties:
   1. Where automatic operators are scheduled, provide complete assemblies of controls, switches, power supplies, relays, and parts/material recommended and approved by the manufacturer of the automatic operator for each individual leaf. Control both doors with actuators simultaneously at pairs. Locate actuators, key switches, and other controls as directed by Architect.
   2. Power-Assist Low Energy Operators:
      a. Construction: Manufacturer's standard units with full covers.
   3. Actuators:
      a. Touchless Units: 433 MHz devices.
         1) Construction: Tamper-resistant stainless-steel face plates, with heavy duty injection molded black ABS mounting boxes, each with a radio frequency transmitter.

C. Types:
   1. Power-Assist Low-Energy Operators:

D. Installation:
   1. Operator Actuators: Include required back boxes, mounting rings, accessories as needed for fixed unit installation.

E. Products:
   1. ED100LE.
   2. Approved Equal.

2.12 OVERHEAD STOPS AND HOLDERS

A. Manufacturers:
   1. Architectural Builders Hardware Mfg (ABH)
   2. Dorma
   3. Glynn Johnson
   4. Rixson
   5. Approved Equal.

B. Sizes: Manufacturer’s standard for the application.

C. Finishes:
   1. Arms and Brackets: Zinc-plated.

D. Grades: As applicable to item specified.
   1. Comply with BHMA A156.8, Grade 1.

E. Types:
   1. Surface-applied.
   2. Concealed.

F. Products:
   1. Surface Overhead Stops and Holders:
      a. 900 Heavy Duty.
      b. ABH: 9020 Series.
      c. Approved Equal.
   2. Concealed Overhead Stops and Holders:
      a. 910 Heavy Duty.
      b. ABH: 1020 SL Series.
      c. Approved Equal.

2.13 PROTECTION PLATES

A. Manufacturers:
   1. Trimco
   2. Hiawatha.
   3. Burns.

NOT FOR BIDDING

4. Approved Equal.

B. Properties:
1. Plates:
a. Kick Plates: Provide along bottom edge of push side of every wood door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
1) Size: 10 inches high by 2 inch less door width (LDW) on push side of door.
b. Mop Plates: Provide along bottom edge of push side of doors to provide protection from cleaning liquids and equipment damage to door surface.
c. Edges: Beveled, on four (4) unless otherwise indicated.

C. Grades: Comply with BHMA A156.6.

D. Material: As indicated for each item by BHMA material and finish designation.
1. Metal Properties: Stainless steel.
a. Metal, Standard Duty: Thickness 0.050 inch (1.27 mm), minimum.

E. Installation:
1. Fasteners: Countersunk screw fasteners

2.14 STOPS AND HOLDERS

A. Manufacturers:
1. Trimco
2. Hiawatha.
3. Burns.
4. Approved Equal.

B. General: Provide overhead stop/holder when wall or floor stop is not feasible.

C. Grades:
1. Door Holders, Wall Bumpers, and Floor Stops: Comply with BHMA A156.16 and Resilient Material Retention Test as described in this standard.

D. Types:

2.15 THRESHOLDS

A. Manufacturers:
1. National Guard Products
2. Pemko.
3. Reese.
4. Approved Equal.

B. Properties:
1. Threshold Surface: Fluted horizontal grooves across full width.

C. Grades: Thresholds: Comply with BHMA A156.21.

D. Material: Base metal as indicated for each item by BHMA material and finish designation.

E. Types: As applicable to project conditions. Provide barrier-free type at every location where specified.
1. Saddle Thresholds: Without thermal break.
2. Bumper Seal Thresholds with Gasket: Use silicone gaskets.

2.16 WEATHERSTRIPPING AND GASKETING

A. Manufacturers:
1. National Guard Products, Inc: www.ngpinc.com/#sle.
2. Pemko .
3. Reese.
4. Approved Equal.

B. Products:
1. Weatherstripping: See Door Hardware Schedule.

NOT FOR BIDDING

2. Smoke Seals: See Door Hardware Schedule.
3. Meeting Stile Seals: See Door Hardware Schedule.
4. Door Bottom Seals:
    a. Door Sweeps: See Door Hardware Schedule.

2.17 ELECTRIFIED HARDWARE

A. Manufacturers: Door Position Switch
1. Dorma MC4
2. Securitron DPS
3. SDC MC-4
4. Approved Equal.

B. Properties:
1. Door Position Switches: Recessed devices with magnetic contacts.
    a. SPDT configuration.

C. Products:
1. Door Position Switches:
    a. 9540 Recessed Magnetic Contact/Door Position Switch.
2. Power Supplies:
    a. RPSMLR2BB
    b. DKPS Series.
3. Wire Harnesses:
    a. Precision wire harnesses.

2.18 KEYS AND CORES

A. Manufacturers:
1. BEST, No Substitution
2. Substitutions: Not permitted.

B. Properties: Complying with guidelines of BHMA A156.28.
1. Provide small format interchangeable core.
2. Provide Patented CORMAX keys and cores.
3. Provide keying information in compliance with DHI (KSN) standards.
4. Keying Schedule: Arrange for a keying meeting, with Architect, Owner and hardware supplier, and other involved parties to ensure locksets and locking hardware, are functionally correct and keying complies with project requirements.
5. Keying: Master keyed.
6. Include construction keying and control keying with Brass removable core cylinders.
7. Supply keys in following quantities:
    a. Grand Master Keys: 2 each.
    b. Master Keys: 4 each each group.
    c. Construction Master Keys: 4 each.
    d. Construction Control Keys: 2 each.
    e. Perm Core Control Keys: 4 each.
    f. Change Keys: 2 each change keys for each keyed core.
8. Deliver keys with identifying tags to Owner by security shipment direct from manufacturer.
9. Include installation of permanent cores and return construction cores to hardware supplier. Construction cores and keys to remain property of hardware supplier.

2.19 FINISHES

A. Finishes: Identified in Hardware Sets.

NOT FOR BIDDING

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.

B. Correct all defects prior to proceeding with installation.

C. Verify that electric power is available to power operated devices and of correct characteristics.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Install hardware using the manufacturer’s fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use “Riv-Nuts” or similar products.

C. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.

D. Install hardware for smoke and draft control doors in accordance with NFPA 105.

E. Use templates provided by hardware item manufacturer.

F. Do not install surface mounted items until application of finishes to substrate are fully completed.

G. Wash down masonry walls and complete painting or staining of doors and frames.

H. Complete finish flooring prior to installation of thresholds.

I. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Section 01 40 00 - Quality Requirements.

3.04 CLEANING

A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.

B. Clean adjacent surfaces soiled by hardware installation activities.

3.05 PROTECTION

A. Do not permit adjacent work to damage hardware or finish.

END OF SECTION

HARDWARE SETS

Set # 01

Doors: 002, 102

Qty	Description	Manufacturer’s Model	Fin	Manf.
3	HINGES	FBB 199 4 ½” x 4 ½” NRP	630	BES
1	LOCKSET-STOREROOM	9K37 D 14D	626	BES
1	ELECTRIC STRIKE	2164 F2LM	32D	RCI
1	POWER SUPPLY	DKPS-2A	PC	RCI
1	CARD READER	BY SECURITY PROVIDER		
1	DOOR CLOSER W/ STOP	8916FC DS BSHD	689	DOR

NOT FOR BIDDING

1	KICK PLATE	K0050 8” x 2” LDW B4E CSK	630	TRI
3	DOOR SILENCERS	1229A	GRY	TRI

Set # 02 ALD x ALF

Doors: 100

Qty	Description	Manufacturer’s Model	Fin	Manf.
1	CONTINUOUS HINGE	661HD	689	BES
1	CONTINUOUS HINGE	661HD (PREP’D FOR EPT)	689	BES
1	CARD READER	BY SECURITY PROVIDER		
1	ELECTRIFIED VERTICAL ROD PANIC	C WTDS MLR 2203 x DS	630	BES
1	ELECTRIC POWER TRANSFER	EPT-12C	630	BES
1	POWER SUPPLY	RPSMLR-2BB	PC	BES
1	VERTICAL ROD PANIC	2201	630	BES
1	TRIM CYLINDERS & CORES	1E72 PATD	626	BES
1	DOOR CLOSER W/ STOP	TS9315 SPT	689	DOR
2	OFFSET DOOR PULLS	AP428 x 36”	710	TRI
1	ADA AUTO DOOR OPERATOR	ED100LE	WHITE	DOR
1	ADA PUSH SWITCHES	94T-HW-475-MO	630	32D
1	KEY SWITCH	960-N-MA	28	RCI
1	CYLINDER & CORE	1E74 PATD	626	BES
1	BOLLARD POST	CBC482A4U x 400RC433 x 400W1-433	AL	SDC
1	SAFETY SENSOR	915	BLK	RCI
1	THRESHOLD	513 SIA ssms/es	AI	NGP
2	DOOR SWEEPS	101AV	AL	NGP

OPERATIONAL DESCRIPTION: ACCESS VIA AUTHORIZED CREDENTIAL AT CARD READER WHICH WILL RETRACT THE LATCHBOLT OF ONE OF THE PANIC DEVICES OR MECHANICAL KEY. FREE EGRESS ALWAYS VIA TOUCH BAR OF PANIC DEVICE. AUTO DOOR OPERATOR IS ACTIVATED BY ON/OFF KEY SWITCH. EXTERIOR H/C PUSH SWITCH IS ACTIVATED BY CARD READER WHEN AUTO OPERATOR IS ACTIVATED. INTERIOR H/C SWITCH IS ALWAYS ACTIVE WHEN AUTO OPERATOR IS ACTIVATED. BOTH PANIC DEVICES CAN BE DOGGED VIA MECHCANICAL KEY FOR PUSH PULL OPERATORATION.
ALL WEATHER SEALS BY ALUMINUM DOOR AND FRAME MANUFACTURER.

Set # 03 GATE

Doors: 101-1, 107

Qty	Description	Manufacturer’s Model	Fin	Manf.
4	HINGES	FBB199 4 ½” x 4 ½” NRP	630	BES

NOT FOR BIDDING

1	RIM PANIC DEVICE	2103 X 4903D	626W	BES
1	TRIM CYLINDER & CORE	1E72 PATD	626	BES
1	ELECTRIC STRIKE	0162 LM	32D	RCI
1	POWER SUPPLY	DKPS-2A	PC	RCI
1	CARD READER	BY SECURITY PROVIDER		
1	ADA AUTO OPERATOR	ED100LE	689	DOR
2	ADA PUSH SWITCHES	94T-HW-475-MO	630	32D
1	KEY SWITCH	960-N-MA	28	RCI
1	CYLINDER & CORE	1E74 PATD	626	BES
1	WALL STOP	1298	630	TRI

OPERATIONAL DESCRIPTION: ACCESS VIA AUTHORIZED CREDENTIAL AT CARD READER WHICH WILL RETRACT THE LATCHBOLT OF THE PANIC DEVICE OR VIA MECHANICAL KEY. FREE EGRESS ALWAYS VIA TOUCH BAR OF PANIC DEVICE. AUTO DOOR OPERATOR IS ACTIVATED BY ON/OFF KEY SWITCH. EXTERIOR H/C PUSH SWITCH IS ACTIVATED BY CARD READER. INTERIOR H/C SWITCH IS ALWAYS ACTIVE WHEN AUTO OPERATOR IS ACTIVATED. BOTH PANIC DEVICES CAN BE DOGGED FOR PUSH PULL OPERATORATION.
NOTES: BALANCE OF HARDWARE BY GATE MANUFACTURER.

Set # 04 GATE

Doors: 101-2, 101-3

Qty	Description	Manufacturer's Model	Fin	Manf.
4	HINGES	FBB199 4 ½" x 4 ½"	630	BES
1	RIM PANIC DEVICE	2103 X 4903D	626W	BES
1	TRIM CYLINDER & CORE	1E72 PATD	626	BES
1	ELECTRIC STRIKE	0162 LM	32D	RCI
1	POWER SUPPLY	DKPS-2A	PC	RCI
1	CARD READER	BY SECURITY PROVIDER		
1	DOOR CLOSER	8916FC DS	689	DOR

OPERATIONAL DESCRIPTION: ACCESS VIA AUTHORIZED CREDENTIAL AT CARD READER WHICH WILL RETRACT THE LATCHBOLT OF ONE OF THE PANIC DEVICES OR VIA MECHANICAL KEY. FREE EGRESS ALWAYS VIA TOUCH BAR OF PANIC DEVICE. AUTO DOOR OPERATOR IS ACTIVATED BY ON/OFF KEY SWITCH. EXTERIOR H/C PUSH SWITCH IS ACTIVATED BY CARD READER. INTERIOR H/C SWITCH IS ALWAYS ACTIVE WHEN AUTO OPERATOR IS ACTIVATED. BOTH PANIC DEVICES CAN BE DOGGED FOR PUSH PULL OPERATION.
NOTES: BALANCE OF HARDWARE BY GATE MANUFACTURER

Set # 05 OVERHEAD DOOR

Doors: 108, 109, 110

Qty	Description	Manufacturer's Model	Fin	Manf.
1	CYLINDER & CORE	TYPE AS REQUIRED PATD	626	BES

NOT FOR BIDDING

Set # 06

Doors: 103

Qty	Description	Manufacturer's Model	Fin	Manf.
1	HINGES	FBB199 4 ½" x 4 ½" NRP	32D	BES
1	RIM PANIC DEVICE	F2103 X 4903D	626W	BES
1	TRIM CYLINDER & CORE	1E72 PATD	626	BES
1	ELECTRIC STRIKE	2164 F2LM	32D	RCI
1	POWER SUPPLY	DKPS-2A	PC	RCI
1	CARD READER	BY SECURITY PROVIDER		
1	DOOR CLOSER W/ STOP	8916FC AF89	689	DOR
1	KICK PLATE	K0050 8" x 2" LDW B4E CSK	630	TRI
3	DOOR SILENCERS	1229A	GRY	TRI

Set # 07 **CHAIN LINK FENCING**

Doors: 104-1, 104-2

Qty	Description	Manufacturer's Model	Fin	Manf.
1	GATE LOCK	LAKQU2	AL	LOCINOX
1	CYLINDER & CORE	AS REQUIRED	626	BES

NOTES: ALL HARDWARE BY FENCING MANUFACTURER

Set # 08

Doors: 106A

Qty	Description	Manufacturer's Model	Fin	Manf.
3	HINGES	FBB 191 4 ½" x 4 ½" NRP	630	BES
1	LOCKSET-STOREROOM	9K37 D 14D	626	BES
1	ELECTRIC STRIKE	2164 F2LM	32D	RCI
1	POWER SUPPLY	DKPS-2A	PC	RCI
1	CARD READER	BY SECURITY PROVIDER		
1	DOOR CLOSER W/ STOP	8916FC DS	689	DOR
1	KICK PLATE	K0050 8" x 2" LDW B4E CSK	630	TRI
3	DOOR SILENCERS	1229A	GRY	TRI

OPERATIONAL DESCRIPTION: ACCESS VIA AUTHORIZED CREDENTIAL AT CARD READER WHICH WILL RELEASE FAIL-SECURE ELECTRIC STRIKE OR VIA MECHANICAL KEY. FREE EGRESS ALWAYS VIA INSIDE LEVER OF LOCKSET.

Set # 08A

Doors: 105

Qty	Description	Manufacturer's Model	Fin	Manf.

NOT FOR BIDDING

3	HINGES	FBB 191 4 ½" x 4 ½" NRP	630	BES
1	LOCKSET-STOREROOM	9K37 D 14D	626	BES
1	ELECTRIC STRIKE	2164 F2LM	32D	RCI
1	POWER SUPPLY	DKPS-2A	PC	RCI
1	CARD READER	BY SECURITY PROVIDER		
1	DOOR CLOSER W/ STOP	8916FC DS	689	DOR
1	KICK PLATE	K0050 8" x 2" LDW B4E CSK	630	TRI
3	DOOR SILENCERS	1229A	GRY	TRI
1	THRESHOLD	950	Al	NGP
OPERATIONAL DESCRIPTION: ACCESS VIA AUTHORIZED CREDENTIAL AT CARD READER WHICH WILL RELEASE FAIL-SECURE ELECTRIC STRIKE OR VIA MECHANICAL KEY. FREE EGRESS ALWAYS VIA INSIDE LEVER OF LOCKSET.				

Set # 09

Doors: 106

Qty	Description	Manufacturer's Model	Fin	Manf.
3	HINGES	FBB 199 4 ½" x 4 ½" NRP	630	BES
1	LOCKSET-STOREROOM	9K37 D 14D	626	BES
1	ELECTRIC STRIKE	2164 F2LM	32D	RCI
1	POWER SUPPLY	DKPS-2A	PC	RCI
1	CARD READER	BY SECURITY PROVIDER		
1	DOOR CLOSER W/ STOP	8916FC DS BSHD	689	DOR
1	KICK PLATE	K0050 8" x 2" LDW B4E CSK	630	TRI
3	DOOR SILENCERS	1229A	GRY	TRI
1	THRESHOLD	950	Al	NGP
OPERATIONAL DESCRIPTION: ACCESS VIA AUTHORIZED CREDENTIAL AT CARD READER WHICH WILL RELEASE FAIL-SECURE ELECTRIC STRIKE OR VIA MECHANICAL KEY. FREE EGRESS ALWAYS VIA INSIDE LEVER OF LOCKSET.				

Set # 10

Doors: 001, 106B

Qty	Description	Manufacturer's Model	Fin	Manf.
3	HINGES	FBB 191 4 ½" x 4 ½"	630	BES
1	LOCKSET-STOREROOM	9K37 D 14D	626	BES
1	DOOR CLOSER	8916FC AF89	689	DOR
1	KICK PLATE	K0050 8" x 2" LDW B4E CSK	630	TRI
3	DOOR SILENCERS	1229A	GRY	TRI

Set # 11

Doors: 106C

NOT FOR BIDDING

Qty	Description	Manufacturer's Model	Fin	Manf.
3	HINGES	FBB 191 4 ½" x 4 ½"	630	BES
1	LATCHSET-PRIVACY	9K30LD 14D	626	BES
1	WALL STOP	1270	626	TRI
3	DOOR SILENCERS	1229A	GRY	TRI

Set # 12

Doors: STR-B

Qty	Description	Manufacturer's Model	Fin	Manf.
3	HINGES	FBB199 4 ½" x 4 ½" NRP	32D	BES
1	RIM PANIC DEVICE	2101	626W	BES
1	DOOR CLOSER W/ STOP	8916FC DS BSHD	689	BES
1	KICK PLATE	K0050 8" x 2" LDW B4E CSK	630	TRI
1	THRESHOLD	896ADJ SIA ssms/ea	AL	NGP
1	WEATHER SEALS	700NA (HEAD & JAMBS)	AL	NGP
1	DOOR SWEEP	101AV	AL	NGP
1	DRIP CAP	16A +4" ODW	AL	NGP

Set # 13

Doors: 302

Qty	Description	Manufacturer's Model	Fin	Manf.
3	HINGES	FBB 199 4 ½" x 4 ½" NRP	630	BES
1	LOCKSET-STOREROOM	9K37 D 14D	626	BES
1	DOOR CLOSER W/ STOP	8916FC DS BSHD	689	DOR
1	ELECTRIC STRIKE	2164 F2LM	32D	RCI
1	POWER SUPPLY	DKPS-2A	PC	RCI
1	CARD READER	BY SECURITY PROVIDER		
1	KICK PLATE	K0050 8" x 2" LDW B4E CSK	630	TRI
3	DOOR SILENCERS	1229A	GRY	TRI
1	THRESHOLD	950	Al	NGP

Set # 14

Doors: MISC.

Qty	Description	Manufacturer's Model	Fin	Manf.
6	PERMANENT CORES	KEYED TO SYSTEM PATD	626	BES

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SECTION 08 71 13
POWER DOOR OPERATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Operators for swinging doors.

B. Maintenance.

1.02 RELATED REQUIREMENTS

A. Section 05 52 13 - Pipe and Tube Railings: Handrails adjacent to operating door units.

B. Section 08 71 00 - Door Hardware: Balance of door hardware.

C. Section 26 05 83 - Wiring Connections.

D. Section 28 31 00 - Fire Detection and Alarm: Connection to fire alarm system.

1.03 DEFINITIONS

A. Activation Device: Device that sends an electrical signal to door operator to open door when actuated.

1.04 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

C. BHMA A156.10 - Power Operated Pedestrian Doors; 2024.

D. BHMA A156.19 - Power Assist and Low Energy Power Operated Swinging Doors; 2019.

E. ITS (DIR) - Directory of Listed Products; current edition.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL (DIR) - Online Certifications Directory; Current Edition.

I. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on system components, sizes, features, and finishes.

C. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and manufacturer's hardware and component templates.

D. 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, and a member of AAADM.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 5-year manufacturer warranty for components of power door operators. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Operators for Swinging Doors:
   1. ASSA ABLOY Entrance Solutions; Besam SW200i: www.besam-usa.com/#sle.

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2. BEST, dormakaba Group, ED100LE: www.bestaccess.com/#sle.
3. Detex Corporation: www.detex.com/#sle.
4. LCN, an Allegion brand: www.allegion.com/us/#sle.
5. Horton Automatics: www.hortondoors.com/#sle.
6. NABCO Entrances Inc: www.nabcoentrances.com/#sle.
7. Portalp USA; ISO Series: www.portalpusa.com/#sle.
8. record-usa; 8100 Series: www.recorddoors.com/#sle.
9. Stanley Access Technologies: www.stanleyaccess.com/#sle.
10. Approved Equal.
11. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 POWER DOOR OPERATORS - GENERAL

A. Electrically Operated or Controlled Hardware: Provide necessary power supplies, relays, and interfaces as required for proper operation; provide wiring between control components and to building power connection in compliance with NFPA 70.

B. Comply with ADA Standards for egress requirements.

C. Comply with NFPA 101 and requirements of authorities having jurisdiction; provide units selected for actual door weight and for light pedestrian traffic unless otherwise indicated.

D. Exterior and Vestibule Doors: Provide equipment suitable for ambient operating temperature range of minus 20 to plus 140 degrees F.

E. Exterior Doors: Provide units capable of operating, closing, and holding doors closed under positive and negative differential pressure; if necessary, provide power closing.

F. System Integration: Integrate operator functionality with other systems as required for a complete working installation.

2.03 OPERATORS FOR SWINGING DOORS

A. Door Operator: Hydraulic.
   1. Applications: Include operators for single and double doors.
   2. Speed Control: Variable, field-adjustable opening and closing cycles.
   3. Functionality: Full-power open, spring close operation.
      a. Full-Power Operators: Comply with BHMA A156.10; safeties required.
         1) Comply with UL 325; acceptable evidence of compliance includes UL (DIR) or ITS (DIR) listing or test report by testing agency acceptable to authorities having jurisdiction.
         2) Force Required to Set Door in Motion When Unpowered: 30 lbf, maximum, measured at 1 inch from the latch edge of the door at any point in the closing cycle.
         3) Signage: Provide signage in accordance with BHMA A156.10.
      b. Low-Energy Power Operators: Comply with BHMA A156.19; operator activated by pushing or pulling the door or by manual actuator, not a sensor; safeties not required.
   4. Mounting: Surface mounted overhead.
   5. Power Supply Units: Self-contained, electrically operated, and independent of door operator.
   6. Actuators: Manufacturer's standard.
      a. Push-Side Actuator: Push plate.
      b. Pull-Side Actuator: Push plate.
   7. Pull-Side Safety: Handrail mounted.

2.04 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Electrical Characteristics:
   1. 1/4 hp.
   2. 120 volts, single phase, 60 Hz.
   3. 20 amperes maximum fuse size.
   4. See Section 26 05 83: Electrical connections.

NOT FOR BIDDING

B. 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.

C. Disconnect Switch: Factory mount disconnect switch in control panel.

2.05 FINISHES

A. Aluminum Finishes: Manufacturer's standard.
   1. Class I Natural Anodized Finish: Clear anodic coating; AAMA 611 AA-M12C22A41, minimum dry film thickness (DFT) of 0.7 mil, 0.0007 inch.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that electric power is available, in the correct location, and of the correct characteristics.

3.02 INSTALLATION

A. Install equipment in accordance with manufacturer's instructions.

3.03 ADJUSTING

A. Adjust door equipment for correct function and smooth operation.

3.04 CLEANING

A. Remove temporary protection, clean exposed surfaces.

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SECTION 08 80 00

GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulating and non-insulating glass units.

B. Glazing units.

C. Plastic sheet glazing units.

1.02 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Sealants for other than glazing purposes.

B. Section 08 11 13 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.

C. Section 08 43 13 - Aluminum-Framed Storefronts: Glazing provided as part of storefront assembly.

D. Section 08 51 13 - Aluminum Windows: Spandrel glazing.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).

C. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2019.

D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).

E. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021a.

F. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.

G. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2019.

H. BS EN 14179-1 - Glass in Building - Heat Soaked Thermally Toughened Soda Lime Silicate Safety Glass - Part 1: Definition and Description; 2016.

I. GANA (SM) - GANA Sealant Manual; 2008.

J. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2023.

K. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2023.

L. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2023.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data on Insulating Glass Unit and Plastic Sheet Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Samples: Submit two samples 12 by 12 inch in size of glass units.

E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

NOT FOR BIDDING

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 the type specified and with at least three years documented experience.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

C. Polycarbonate Sheet Glazing: Provide a five (5) year manufacturer warranty to include coverage for breakage, coating failure, abrasion resistance, including providing products to replace failed units.

D. Heat Soaked Tempered Glass: Provide a five (5) year manufacturer warranty to include coverage for spontaneous breakage of fully tempered glass caused by nickel sulfide (NiS) inclusions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Glass Fabricators:
1. GGI - General Glass International: www.generalglass.com/#sle.
2. Standard Bent Glass Corp: www.standardbent.com/#sle.
3. Tecnoglass: www.tecnoglass.com/#sle.
4. Thompson I.G., LLC: www.thompsonig.com/#sle.
5. Trulite Glass & Aluminum Solutions, LLC: www.trulite.com/#sle.
6. Viracon, Inc: www.viracon.com/#sle.
7. Approved Equal.
8. Substitutions: See Section 01 60 00 - Product Requirements.

B. Float Glass Manufacturers:
1. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
2. Guardian Glass, LLC: www.guardianglass.com/#sle.
3. Pilkington North America Inc: www.pilkington.com/na/#sle.
4. Saint Gobain North America: www.saint-gobain.com/#sle.
5. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.
6. Approved Equal.
7. Substitutions: See Section 01 60 00 - Product Requirements.

C. Plastic Sheet Glazing Manufacturers:
1. Altuglas International: www.altuglasint.com/#sle.
2. American Acrylic Corp: www.americanacrylic.com/#sle.
3. Covestro LLC; Makrolon UV: www.sheets.covestro.com/#sle.
4. Evonik Industries: www.acrylite.net/#sle.
5. Palram: www.palram.com/#sle.
6. Plazit Polygal, the Plastic Sheets Group: www.polygal-northamerica.com/#sle.
7. SABIC Innovative Plastics US LLC: www.sabic.com/sfs/#sle.
8. Approved Equal.
9. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
1. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.

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2. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
3. Glass thicknesses listed are minimum.

B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.
1. In conjunction with weather barrier related materials described in other sections, as follows:

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
3. Solar Optical Properties: Comply with NFRC 300 test method.

2.03 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.
1. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
2. Heat-Soak Testing (HST): Provide HST of fully tempered glass used on canopy, point-supported, spider wall, high-risk, sloping overhead, horizontal overhead, free-standing glass protective barrier, or other demanding applications of project, to reduce risks of spontaneous breakage due to nickel sulfide (NiS) induced fractures in accordance with BS EN 14179-1.
3. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.

2.04 INSULATING GLASS UNITS

A. Manufacturers:
1. Glass: Any of the manufacturers specified for float glass.
2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Fabricator: Certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.

C. Insulating Glass Units: Types as indicated.
1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
3. Warm-Edge Spacers: Low-conductivity thermoplastic with desiccant warm-edge technology design.
   a. Spacer Width: As required for specified insulating glass unit.
   b. Spacer Height: Manufacturer's standard.
4. Spacer Color: White.
5. Edge Seal:
   a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
   b. Color: Gray.
6. Purge interpane space with dry air, hermetically sealed.

D. Insulating Glass Units: Vision glass, double glazed.

NOT FOR BIDDING

1. Applications: Glazing at Windows Type W4.
2. Space between lites filled with air.
3. Outboard Lite: Laminated, 1/4 inch thick, minimum.
   a. Tint: Clear.
4. Inboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
   a. Tint: Gray.
5. Total Thickness: 1 inch.
6. Thermal Transmittance (U-Value): 0.38 or better, nominal.
7. Solar Heat Gain Coefficient (SHGC): 0.58 or better, nominal.

E. Non-Insulating Glass Units: Vision Glass, Double Glazed.
1. Applications: Door and Frame System Type B (Aluminum Storefront).
2. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
   a. Tint: Clear.
3. Total Thickness: 1/2" inch minimum.

2.05 PLASTIC SHEET GLAZING UNITS

A. Polycarbonate Flat Sheet: Ultraviolet (UV) stabilized.
1. Applications: Locations as indicated on drawings.
2. Type: Cellular (multi-wall, "structured") sheet.
3. Silicone abrasion resistant coating for scratch resistance.
4. Tint: Grey.
5. Thickness: 0.315 inch.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

B. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

3.04 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove nonpermanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. 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.

3.05 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

NOT FOR BIDDING

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

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SECTION 08 91 00
LOUVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Louvers, frames, and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 25 00 - Weather Barriers: Sealing frames to water-resistive barrier installed on adjacent construction.

B. Section 07 62 00 - Sheet Metal Flashing and Trim.

C. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.

D. Section 23 31 00 - HVAC Ducts and Casings: Ductwork attachment to louvers, and blank-off panels.

E. Section 23 33 00 - Air Duct Accessories: Fire/smoke dampers associated with exterior wall louvers.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.

B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

C. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2015.

D. AMCA 511 - Certified Ratings Program for Air Control Devices; 2010.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.

C. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, and tolerances; head, jamb and sill details; blade configuration, screens, blank-off areas required, and frames.

D. Test Reports: Independent agency reports showing compliance with specified performance criteria.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer's warranty against distortion, metal degradation, and connection failures of louver components.

1. Finish: Include twenty year coverage against degradation of exterior finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Louvers:

1. Construction Specialties, Inc; Acoustical Louver: www.c-sgroup.com/#sle.
2. NCA, a brand of Metal Industries Inc: www.ncamfg.com/#sle.
3. Pottorff: www.pottorff.com/#sle.
4. Ruskin Company; Louvers: www.ruskin.com/#sle.
5. United Enertech: www.unitedenertech.com/#sle.

NOT FOR BIDDING

6. Greenheck; www.greenheck.com.
7. Approved Equal.
8. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 LOUVERS

A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.
   1. Wind Load Resistance: Design to resist positive and negative wind load of 25 psf without damage or permanent deformation.
   2. Intake Louvers: Design to allow maximum of 0.01 oz/sq ft water penetration at calculated intake design velocity based on design air flow and actual free area, when tested in accordance with AMCA 500-L.
   3. Drainable Blades: Continuous rain stop at front or rear of blade aligned with vertical gutter recessed into both jambs of frame.
   4. Screens: Provide insect screens at intake louvers and bird screens at exhaust louvers.

B. Operable Louvers, Type ___: Operable horizontal blades, extruded aluminum construction.
   1. Movable Blades: Straight, pivoted at, with vinyl, rubber, or polyethylene blade edge and jamb seals; rattle-free linkage.
   2. Frame: 4 inches deep, channel profile; corner joints mitered and, with continuous recessed caulking channel each side.
   3. Aluminum Thickness: Frame 12 gauge, 0.0808 inch minimum; blades 12 gauge, 0.0808 inch minimum.

2.03 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

2.04 FINISHES

A. High Performance Organic Coating: Primer and topcoat coatings system based on polyester resin powder containing high-level of isophthalic acid; with minimum dry film thickness (DFT) of 2 to 3.5 mil, 0.0020 to 0.0035 inch over aluminum extrusions and panels; meeting requirements of AAMA 2604.

B. Primer: Zinc chromate, alkyd type.

C. Color: As selected from manufacturer's standard colors.

2.05 ACCESSORIES

A. Blank-Off Panels: See Section 23 31 00.

B. Screens: Frame of same material as louver, with reinforced corners; removable, screw attached; installed on inside face of louver frame.

C. Bird Screen: Interwoven wire mesh of steel, 14 gauge, 0.0641 inch diameter wire, 1/2 inch open weave, diagonal design.

D. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared openings and flashings are ready to receive this work and opening dimensions are as indicated on shop drawings.

B. Verify that field measurements are as indicated.

3.02 INSTALLATION

A. Install louver assembly in accordance with manufacturer's instructions.

B. Install louvers level and plumb.

C. Align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.

D. Secure louver frames in openings with concealed fasteners.

NOT FOR BIDDING

3.03 ADJUSTING

A. Adjust operable louvers for freedom of movement of control mechanism. Lubricate operating joints.

3.04 CLEANING

A. Strip protective finish coverings.

B. Clean surfaces and components.

END OF SECTION

NOT FOR BIDDING

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SECTION 09 05 61

COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
   1. Resilient tile and sheet.
   2. Thin-set ceramic tile and stone tile.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Limitations on curing requirements for new concrete floor slabs.

1.03 REFERENCE STANDARDS

A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

B. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

A. Perform following operations in the order indicated:
   1. Preliminary cleaning.
   2. Specified remediation, if required.
   3. Patching, smoothing, and leveling, as required.
   4. Other preparation specified.
   5. Adhesive bond and compatibility test.
   6. Protection.

3.02 PRELIMINARY CLEANING

A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.

B. Do not use solvents or other chemicals for cleaning.

3.03 INTERNAL RELATIVE HUMIDITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F2170 Procedure A and as follows.

D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.

F. Report: Report the information required by the test method.

3.04 PREPARATION

A. See individual floor covering section(s) for additional requirements.

NOT FOR BIDDING

B. Comply with requirements and recommendations of floor covering manufacturer.

C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.

D. Do not fill expansion joints, isolation joints, or other moving joints.

3.05 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations of floor covering manufacturer.

3.06 PROTECTION

A. Cover prepared floors with building paper or other durable covering.

END OF SECTION

NOT FOR BIDDING

SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.
B. Metal stud wall framing.
C. Gypsum sheathing.
D. Gypsum wallboard.
E. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 21 00 - Thermal Insulation: Acoustic insulation.
B. Section 07 25 00 - Weather Barriers: Water-resistive barrier over sheathing.
C. Section 07 84 00 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.
D. Section 07 92 00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.03 REFERENCE STANDARDS

A. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.
B. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).
C. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.
D. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020.
E. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).
F. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
G. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2020.
H. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing; 2018.
I. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.
J. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).
K. ASTM E413 - Classification for Rating Sound Insulation; 2022.
L. GA-216 - Application and Finishing of Gypsum Panel Products; 2021.

1.04 SUBMITTALS

A. See Section 01 30 00 - 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.

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.

NOT FOR BIDDING

1.06 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

B. Interior Partitions: Provide completed assemblies with the following characteristics:
   1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

2.02 METAL FRAMING MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.

B. Manufacturers - Metal Framing, Connectors, and Accessories:
   1. ClarkDietrich: www.clarkdietrich.com/#sle.
   2. Jaimes Industries: www.jaimesind.com/#sle.
   3. MarinoWARE: www.marinoware.com/#sle.
   4. Phillips Manufacturing Co: www.phillipsmfg.com/#sle.
   5. R-stud: www.rstud.com/#sle.
   6. SCAFCO Corporation: www.scafco.com/#sle.
   7. Steel Construction Systems: www.steelconsystems.com/#sle.
   8. Telling Industries: www.tellingindustries.com/#sle.
   9. Approved Equal.
   10. Substitutions: See Section 01 60 00 - Product Requirements.

C. 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.
   1. Studs: C-shaped with knurled or embossed faces.
   2. Runners: U shaped, sized to match studs.
   3. Furring Members: Zee-shaped sections, minimum depth of 2 inch.
   4. Resilient Furring Channels: Double leg configuration; 3/4 inch channel depth.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. American Gypsum Company: www.americangypsum.com/#sle.
   2. CertainTeed Corporation: www.certainteed.com/#sle.
   3. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.
   4. Gold Bond Building Products, LLC provided by National Gypsum Company: www.goldbondbuilding.com/#sle.
   5. PABCO Gypsum: www.pabcogypsum.com/#sle.
   6. USG Corporation: www.usg.com/#sle.
   7. Approved Equal.
   8. Substitutions: See Section 01 60 00 - 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. Thickness:
      a. Vertical Surfaces: 5/8 inch.
   3. Paper-Faced Products:
      a. American Gypsum Company; LightRoc Gypsum Wallboard: www.americangypsum.com/#sle.

NOT FOR BIDDING

b. American Gypsum Company; FireBloc Type X Gypsum Wallboard: www.americangypsum.com/#sle.
c. American Gypsum Company; FireBloc Type C Gypsum Wallboard: www.americangypsum.com/#sle.
d. CertainTeed Corporation; Type C Drywall: www.certainteed.com/#sle.
e. CertainTeed Corporation; Type X Drywall: www.certainteed.com/#sle.
f. Georgia-Pacific Gypsum; ToughRock: www.gpgypsum.com/#sle.
g. Georgia-Pacific Gypsum; ToughRock Fireguard X: www.gpgypsum.com/#sle.
h. Georgia-Pacific Gypsum; ToughRock Fireguard C: www.gpgypsum.com/#sle.
i. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond Fire-Shield Gypsum Board: www.goldbondbuilding.com/#sle.
j. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond Fire-Shield C 5/8" Gypsum Board: www.goldbondbuilding.com/#sle.
k. USG Corporation; Sheetrock Brand EcoSmart Panels Firecode X 5/8 in. (15.9 mm): www.usg.com/#sle.
l. USG Corporation; Sheetrock Brand Firecode X Panels 5/8 in. (15.9 mm): www.usg.com/#sle.
m. USG Corporation; Sheetrock Brand Gypsum Panels 1/4 in. (6.4 mm): www.usg.com/#sle.
n. USG Corporation; Sheetrock Brand Gypsum Panels 3/8 in. (9.5 mm): www.usg.com/#sle.
o. USG Corporation; Sheetrock Brand Flexible Gypsum Panels 1/4 in. (6.4 mm): www.usg.com/#sle.
p. USG Corporation; Sheetrock Brand Ultracode Core Panels 3/4 in. (19.1 mm): www.usg.com/#sle.
q. USG Corporation; Sheetrock Brand UltraLight Panels Firecode ULIX 5/8 in. (15.9 mm): www.usg.com/#sle.
r. USG Corporation; Sheetrock Brand UltraLight Panels Flexible 1/4 in. (6.4 mm): www.usg.com/#sle.
s. Approved Equal.

4. Mold-Resistant, Paper-Faced Products:
a. American Gypsum Company; M-Bloc: www.americangypsum.com/#sle.
b. American Gypsum Company; M-Bloc Type X: www.americangypsum.com/#sle.
c. American Gypsum Company; M-Bloc Type C: www.americangypsum.com/#sle.
d. CertainTeed Corporation; M2Tech 1/2" Moisture & Mold Resistant Drywall: www.certainteed.com/#sle.
e. CertainTeed Corporation; M2Tech 5/8" Type X Moisture & Mold Resistant Drywall: www.certainteed.com/#sle.
f. Georgia-Pacific Gypsum; ToughRock Mold-Guard: www.gpgypsum.com/#sle.
g. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard: www.gpgypsum.com/#sle.
h. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond XP Gypsum Board: www.goldbondbuilding.com/#sle.
i. Gold Bond Building Products, LLC provided by National Gypsum Company; Gold Bond XP Fire-Shield Gypsum Board: www.goldbondbuilding.com/#sle.
j. USG Corporation; Sheetrock Brand EcoSmart Panels Mold Tough Firecode X 5/8 in. (15.9 mm): www.usg.com/#sle.
k. USG Corporation; Sheetrock Brand Mold Tough Firecode SCX Panels 5/8 in. (15.9 mm): www.usg.com/#sle.
l. USG Corporation; Sheetrock Brand Mold Tough Ultracode Core Panels 3/4 in. (19.1 mm): www.usg.com/#sle.
m. USG Corporation; Sheetrock Brand UltraLight Panels Mold Tough 1/2 in. (12.7 mm): www.usg.com/#sle.
n. Approved Equal.

C. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.

NOT FOR BIDDING

1. Application: Exterior sheathing, unless otherwise indicated.
2. Core Type: Type X, as indicated.
3. Type X Thickness: 5/8 inch.
4. Edges: Square.

2.04 GYPSUM BOARD ACCESSORIES

A. Water-Resistive Barrier: See Section 07 25 00.

B. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
   1. Fiberglass Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
   2. Joint Compound: Setting type, field-mixed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C1007AISI S220 and manufacturer's instructions.

B. Studs: Space studs at 16 inches on center.
   1. Extend partition framing to structure where indicated and to ceiling in other locations.
   2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

3.03 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.

C. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
   1. Paper-Faced Sheathing: Immediately after installation, protect from weather by application of water-resistive barrier.

3.04 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.05 JOINT TREATMENT

A. 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 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.

B. 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.

C. 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.

NOT FOR BIDDING

3.06 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

3.07 PROTECTION

A. Protect installed gypsum board assemblies from subsequent construction operations.

END OF SECTION

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SECTION 09 30 00

TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Cementitious backer board as tile substrate.

D. Stone thresholds.

E. Ceramic accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.

B. Section 09 05 61 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

C. Section 09 21 16 - Gypsum Board Assemblies: Tile backer board.

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 A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesive or Water Cleanable Tile-Setting Epoxy Adhesive; 2023.

E. 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.

F. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grout Epoxy; 2023.

G. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (Reaffirmed 2019).

H. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 2023.

I. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 2017 (Reaffirmed 2022).

J. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2018.

K. ANSI A108.12 - Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Modified Dry-Set Mortar; 2023.

L. 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).

M. 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.

NOT FOR BIDDING

N. ANSI A108.20 - American National Standard Specifications for Exterior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs; 2020.

O. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 2019.

P. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2014 (Reaffirmed 2019).

Q. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2022.

R. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2024.

S. 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 01 30 00 - 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. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches in size illustrating pattern, color variations, and grout joint size variations.

D. Installer's Qualification Statement:
   1. Submit documentation of National Tile Contractors Association (NTCA) or Tile Contractors' Association of America (TCAA) accreditation.

1.06 QUALITY ASSURANCE

1.07 MOCK-UPS

A. See Section 01 40 00 - 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.

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 and below 100 degrees F during installation and curing of setting materials.

PART 2 PRODUCTS

2.01 TILE

A. Manufacturers: All products by the same manufacturer.
   1. American Olean Corporation: www.americanolean.com/#sle.
   2. Architessa: www.architessa.com/#sle.
   3. Dal-Tile Corporation; (Basis-of-Design Manufacturer): www.daltile.com/#sle.
   4. Emser Tile, LLC: www.emser.com/#sle.
   5. Florim USA: www.milestonetiles.com/#sle.
   6. Approved Equal.
   7. Substitutions: See Section 01 60 00 - Product Requirements.

B. Glazed Wall Tile, Type Toilet Room Walls: ANSI A137.1, standard grade.
   1. Size: 4 by 4 inch, nominal.

NOT FOR BIDDING

2. Edges: Cushioned.
3. Surface Finish: High gloss.
4. Color(s): To be selected by Architect from manufacturer's standard range.

C. Quarry Tile, Type Toilet Room Floors: ANSI A137.1, standard grade.
1. Size: 2 by 2 inch, nominal.
2. Edges: Cushioned.
3. Surface Finish: Unglazed.
4. Color(s): To be selected by Architect from manufacturer's standard range.

2.02 TRIM AND ACCESSORIES

A. Thresholds: 5 inches 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.
2. Material: Marble, honed finish.
3. Color and Pattern: As selected from Manufacturer's standard range.
4. Applications:
a. At doorways where tile terminates.

2.03 SETTING MATERIALS

A. Provide setting and grout materials from same manufacturer.

2.04 GROUTS

A. Provide setting and grout materials from same manufacturer.

2.05 ACCESSORY MATERIALS

A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
1. Crack Resistance: No failure at 1/8 inch gap, minimum.

B. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 5/8 inch thick; 2 inch wide coated glass fiber tape for joints and corners.

PART 3 EXECUTION

3.01 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.

3.02 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 floor 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 thresholds where indicated.

G. Sound tile after setting. Replace hollow sounding units.

H. Keep control and expansion joints free of mortar, grout, and adhesive.

NOT FOR BIDDING

I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

J. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

K. 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.

3.03 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
   1. Use uncoupling membrane under all tile unless other underlayment is indicated.

B. Install tile-to-tile floor movement joints in accordance with TCNA (HB) Method EJ171F.

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.

END OF SECTION

NOT FOR BIDDING

SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - 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; 2017.

B. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2017.

C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.

D. 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.

E. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

F. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on suspension system components and acoustical units.

C. Samples: Submit two full size samples illustrating material and finish of acoustical units.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. Designer's qualification statement.

F. Manufacturer's qualification statement.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Tiles/Panels:
   1. Armstrong World Industries, Inc; Cortega 770 (Basis-ofDesign): www.armstrongceilings.com/#sle.
   2. Acoustic Ceiling Products, Inc: www.acpideas.com/#sle.
   3. Acoustics First Corporation: www.acousticsfirst.com/#sle.
   4. Ceilings4U: www.ceilings4u.com/#sle.

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5. Certainteed Architectural: www.certainteed.com/ceilings-and-walls/#sle.
6. Kinetics Noise Control, Inc: www.kineticsnoise.com/#sle.
7. Rockfon: www.rockfon.com/#sle.
8. TECHLITE: www.techlite.com/#sle.
9. USG Corporation: www.usg.com/ceilings/#sle.
10. Approved Equal.
11. Substitutions: See Section 01 60 00 - Product Requirements.

B. Suspension Systems:
1. Same as for acoustical units.
2. Armstrong World Industries, Inc; 15/16" (Basis-of-Design): www.armstrongceilings.com/#sle.
3. Certainteed Architectural: www.certainteed.com/ceilings-and-walls/#sle.
4. Rockfon: www.rockfon.com/#sle.
5. USG Corporation: www.usg.com/ceilings/#sle.
6. Approved Equal.
7. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 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).

2.03 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, stabilizer bars, and splices as required.
1. Materials:
a. Steel Grid: ASTM A653/A653M, G30 coating, unless otherwise indicated.

2.04 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 galvanized steel wire.

C. Perimeter Moldings: Same metal and finish as grid.
1. Angle Molding: L-shaped, for mounting at same elevation as face of grid.

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 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
1. Use longest practical lengths.

D. 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.

E. 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.

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F. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

G. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

H. Do not eccentrically load system or induce rotation of runners.

3.03 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.

3.04 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.05 CLEANING

A. Clean surfaces.

B. Replace damaged or abraded components.

END OF SECTION

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SECTION 09 65 00
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient tile flooring.

B. Resilient base.

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied resilient flooring.

C. Section 09 05 61 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing.

1.03 REFERENCE STANDARDS

A. ASTM D6329 - Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers; 1998 (Reapproved 2023).

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 F1344 - Standard Specification for Rubber Floor Tile; 2021a.

E. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile; 2020.

F. ASTM F1859 - Standard Specification for Rubber Sheet Floor Covering Without Backing; 2021a.

G. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.

H. 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 01 30 00 - 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. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

D. Verification Samples: Submit two samples, 6 by 6 inch in size illustrating color and pattern for each resilient flooring product specified.

E. Sustainable Design Submittal: Submit VOC content documentation for flooring and adhesives.

1.05 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 to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.01 TILE FLOORING

A. Vinyl Tile - VCT-1: Printed film type, with transparent or translucent wear layer; acoustic interlayer or backing.
   1. Manufacturers:
      a. AHF Products: www.ahfcontract.com/#sle.

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b. Architessa: www.architessa.com/#sle.
c. Armstrong Flooring; Unify: www.armstrongflooring.com/#sle.
d. Dal-Tile Corporation: www.daltile.com/#sle.
e. Flexco Corporation; Delane Solid Vinyl Tile: www.flexcofloors.com/#sle.
f. Gerflor USA, Inc: www.gerflorusa.com/#sle.
g. Mannington Commercial: www.manningtoncommercial.com#sle.
h. TAJ Flooring: www.tajflooring.com/#sle.
i. Approved Equal.
j. Substitutions: See Section 01 60 00 - Product Requirements.

2. Minimum Requirements: Comply with ASTM F1700, Class III.
3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648.
4. Mold and Microbial Resistance: Highly resistant when tested in accordance with ASTM D6329.
5. VOC Content Limits: As specified in Section 01 61 16.
6. Square Tile Size: 12 by 12 inch, nominal.
7. Wear Layer Thickness: 0.020 inch.
8. Total Thickness: 0.20 inch.
9. Color: To be selected by Architect from manufacturer's full range.

B. Rubber Tile: Homogeneous, color and pattern throughout thickness.
1. Manufacturers:
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; Envire Rubber Tile (Basis-of-Design): www.roppe.com/#sle.
1) Style: #996
2) Color: To be determined.
e. Approved Equal.
f. Substitutions: See Section 01 60 00 - Product Requirements.
2. Minimum Requirements: Comply with ASTM F1344, of Class 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 01 61 16.
5. Size: 19 11/16 by 19 11/16 inch nominal.
6. Total Thickness: 5/32 inch.
7. Texture: Raised circles.
8. Color: To be selected by Architect from manufacturer's full range.

2.02 RESILIENT BASE

A. Resilient Base: ASTM F1861, Type TS, rubber, vulcanized thermoset; style as scheduled.
1. Manufacturers:
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(Basis-of-Design): www.roppe.com/#sle.
e. Approved Equal.
f. Substitutions: See Section 01 60 00 - 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.
4. Color: To be selected by Architect from manufacturer's full range.

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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. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
   1. Test in accordance with Section 09 05 61.
   2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

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. Fit joints and butt seams tightly.
   2. Set flooring in place, press with heavy roller to attain full adhesion.

D. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

E. At movable partitions, install flooring under partitions without interrupting floor pattern.

3.04 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.

3.05 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches 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.

3.06 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.07 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

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SECTION 09 91 00
PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. The extent of work included in this Section is shown on the Drawings and is specified as follows:

1. Exposed exterior items and surfaces.
2. Exposed interior items and surfaces.
3. Painting parking lines, arrows, and curb edges.
4. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
5. Pipe guards
6. Railings

B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface as directed by the Architect. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

1. Prefinished items include the following factory-finished components:
   a. Metal panel ceiling.
   b. Toilet compartments.
   c. Finished mechanical and electrical equipment.
   d. Light fixtures.
   e. Distribution cabinets.

2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
   a. Foundation spaces.
   b. Furred areas.
   c. Ceiling plenums.
   d. Pipe spaces.
   e. Duct shafts.

3. Finished metal surfaces include the following:
   a. Color anodized aluminum.
   b. Stainless steel.
   c. Chromium plate.
   d. Copper.
   e. Bronze and brass.

4. Operating parts include moving parts of operating equipment and the following:
   a. Valve and damper operators.
   b. Linkages.
   c. Sensing devices.
   d. Motor and fan shafts.

5. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

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D. Refer to other Sections of these Specifications, which may have shop priming requirements affecting the Work of this Section

1.2 DEFINITIONS

A. General: Standard coating terms defined in ASTM D16 apply to this Section.

1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
2. Eggshell refers to low-sheen finish with a gloss range between 5 and 20 when measured at a 60-degree meter.
3. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.
4. Semi-gloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
5. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

1.3 SUBMITTALS

A. Product Data: For each paint system specified. Include block fillers and primers.

1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
3. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

B. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.

1. After color selection, the Architect will furnish color chips for surfaces to be coated.

C. Samples for Verification: Of each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.

1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
2. Provide a list of materials and applications for each coat of each sample. Label each sample for location and application.
3. Submit Samples on the following substrates for the Architect's review of color and texture only:
    a. Painted Wood: Provide two 12-inch-square samples of each color and material on hardboard.
    b. Ferrous Metal: Provide two 4-inch-square samples of flat metal and two 8-inch long samples of solid metal for each color and finish.

D. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

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1.4 QUALITY ASSURANCE

A. Applicator Qualifications: The Contractor performing the Work of this Section must, within the last five (5) consecutive years, have successfully completed in a timely fashion at least three (3) projects similar in scope and type to the required work for this Section.

B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

C. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample of each type of coating and substrate required on the Project. Comply with procedures specified in PDCA P5. Duplicate finish of approved prepared samples.

1. The Architect will select one room or surface to represent surfaces and conditions for each type of coating and substrate to be painted.

a. Wall Surfaces: Provide samples on at least 100 sq. ft. of wall surface.
b. Small Areas and Items: The Architect will designate an item or area as required.

2. After permanent lighting and other environmental services have been activated, apply coatings in this room or to each surface according to the Schedule or as specified. Provide required sheen, color, and texture on each surface.

a. After finishes are accepted, the Architect will use the room or surface to evaluate coating systems of a similar nature.

3. Final approval of colors will be from job-applied samples.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:

1. Product name or title of material.
2. Product description (generic classification or binder type).
3. Manufacturer's stock number and date of manufacture.
4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain storage space temperature and humidity within range acceptable to paint manufacturer. Maintain containers used in storage in a clean condition, free of foreign materials and residue.

1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.6 PROJECT CONDITIONS

A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F.

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F.

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C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.7 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied in the quantities described below. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the Owner.

1. Quantity: Furnish the Owner with extra paint materials in the quantities indicated below:
   a. Exterior, Full-Gloss Alkyd Enamel: 2 gal. of each color applied.
   b. Interior, Flat Acrylic Paint: One case of each color applied.
   c. Interior, Low-Luster Acrylic Finish: One case of each color applied.
   d. Interior, Semigloss Acrylic Enamel: 2 gal. of each color applied.
   e. Interior, Full-Gloss Alkyd Enamel: 1 gal. of each color required.

2. Quantity: Furnish the Owner with an additional 5 percent, but not less than 1 gal. or 1 case, as appropriate, of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products in the paint schedules.

B. Manufacturers Names: The following manufacturers are referred to in the paint schedules by use of shortened versions of their names, which are shown in parentheses:
1. Benjamin Moore & Co. (Moore).
2. PPG Industries, Inc. (PPG).
3. Sherwin-Williams Co. (S-W).
4. Tnemec.
5. Approved equal.

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. Colors: Provide color samples for selections made by the Architect.

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.

1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
Notify the Architect about anticipated problems using the materials specified over substrates primed by others.

3.2 PREPARATION

A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.
2. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.

a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and backsides of wood, including cabinets, counters, cases, and paneling.
c. When transparent finish is required, backprime with spar varnish.
d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on backside.
e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.

3. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.

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a. Blast steel surfaces clean as recommended by paint system manufacturer and according to requirements of SSPC-SP 10.
b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.

4. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

5. Cementitious Materials: Prepare concrete, concrete masonry block and cement plaster surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen, as required, to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.

a. Use abrasive blast-cleaning methods if recommended by the paint manufacturer.
b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid or neutralize the ammonia, rinse, allow to dry, and vacuum before painting.

6. Gypsum Materials: Prepare gypsum castings, gypsum block and gypsum based plaster surfaces to be painted. Remove chalk, dust, dirt, grease, oils, and release agents. Roughen, as required, to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.

a. Use abrasive cleaning methods if recommended by the paint and gypsum product manufacturer.
b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's printed directions.
c. Prepare gypsum wall board in accordance with wall board manufacturer and paint manufacturer, provide sizing, sealers and related treatments as recommended.

D. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.

1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
3. Use only thinners approved by paint manufacturer and only within recommended limits.

3.3 APPLICATION

A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Paint colors, surface treatments, and finishes are indicated in the schedules.
2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
3. Provide finish coats that are compatible with primers used.

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4. The term “exposed surfaces” includes areas visible when permanent or built-in fixtures, convector covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
9. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
10. Sand lightly between each succeeding enamel or varnish coat.
11. Where fascias, soffits and housings that are to be painted are exposed to exterior viewing, allow for second color selection by Architect, and for painting of viewable surfaces different color from adjacent surfaces, match approved samples.

B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer’s written instructions, sand between applications.
2. Omit primer on metal surfaces that have been shop primed and touchup painted.
3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer’s written instructions.

1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.
2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep’s wool as recommended by the manufacturer for the material and texture required.
3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.

D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer’s recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.

E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.

F. Mechanical items to be painted include, but are not limited to, the following:

1. Piping, pipe hangers, and supports.

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2. Heat exchangers.
3. Tanks.
4. Ductwork.
5. Insulation.
6. Motors and mechanical equipment.
7. Accessory items.

G. Electrical items to be painted include, but are not limited to, the following:

1. Conduit and fittings.
2. Switchgear.
3. Panelboards.

H. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

I. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

J. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

K. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

L. Paint parking stalls, marking lines, etc. to be as detailed on the Drawings. Unless otherwise detailed, single line width shall be four-inches-wide. Striped areas shall consist of four-inch-wide lines spaces 18-inches on center. Lay out all painted lines and define with chalk lines for approval before proceeding with painting.

3.4 FIELD QUALITY CONTROL

A. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary during the period when paint is being applied:

1. The Owner will engage the services of an independent testing agency to sample the paint material being used. Samples of material delivered to the Project will be taken, identified, sealed, and certified in the presence of the Architect.
2. The testing agency will perform appropriate tests for the following characteristics as required by the Owner:

a. Quantitative material analysis.
b. Abrasion resistance.
c. Apparent reflectivity.
d. Flexibility.
e. Washability.
f. Absorption.
g. Accelerated weathering.
h. Dry opacity.
i. Accelerated yellowness.
j. Recoating.

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k. Skinning.
l. Color retention.
m. Alkali and mildew resistance.

3. The Owner may direct the Contractor to stop painting if test results show material being used does not comply with specified requirements. The Contractor shall remove noncompliant paint from the site, pay for testing, and repaint surfaces previously coated with the rejected paint. If necessary, the Contractor may be required to remove rejected paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

3.5 CLEANING

A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

3.6 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

B. Provide “Wet Paint” signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.7 EXTERIOR PAINT SCHEDULE

A. Ferrous Metals: provide the following finish systems over exterior ferrous metals:

1. Full-Gloss, Alkyd-Enamel Finish: 2 finish coats over a rust-inhibitive primer.

a. Primer: Rust-inhibitive metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils.

1) Moore: IronClad Retardo Rust-Inhibitive Paint #163.
2) PPG: 6-208 Speedhide Interior/Exterior Rust Inhibitive Steel Primer.
3) S-W: Kem Kromik Metal Primer B50N2/B50W1.
4) Approved equal.

b. First and Second Coats: Full-gloss, exterior, alkyd enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 3.0 mils.

1) Moore: Impervo Enamel #133.
2) PPG: 6-282 Speedhide Interior/Exterior Gloss-Oil Enamel.
3) S-W: Industrial Enamel B-54 Series.
4) Approved equal.

B. Zinc-Coated Metal: Provide the following finish systems over exterior zinc-coated (galvanized) metal surfaces:

1. Full-Gloss, Alkyd-Enamel Finish: 2 finish coats over a galvanized metal primer.

NOT FOR BIDDING

a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.
   1) Moore: IronClad Galvanized Metal Latex Primer #155.
   2) PPG: 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel.
   3) S-W: Galvite Paint B50W3.
   4) Approved equal.

b. First and Second Coats: Full-gloss, exterior, alkyd enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils.
   1) Moore: Impervo Enamel #133.
   2) PPG: 6-282 Speedhide Interior/Exterior Gloss-Oil Enamel.
   3) S-W: Industrial Enamel B-54 Series.
   4) Approved equal.

C. Concrete, Stucco, and Masonry (Other than Concrete Masonry Units): Provide the following finish systems over exterior concrete, stucco, and brick masonry surfaces:

1. Flat Acrylic Finish: 2 finish coats over a primer.

   a. Primer: Alkali-resistant, exterior, acrylic-latex primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils.
      1) Moore: Primer not required over this substrate.
      2) PPG: 6-603 Speedhide Interior/Exterior Acrylic Latex Alkali Resistant Primer.
      3) Approved equal.

   b. First and Second Coats: Flat, exterior, acrylic-emulsion paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.4 mils.
      1) Moore: MoorLife Latex House Paint #105.
      2) PPG: 10 Line Pitt-Cryl Exterior Water Base Paint.
      3) Approved equal.

2. Low-Luster Acrylic Finish: 2 finish coats over a primer.

   a. Primer: Alkali-resistant, exterior, acrylic-latex primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils.
      1) Moore: Moore's Latex Exterior Primer #102.
      2) PPG: 6-603 Speedhide Interior/Exterior Acrylic Latex Alkali Resistant Primer.
      3) Approved equal.

   b. First and Second Coats: Low-luster (eggshell or satin), exterior, acrylic-latex paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.3 mils.
      1) Moore: MoorGard Latex House Paint #103.
      2) PPG: 76 Line Sun-Proof Exterior House & Trim Acrylic Satin Latex.
      3) Approved equal.

3. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a primer.

NOT FOR BIDDING

a. Primer: Alkali-resistant, exterior, acrylic-latex primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.4 mils.
   1) Moore: Moore's Latex Exterior Primer #102.
   2) PPG: 6-603 Speedhide Interior/Exterior Acrylic Latex Alkali Resistant Primer.
   3) Approved equal.

b. First and Second Coats: Semigloss, exterior, acrylic-latex enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.4 mils.
   1) Moore: MoorGlo Latex House & Trim Paint #096.
   2) PPG: 78 Line Sun-Proof Semi-Gloss Acrylic Latex House and Trim Paint.
   3) Approved equal.

D. Traffic and Parking Stall Markings:
   1. Two Coats of Latex Acrylic Emulsion Paint
      a. First and Second Coats: Latex Acrylic Emulsion 15 mils wet coat; yellow (AASHTO Designation M248, Traffic Type II Paints).

3.8 INTERIOR PAINT SCHEDULE

A. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:

1. Low-Luster, Acrylic-Enamel Finish: 2 finish coats over a primer.

a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

   1) Moore: Regal First Coat Interior Latex Primer & Underbody #216.
   2) PPG: 17-10 Quick-Drying Interior Latex Primer-Sealer.
   3) Approved equal.

b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils.

   1) Moore: Moore's Regal AquaVelvet #319.
   2) PPG: 89 Line Manor Hall Eggshell Latex Wall and Trim Enamel.
   3) Approved equal.

B. Woodwork: Provide the following paint finish systems over new, interior wood surfaces:

1. Semigloss, Alkyd-Enamel Finish: 2 finish coats over a primer.

a. Primer: Alkyd or latex-based, interior enamel undercoater applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).

   1) Moore: Moore's Alkyd Enamel Underbody #217.
   2) PPG: 17-255 Quick-Drying Enamel Undercoater.
   3) S-W: ProMar 200 Alkyd Enamel Undercoater B49W200.
   4) Approved equal.

b. First and Second Coats: Odorless, semigloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.4 mils.

   1) Moore: Satin Impervo #235.

NOT FOR BIDDING

2) PPG: 27 Line Wallhide Low Odor Interior Enamel Wall and Trim Semi-Gloss Oil.
3) S-W: Classic 99 Interior Alkyd Semi-Gloss Enamel A-40 Series.
4) Approved equal.

C. Ferrous Metal: Provide the following finish systems over ferrous metal:

1. Semigloss, Alkyd-Enamel Finish: One finish coat over an enamel undercoater and a primer.

a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils.

1) Moore: IronClad Retardo Rust-Inhibitive Paint #163.
2) PPG: 6-208 Speedhide Interior/Exterior Rust Inhibitive Steel Primer.
3) Approved equal.

b. Undercoat: Alkyd, interior enamel undercoat or semigloss, interior, alkyd-enamel finish coat, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Moore: Moore's Alkyd Enamel Underbody #217.
2) PPG: 6-6 Speedhide Interior Quick-Drying Enamel Undercoater.
3) S-W: ProMar 200 Interior Alkyd Semi-Gloss Enamel B34W200.
4) Approved equal.

c. Finish Coat: Odorless, semigloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.4 mils.

1) Moore: Satin Impervo #235.
2) PPG: 27 Line Wallhide Low Odor Interior Enamel Wall and Trim Semi-Gloss Oil.
3) S-W: Classic 99 Interior/Exterior Semi-Gloss Alkyd Enamel A-40 Series.
4) Approved equal.

D. Zinc-Coated Metal: Provide the following finish systems over zinc-coated metal:

1. Semigloss, Alkyd-Enamel Finish: One finish coat over an undercoat and a primer.

a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) Moore: IronClad Galvanized Metal Latex Primer #155.
2) PPG: 90-709 Pitt-Tech One Pack Interior/Exterior Primer/Finish DTM Industrial Enamel.
3) S-W: Galvite Paint B50W3.
4) Approved equal.

b. Undercoat: Alkyd, interior enamel undercoat or semigloss, interior, alkyd-enamel finish coat, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.

1) S-W: ProMar 200 Interior Alkyd Semi-Gloss Enamel B34W200.
2) MAB: Rich Lux Low Lustre Alkyd Enamel 021 line.

NOT FOR BIDDING

3) Approved equal.

c. Finish Coat: Odorless, semigloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.4 mils.

1) Moore: Satin Impervo #235.
2) PPG: 27 Line Wallhide Low Odor Interior Enamel Wall and Trim Semi-Gloss Oil.
3) S-W: Classic 99 Interior Alkyd Semi-Gloss Enamel A-40 Series.
4) Approved equal.

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SECTION 10 14 19

DIMENSIONAL LETTER SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Dimensional letter signage.

1.02 SUBMITTALS

A. See Section 01 30 00 - 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.

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:
   1. FASTSIGNS International, Inc: www.fastsigns.com/#sle.
   2. Inpro Corporation: www.inprocorp.com/#sle.
   3. Takeform: www.takeform.net/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DIMENSIONAL LETTERS

A. Applications: Building identification.
   1. Use individual metal letters.
   2. Mounting Location: Exterior as indicated on drawings.

B. Metal Letters:
   1. Material: Stainless steel sheet, fabricated reverse channel.
   2. Thickness: 1/8 inch minimum.
   3. Letter Height: 16 inches.
   4. Text and Typeface:
      a. Character Font: Helvetica, Arial, or other sans serif font.
      b. Character Case: Upper case only.
   5. Finish: Brushed, satin.
   6. Color: As selected.
   7. Mounting: Concealed screws.

2.03 ACCESSORIES

A. Concealed Screws: Noncorroding metal; stainless steel, galvanized steel, chrome plated, or other.

NOT FOR BIDDING

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

NOT FOR BIDDING

SECTION 10 14 23
PANEL SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Panel signage.

1.02 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's product literature for each type of panel sign, indicating styles, font, foreground and background colors, locations, and overall dimensions of each sign.

C. Shop Drawings:
   1. Include dimensions, locations, elevations, materials, text and graphic layout, attachment details, and schedules.

D. Samples: Submit two samples of each type of sign, of size similar to that required for project, indicating sign style, font, and method of attachment.

E. Selection Samples: Where colors, materials, and finishes are not specified, submit two sets of color selection charts or chips.

F. Verification Samples: Submit samples showing colors, materials, and finishes specified.

G. Manufacturer's Installation Instructions: Include installation templates and attachment devices.

H. Manufacturer's qualification statement.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

B. Package room and door signs in sequential order of installation, labeled by floor or building.

C. Store tape adhesive at normal room temperature.

1.06 FIELD CONDITIONS

A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.

B. Maintain minimum ambient temperature during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Panel Signage:
   1. Best Sign Systems, Inc: www.bestsigns.com/#sle.
   2. FASTSIGNS International, Inc: www.fastsigns.com/#sle.
   3. Inpro Corporation: www.inprocorp.com/#sle.

2.02 REGULATORY REQUIREMENTS

A. Accessibility Requirements: Comply with ADA Standards and ICC A117.1 and applicable building codes, unless otherwise indicated; in the event of conflicting requirements, comply with the most restrictive requirements.

NOT FOR BIDDING

2.03 PANEL SIGNAGE

A. Panel Signage:
   1. Application: Room and door signs.
   2. Description: Flat signs with engraved panel media, tactile characters.
   3. Sign Size: As indicated on drawings.
   4. Total Thickness: 1/8 inch.
   5. Sign Edges: Radiused.
   6. Color and Font, unless otherwise indicated:
      a. Character Font: Helvetica, Arial, or other sans serif font.
      b. Character Case: Upper and lower case (title case).
      c. Background Color: As scheduled.
      d. Character Color: Contrasting color.
   7. Material: Laminated colored plastic engraved through face to expose core as background color.
   8. Profile: Flat panel in matching plastic frame.
   9. Tactile Letters: Raised 1/32 inch minimum.

2.04 SIGNAGE APPLICATIONS

A. Room and Door Signs:

2.05 ACCESSORIES

A. Exposed Screws: Stainless steel.

B. Tape Adhesive: Double-sided tape, permanent adhesive.

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. Locate panel signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

END OF SECTION

NOT FOR BIDDING

SECTION 10 22 13
WIRE MESH PARTITIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wire mesh systems for doors and openings..

1.02 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware

B. Section 09 91 00 - Painting

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

C. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021a.

D. ASTM A510/A510M - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel; 2020.

E. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021.

F. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015, with Errata (2016).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for mesh materials, finishes, and _____.

C. Shop Drawings: Indicate plan and vertical dimensions, elevations, component details; head, jamb, and sill details; location of hardware. Provide component details, anchorage, and type and location of fasteners.

D. Samples: Submit two samples, 6"by 6" inch in size, illustrating mesh material. Submit samples of hinge and latchset illustrating style, color, and finish. Incorporate sample into the work.

E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

F. 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.

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.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wire Mesh Partitions:
   1. Acorn Wire and Iron Works, Inc; 135 Heavy Duty Wire Mesh (Basis-of-Design): www.acornwire.com/#sle.
   2. The G-S Company; Sure Guard Heavy Duty: www.g-sco.com/#sle.
   3. Miller Wire Works, Inc: www.millerwireworks.com/#sle.
   4. SpaceGuard Products; BeastWire Mesh Partitions with Heavy-Duty 6 ga. Welded Wire Mesh - 2 Inch Square: www.spaceguardproducts.com/#sle.
   5. Approved Equal.
   6. Substitutions: See Section 01 60 00 - Product Requirements.

NOT FOR BIDDING

2.02 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. Design Criteria:
      a. Design partition system to provide for movement of components without damage, undue stress on fasteners or other detrimental effects, when subject to design loads.
      b. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

2.03 COMPONENTS

A. Woven Wire Mesh: Heavy duty.
   1. Material: ASTM A510/A510M uncoated crimped steel wire.
   2. Wire Size: 6 gauge, 0.192 inch.
   3. Mesh Opening Size: 2 inch diamond shape.
   4. Mesh Weave: Plain weave, double crimped.

B. Framing and Support Members:
   1. Material: ASTM A36/A36M steel shapes and ASTM A500/A500M cold-formed steel tubing.
   2. Framing, Corner Posts, and Intermediate Support Members: Manufacturer's standard sizes for system specified and as indicated on drawings.

C. Doors: Same material as partitions, fully framed; manufacturer's standard construction and hardware for swing operation.
   1. Locking: Refer to Specification Section 08 71 00.

2.04 FASTENERS

A. Bolts, Nuts and Washers: Hot dip galvanized.

B. Anchorage Devices: Provide power driven, powder actuated, and drilled expansion bolts.

2.05 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 Base: Formed steel.

2.06 FABRICATION

A. Fit and assemble in largest practical sections for delivery to site, ready for installation.

B. Make exposed joints flush or tight.

C. Provide components required for anchorage to adjacent construction.

2.07 FINISHES

A. Painted Finish: Manufacturer's standard powder coat finish.

B. Galvanized Finish: In accordance with requirements of ASTM A123/A123M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces and required openings are ready to receive work.

3.02 PREPARATION

A. Clean substrate surfaces.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install items plumb and level, accurately fitted, free from distortion or defects.

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C. After installation, touch-up field welds scratched or damaged surfaces with shop applied finish.

3.04 TOLERANCES

A. Maximum Variation From Plumb or Level: 1/4 inch.

3.05 ADJUSTING

A. Adjust doors to achieve free movement.

3.06 CLEANING

A. Remove temporary protection to prefinished surfaces.

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SECTION 10 28 00
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

B. Under-lavatory pipe supply covers.

C. Utility room accessories.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Blocking in walls.

B. Section 09 30 00 - Tiling: Ceramic washroom accessories.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015a.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

D. ASTM C1036 - Standard Specification for Flat Glass; 2021.

E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

F. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping; 2015.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.

H. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.

I. 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 01 33 00 - 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 MANUFACTURERS

A. Basis-of-Design: Bobrick: www.bobrick.com/#sle.

B. Commercial Toilet, Shower, and Bath Accessories: Subject to requirements of drawings and specifications, products from the following manufacturers may be provided.

1. AJW Architectural Products: www.ajw.com/#sle.
2. American Specialties, Inc: www.americanspecialties.com/#sle.
3. Bobrick Washroom Equipment, Inc.: www.bobrick.com/#sle.
4. Bradley Corporation: www.bradleycorp.com/#sle.
5. Approved Equal.
6. Substitutions: Section 01 60 00 - Product Requirements.

NOT FOR BIDDING

C. Under-Lavatory Pipe Supply Covers:
   1. IPS Corporation; Lav Shield: www.spsplumbingproducts.com
   2. Zurn Water LLC; Z6900-VG, Vandal-guard Lav Sheild Assembly. www.zurn.com/#sle.
   3. Approved Equal.
   4. Substitutions: Section 01 60 00 - Product Requirements.

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.

B. Stainless Steel Sheet: ASTM A666, Type 304.

C. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.

D. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.

E. Adhesive: Two component epoxy type, waterproof.

F. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.03 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

2.04 COMMERCIAL TOILET ACCESSORIES

A. Toilet Paper Dispenser:
   1. Basis-of-Design Product: Bobrick B-2888

B. Paper Towel Dispenser:
   1. Paper Discharge: Touchless automatic.
   2. Mounting: Surface mounted.
   3. Power: Battery operated.
   4. Basis of Design Product: San Jamar: Classic Ecologic Electronic Roll Towel Dispenser - Black

C. Waste Receptacle: Stainless steel, recessed.
   1. Liner: Removable, heavy-duty vinyl liner ___.
   2. Minimum capacity: 12 gallons.
   3. Basis-of-Design Products: Bobrick B-3644.

D. Soap Dispenser:
   1. Basis-of-Design Product: San Jamar SHF900TBK Touchless Foam Sanitizer / Soap Dispenser.

E. Mirrors: Stainless steel framed, 1/4 inch thick tempered safety glass; ASTM C1048.
   1. Size: 24"x36".
   2. Frame: 1/2 inch channel shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
   3. Backing: Full-mirror sized, minimum 0.03 inch galvanized steel sheet and nonabsorptive filler material.
   4. Basis-of-Design Product: Bobrick B-290

F. Seat Cover Dispenser: Stainless steel, surface-mounted, reloading by concealed opening at base, tumbler lock.
   1. Minimum capacity: 250 seat covers.
   2. Basis-of-Design Product: Bobrick, B-4221.

G. Grab Bars: Stainless steel, satin surface.
   1. Standard Duty Grab Bars:
      a. Push/Pull Point Load: 250 pound-force, minimum.
      b. Dimensions: 1-1/2 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
      c. Finish: Satin.

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d. Length and Configuration:
   1) 36" horizontal.
   2) 42" horizontal.
   3) 18" vertical.
e. Basis-of-Design Product: Bobrick, B-6806.

H. Coat Hook: Machined stainless steel, hat and coat hook with backplate for concealed attachments, satin finish.
1. Basis-of-Design Products: Bobrick, B-6827.

2.05 UNDER-LAVATORY PIPE AND SUPPLY COVERS

A. Under-Lavatory Pipe and Supply Covers:
1. Cover exposed drainage piping, including hot, cold, and tempered water supplies under lavatories or sinks to comply with ADA Standards.
2. Exterior Surfaces: Rigid, High-impact, stain-resistant PVC.
3. Construction: 0.093 inch" 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 ICC A117.1.
   d. Microbial and Fungal Resistance: Comply with ASTM G21.
4. Color: White.
5. Fasteners: Stainless steel screws with wall anchors.
6. Basis-of-Design Product: Truebro Lav Sheild.

2.06 UTILITY ROOM ACCESSORIES

A. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.
1. Length: 34 inches.
2. Products:
   a. Bobrick B-239.
   b. Approved Equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. Verify that field measurements are as indicated on drawings.

D. See Section 06 10 00 for installation of blocking 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 required by accessibility regulations, unless otherwise indicated.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

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SECTION 10 29 60

BIRD BARRIERS

GENERAL

1.01 DESCRIPTION

A. Install Bird Barrier on exposed or protected ledges where birds loaf, roost or nest, to prevent damage from droppings and nesting materials.

B. Quality Assurance
   1. Obtain technical literature from manufacturer or distributor, telephone consultation and plan/photograph evaluation.
   2. Utilize certified installation companies who are fully skilled with Bird Barrier products, and carry the proper insurance coverage.
   3. Utilize labor recommended by Bird Barrier for especially challenging applications.

C. Submittals
   1. Submit manufacturer's samples, catalog cuts, shop sketches and other descriptive material.
   2. Product Handling
      a. Protect Bird Barrier from damage before, during and after installation.
      b. If damage occurs to Bird Barrier, make all replacements immediately.

PRODUCTS

2.01 MANUFACTURERS:

A. Basis-of-Design Manufacturer: Bird Barrier America, Inc., 20925 Chico Street, Carson, CA 90746. Phone 800-503-5444
   1. Basis-of-Design Product: Dura-Spike Xtra-Wide (BP-S600)
      a. Rod Material : 302 grade Stainless Steel, 36 per foot Base Material: 302 grade Stainless Steel
      b. Width: 8" (20.5 cm)
      c. Height: 4.75" (12 cm)
      d. Length: 36" (91.44 cm) per piece

B. Or approved equal.

2.02 MOUNTING SYSTEMS

A. Basis-of-Design: Bird Barrier Bond (2-hour cure) or Super Bond (1 hour cure) for steel, stone, concrete, wood or other surfaces where holes are not desired.

B. Or approved equal.

EXECUTION

3.01 EXAMINATION

A. Examine installation area. Notify architect of detrimental work conditions.

B. Do not proceed until conditions are corrected.

3.02 SURFACE PREPARATION

A. Ledges and mounting surfaces shall be cleaned with a combination of Bird Barrier's cleaning products, Dissolve-It, Disinfect-It or Absorb-It when applicable . The surface should then be dry and free of peeling paint, rust, bird droppings or other debris. Bird droppings shall be removed in a safe manner; large quantities shall be removed and disposed of by reputable waste removal companies.

B. Remove or repair articles that may damage the bird barrier after installation, such as tree limbs, brush, and loose parts of the building.

3.03 INSTALLATION

A. Installing bird barriers on surfaces not able to be drilled using Bird Barrier Bond. Apply 4-5 quarter sized dabs of Bird Barrier Bond to the base of the 3-foot piece of bird barrier and apply

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to surface to be protected. Follow recommended installation instructions, which are supplied by the manufacturer. The bird barrier shall overhang the ledge by 1/4", and the tips can be up to 2.5" from the back wall of the ledge.

B. Bird barrier shall cover the complete ledge, not just the outer perimeter. Bird barrier shall extend to each corner. It is acceptable to leave 2.5" between rows (measured from the tip of the rods) of Dura-Spike narrow or wide.

C. Bird barrier shall be installed straight, or must follow the contours of the architecture perfectly. Uneven spacing of the bird barrier will result in an unattractive installation, and space left between ends of bird barrier will present a landing opportunity for the deterred birds. Refer to Manufacturer's installation literature for details.

3.04 INSPECTION

A. Visually inspect bird barrier for poor adherence to mounting surfaces, or other problems related to poor installation or surface preparation.

B. Repair as necessary immediately.

3.05 OM-OPERATION, MAINTENANCE

A. If the product is installed per Manufacturer's specifications, the product should be virtually maintenance-free. Debris which is not released by the product should be removed by maintenance people on a regular basis.

END OF SECTION

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SECTION 10 40 00

SIGNS, GRAPHICS AND SUPPORTS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Furnish and install traffic and graphic signs including all necessary incidental items at the locations shown and in accordance with the details indicated on the drawings and specified herein.

B. The extent of each type of sign is shown on the drawings and includes the following:
   1. Reflective traffic and directional signs with silk-screened text.
   2. Painted graphic signs with reflective letters and numbers.
   3. Clearance bar with painted finish.

1.2 QUALITY ASSURANCE

A. Manufacturer's Instructions:
   The assembly, erection, and installation of each type of sign or graphic shall be accomplished in strict accordance with signage manufacturer's instructions.

B. Electrical service and connections for illuminated signs are specified in Division 26. Provide lighting fixtures and electrical components which are UL-labeled and listed.

1.3 SUBMITTALS

A. Manufacturer's Data:
   Submit copies of manufacturer's specifications, anchor details, and installation instruction for products used in signs and graphics.

B. Shop Drawings:
   Submit shop drawings indicating dimensions and layout of signs and graphics. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items.

C. Samples:
   For each type of finish material specified, submit two samples of color and finish of exposed materials and accessories required. Architects review of samples will be for color and texture only.

1.4 JOB CONDITIONS

A. Examine premises and site to determine conditions affecting this work. No representation is made that all conditions are indicated on the drawings. Take field measurements where necessary to assure proper fit of components.

B. Check locations of signs with actual field conditions to assure that signs are not obstructed from view by structural or other elements for the purpose they are intended to serve. Advise Architect of any difficulties prior to installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Sign Blanks: Alloy and temper recommended by aluminum producer or finisher for type of use and finish indicated, and with not less than the strength and durability properties specified in ASTM B-209

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for 5005-H15.
1. Minimum thickness: 0.125 inches thick for traffic signs, 0.080 inches thick for graphic signs.

B. Aluminum Sheet: Alloy and temper recommended by aluminum producer or finisher for type of use and finish indicated, and with not less than the strength and durability properties specified in ASTM B-209 for 5005-H15.

C. Aluminum Extrusions: Alloy and temper recommended by aluminum producer or finisher for type of use and finish indicated, and with not less than the strength and durability properties specified in ASTM B-221 for 6063-T5.

D. Reflective Sheeting and Letters: Equal to 3M Company "Scotchlite" reflective sheeting engineer grade, Series, 3200. Colors as indicated on the drawings.

E. Paint Finish: Acrylic Polyurethane paint system with epoxy primer as manufactured by Mattews Paint Company or approved equal.

F. Typeface Standards: The standard typefaces for use throughout the signage system, unless otherwise specified in the drawings, shall be Helvetica Medium.

G. Anchors and Fasteners:
1. General: aluminum, non-magnetic stainless steel or other non-corrosive metal fasteners which are compatible with the items being fastened. Use concealed fasteners wherever possible, and tamper-proof fasteners on exposed surfaces with finish to match the item fastened.
2. Concrete inserts: threaded or wedge type, galvanized ferrous castings, either malleable iron ASTM A47-77 or cast steel ASTM A27-77. Provide bolts, washers, and shims as required; hot-dip galvanized, ASTM A153-54.

2.2 FABRICATION

A. General: The fabrication of aluminum sign blanks including cutting to size and shape and the punching of mounting holes shall be completed prior to metal degreasing and the application of reflective sheeting or painting. Aluminum sign blanks shall be free of buckles, warps, dents, cockles, burrs and defects resulting from fabrication.

B. Traffic Signs: Non-reflective copy shall be applied by the silkscreen process in a manner specified by the reflective sheeting manufacturer. The silk screening of all copy, on encapsulated lens reflective sheeting shall be accomplished prior to the application of the reflective sheeting to the finished aluminum sign blank. Encapsulated lens reflective sheeting shall be of the pressure sensitive adhesive type and shall be applied in a manner specified by the reflective sheeting manufacturer.
1. Silk screening shall be of the highest quality, with sharp lines; no sawtooths or uneven ink coverage. Screens shall be photographically produced.

C. Graphic Signs (Floor designation): Prepare aluminum surface by removing all grease and dirt and applying a phosphate activated metal pretreatment.
1. Apply one coat of an epoxy primer and two coats of the acrylic polyurethane top coat in accordance with the paint manufacturer’s instructions.
2. Apply die-cut pressure sensitive letters to well cured paint surface. Properly align letters and furbish to avoid air bubbles and peeling.

D. Headache Bar: Suspended PVC tube of size shown on drawings, with end caps. Clearance copy to be typeface, white reflective pressure-sensitive vinyl, equal to 3M-3290 applied over painted finish. Suspension rods, links and fittings to be No. 4 satin finish stainless steel.

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PART 3 - EXECUTION

3.1 GENERAL

A. Signs shall be free from sharp edges, burrs and other defects. Sawed edges shall be smooth and properly finishes.

B. Exposed sign and graphic surfaces shall be free of glue, fingerprints, dirt, grease or any other imperfections upon completion of installation.

3.2 INSTALLATION

A. Provide anchorage devices and fasteners where necessary for securing signs; including threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors as required.

B. Locate sign units and accessories where shown or scheduled, using mounting methods of type described and in compliance with manufacturer's instructions, unless otherwise indicated.

C. Install sign units level, plumb and at height indicated, with sign surfaces free from distortion or other defects of appearance.

D. All signs and supports mounted on concrete shall have faying surfaces coated to prevent corrosion due to cathodic action.

E. Touch up of finish surfaces damaged during installation shall be done with materials furnished by manufacturer and used according to direction from manufacturer.

3.3 CLEANING AND PROTECTION

A. Remove any excess adhesives or other surface blemishes. Restore or replace signs damaged during installation, as directed by the Architect.

B. Provide all procedures required for protection of installed signs from damage or deterioration until acceptance of the work.

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SECTION 10 44 00
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Accessories.

1.02 REFERENCE STANDARDS

A. FM (AG) - FM Approval Guide; current edition.

B. NFPA 10 - Standard for Portable Fire Extinguishers; 2022.

C. UL (DIR) - Online Certifications Directory; Current Edition.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, 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.

1.04 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: 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: 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 01 60 00 - 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. Class: A:B:C type.
   2. Size: 5 pound.
   3. Finish: Baked polyester powder coat, red color.
   4. Temperature range: Minus 40 degrees F to 120 degrees F.

2.03 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

B. Extinguisher Theft Alarm: Battery operated alarm, 10 second delay for disarming, activated by opening cabinet door.

C. Lettering: “FIRE EXTINGUISHER” decal, or vinyl self-adhering, prespaced black lettering in accordance with authorities having jurisdiction (AHJ).

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D. Floor Signs:
   1. Floor Sign: 17-1/2 inch diameter vinyl sign with "DO NOT BLOCK FIRE EXTINGUISHER", directional arrow, and fire extinguisher icon.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure rigidly in place.

3.03 MAINTENANCE

A. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

END OF SECTION

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SECTION 11 12 01

PARKING & REVENUE CONTROL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. The extent of work included in this Section is shown on the Drawings and is specified as follows:

1. Fully operating Parking and Revenue Control System (PRCS).

B. Conduit for the Parking and Revenue Control System is shown on the Electrical Drawings:

1. All wiring for the system (power, control, communication, etc.) will be provided and installed under this contract.
2. Any conduit not shown on the Electrical Drawings which is required for a complete system, will be provided under this contract. If additional conduit is required, the conduit may be installed exposed if it is impractical to conceal it in the structure.

1.2 SYSTEM DESCRIPTION

A. General: The parking facility Ground Level accommodates permit parkers only. The parkers will enter and exit by activating an entry or exit card reader by the use of an encoded card. The encoded cards will be issued to individuals who are authorized to use the facility. The public area (Levels 1-3) accommodates both transient and permit parkers. The transient parkers will be issued a token upon entry and will surrender the token upon exit. The permit parkers will enter and exit by activating an entry or exit card reader by the use of an encoded card. The encoded cards will be issued to individuals who are authorized to use the facility.

B. The facility provides a total of approximately 97 secured parking spaces, and 247 public parking spaces.

C. Description of Lanes:
1. Secured Area Entrance Lanes:
Permit Only - 1 at Ground Level (West Elevation, Center Bay)

2. Secured Area Exit Lanes:
Permit Only - 1 at Ground Level (West Elevation, Center Bay)

3. Secured Area Entrance Lanes:
Public / Permit - 1 at Ground Level (West Elevation, South Bay)

4. Secured Area Exit Lanes:
Public / Permit - 1 at Ground Level (West Elevation, South Bay)

D. Operation:

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1. Secured Area Entrance Lane - Permit Parkers

    a. The entering vehicle will be automatically detected as it passes over the inductive loop in the pavement and card reader will be activated.
    b. The patron will insert the card into the card reader.
    c. When the card is inserted into the card reader, the permit card monitoring equipment will check the card number for validity and the entry/exit sequence for an anti-passback violation.
    d. If the card is valid and the entry/exit sequence is correct, the high-speed overhead door will be activated and will rise to allow passage of the vehicle into the facility.
    e. When the vehicle passes over the inductive loop, the high-speed overhead door will close and the entry lane equipment will reset to repeat the operation for the next vehicle.
    f. If the card fails validity or anti-passback checks, an alarm will be triggered in the Manager's Office and the computer will print an "invalid attempt" statement indicating card reader location, user I.D. number and type of invalid access. The facility manager will personally contact the permit holder via the intercom system and take the necessary steps to correct the situation.

2. Secured Area Exit Lanes - Permit Parkers

    a. The exiting vehicle will be automatically detected as it passes over the inductive loop in the pavement and the card reader will be activated.
    b. The patron will insert the card into the card reader.
    c. When the card is inserted in the card reader, the permit card monitoring system will check the card number for validity and the entry/exit sequence for an anti-passback violation.
    d. If the card is valid and the entry/exit sequence is correct, the high-speed overhead door will be activated and will rise to allow passage of the vehicle from the facility.
    e. When the vehicle passes over the gate inductive loop, the high-speed overhead door will close, and the exit lane equipment will reset to repeat the operation for the next vehicle.
    f. If the card fails validity or anti-passback checks, an alarm will be triggered in the manager's office and the computer will print an "invalid attempt" statement indicating card reader location, user I.D. number and type of invalid access. The facility manager will personally contact the permit holder via the intercom system and take the necessary steps to correct the situation.

3. Entrance Lane - Transient (Public) Parkers

    a. The entering vehicle will be automatically detected as it passes over the inductive loop in the pavement and the ticket dispenser will be activated.
    b. The entry terminal ticket dispenser will issue one (1) and only one token to each patron when the patron pushes the token issue button.
    c. When the patron takes the token, the entry gate will be activated and the gate arm will rise to allow the vehicle passage into the parking area.

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d. When the vehicle passes over the gate inductive loop, the gate will close, and the lane will reset to repeat the operation for the next vehicle.
e. If a vehicle does not enter the parking area after obtaining a ticket, the entrance gate will return to the down position within ten (10) seconds. The entry lane equipment will reset to issue a token or accept a permit parker card from the next patron.

4. Entrance Lane - Permit (Monthly) Parkers

a. The entering vehicle will be automatically detected as it passes over the inductive loop in the pavement and card reader will be activated.
b. When the reader is activated, the permit control tag monitoring equipment will check the card number for validity and the entry/exit sequence for an anti-passback violation.
c. If the tag is valid and the entry/exit sequence is correct, the gate will be activated and the gate arm will rise to allow passage of the vehicle into the facility.
d. Once the gate arm has been raised by the entry card reader, the ticket dispenser will not issue a ticket.
e. When the vehicle passes over the gate inductive loop, the gate will close and the entry lane equipment will reset to repeat the operation for the next succeeding vehicle.
f. If the card fails validity or anti-passback checks, an alarm will be triggered in the manager's office and the computer will print an "invalid attempt" statement indicating card reader location, user I.D. number and type of invalid access. The facility manager will personally contact the permit holder via the intercom system and take the necessary steps to correct the situation.

5. Exit Lanes - Transient (Public) Parkers

a. The exiting vehicle will be automatically detected as it passes over the front inductive loop.
b. The exit terminal will audibly instruct the user to insert a token. The ticket or card is then processed by the verifier.
c. The exit verifier will not be operative if a vehicle is not present in the lane.
d. If a ticket is inserted into the machine it will verify its validity. If valid it will activate the gate arm and the vehicle will be allowed passage.
e. When the vehicle passes over the gate inductive loop, the gate will close, and the lane will reset to repeat the operation for the next vehicle.
f. An intercom will be located at all entry lanes for communication with garage manager. The manager will have the ability to activate the gate arm and direct the vehicle back into the garage via the recirculation lanes.

6. Exit Lanes - Permit (Monthly) Parkers

a. The exiting vehicle will be automatically detected as it passes over the inductive loop in the pavement and the smart pass reader will be activated.
b. When the reader is activated, the permit control tag monitoring system will check the tag for validity and the entry/exit sequence for an anti-passback violation.

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c. If the tag is valid and the entry/exit sequence is correct, the gate will be activated and the gate arm will rise to allow passage of the vehicle from the facility. If the coiling grille is in the closed position, the coiling grille will also rise to allow passage of the vehicle from the facility.
d. When the vehicle passes over the gate inductive loop, the gate and/or the coiling grille will close, and the exit lane equipment will reset to repeat the operation for the next vehicle.
e. If the tag fails validity or anti-passback checks, an alarm will be triggered in the manager's office and the computer will print an "invalid attempt" statement indicating card reader location, user I.D. number and type of invalid access.

7. Controls: At each entry and exit location, card and/or fee computer systems will be integrated with a central microcomputer control system.

8. Monitor: The entrance and exit lane parking equipment will be monitored by a status scanner located in the Manager's Office which will identify the status of the equipment such as gates, and card readers.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's product data, specifications, installation, and maintenance instructions for each type of parking equipment required.

1. Provide templates for anchor bolts and other items encased in concrete or below finished surfaces in sufficient time so as not to delay the Work.
2. Documentation: The Contractor shall supply three sets of wiring diagrams and maintenance manuals for each of the major components of the system, as well as the entire as-built system wiring diagrams. The Contractor will supply operating manuals for all equipment in the entire system. A minimum of three manuals per component shall be provided.

1.4 QUALITY ASSURANCE

A. Supplier shall have at least 5 years of experience in the parking control field and maintain a stock of replacement parts for the equipment specified. The equipment supplier shall have a service outlet within 100 miles of the project.

1. Contractor shall supply list of anticipated time to replace any piece of equipment.

B. In the event the parking control system manufacturer is not the installer, then the installer shall be approved in writing by the system manufacturer.

1. Said installer shall have previously worked successfully with the equipment manufacturer and shall submit names, locations, contacts and telephone numbers for the five most recently installed, completed projects.

C. The equipment shall be designed, fabricated and installed to operate effectively under the climate and exposure conditions of the installation site and of the individual site requirements of each exit/entrance lane.

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1. All equipment shall be new. Rebuilt, reconditioned or used parts are not acceptable.

D. All electrical equipment shall be approved by Underwriters Laboratories, Inc. (UL) where such approval is standard in the industry.

1.5 DELIVERY, STORAGE, AND HANDLING

A. The equipment shall be delivered to the site packaged to prevent damage and marked for easy identification of each component.

B. The equipment shall be stored in a clean, dry location. Damaged equipment shall be replaced at no cost to the Owner.

1.6 WARRANTY

A. All equipment is to be covered by a manufacturer's warranty covering all parts and labor for a two year period, excluding misuse or vandalism.

B. All warranties commence when the respective equipment is totally operational and is accepted in writing as such by the Owner.

C. Local service shall be provided to maintain all equipment and systems during the warranty period with regularly scheduled maintenance.

D. In addition to scheduled maintenance, in the case of any malfunction, the response time for repair shall be limited to four (4) hours and no equipment, system or component shall be left non-operable after the next business day following notification by the Owner.

E. Include, as an option, the cost to extend warranty for a second and third year.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Parking control system as described herein shall be as manufactured and/or supplied by:

1. Amano McGann
2. CTR Systems
3. Skidata
4. TIBA Parking Systems
5. DESIGNA
6. Or approved equal

B. Intercoms - acceptable manufacturers:

1. Aiphone
2. DuKane
3. Bogen

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4. Rauland Borg
5. Or approved equal

2.2 EQUIPMENT LIST

A. The following equipment list consists of basic system components. Auxiliary items required for the proper functioning of the system, whether mentioned or not, shall include but not be limited to: heaters, coolers, wiring, transformers, relays, pedestals, etc. It is the manufacturer's responsibility to provide every component necessary for a complete functional system.

B. Equipment should be located as shown on the drawings. Adjustments may be necessary due to field conditions and may be permitted following consultation with the Architect.

2.3 SYSTEM CONFIGURATION

A. The system lanes configuration is indicated on the drawings.

B. Manager's Office

1. (1) Access Control System including Central Computer, Printer, Multiplexer Port Controllers, Constant Voltage Transformer
2. (1) Master Intercom Station

2.4 AUTOMATIC PARKING GATES

A. General: Provide Magnetic Parking Pro or Approved Equal.

B. Cabinet: Welded construction of 10 gauge aluminum with mounting holes accessible from inside the cabinet. Gasketed door with flush mount T-handle lock; provide two keys. Finish cabinet with two coats of baked on enamel paint in manufacturers standard colors.

C. Gate Arm: Wood construction with breakaway gate arm flange for straight arms. Provide folding gate arm if required by low height clearance. Finish in diagonal stripes of black and white enamel paint. Height of arm approximately 36 inches in the down position.

D. Mechanical: Gate motor minimum 1/3 HP, heavy duty, high output torque, 115 VAC, single phase, instant reversing with duty cycle match to a load in excess of 10,000 operations per day. Connect to gate with double V-belts to a heavy-duty, 60 to 1 single reduction speed reducer. Provide adjustable cams for adjustment of gate arm travel. Provide feature that will automatically reverse gate direction, should any object be struck in its downward motion.

E. Controller: Controller shall contain logic for one-way lanes, two-way lanes, operations with automatic and push button ticket dispensers, card readers, detector loops and be easily field programmable through the use of easily accessible DIP type switches or by keypad buttons. All gate logic controllers shall be removable and interchangeable with the logic controllers of all other gates on this project. Provide separate gate open inputs for transient and employee patrons. Provide output signals for the following counts: Total monthly, total transient, total vehicle and total illegal vehicles (see illegal

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vehicle counts below). These counts shall be taken directly from the control logic and not from detector loops. Provide a momentary contact any time a car illegally passes through the lane by tailgating the previous automobile. Provide two vehicle detectors inside the control logic. The detectors shall incorporate a tailgate recognition system capable of resolving two automobiles within six inches of each other on a standard 2-1/2 foot by 6 foot detector loop. The logic controller shall send and receive information from the computer located in the manager's office.

F. Electrical: All electrical control components for the auto gate shall be supplied in a factory sealed, plug-in controller. Supply a cadmium plated connection box for all high voltage wiring with a 115 VAC grounded convenience outlet, heater control switch with preset thermostat and an on-off switch for the power to the auto gate.

1. All external inputs shall be low voltage control and provide a connection panel containing at least 16 spare terminals for use by the installing contractor.

2.5 CARD READER

A. General: Provide Amano McGann Magstripe Reader Access Terminal, or approved equal.

B. Enclosure: The Card Reader shall be pedestal mounted as indicated on the drawings in an all steel enclosure with an access door on the front of the enclosure. Supply a high security tubular key lock with two keys for the access door. Paint enclosure and pedestal with two coats of polyurethane-polanevimyl textured enamel painting in manufacturers standard color.

C. Electrical: The Card Readers primary power shall be 115 VAC Secondary Power shall be 24 VAC (24 VDC) or less. The Card Reader shall read encoded information on a mag-stripe card.

D. The Card Reader shall have the following features:

1. Card memory of at least 5,000 cards.
2. One primary output at 151 VAC/24 VDC at 5 Amp., N.O. and N.C.
3. One secondary output at 115 VAC/24 VDC at 1 Amp., N.O.
4. All programmable data shall be on EEROM, permanent data retention without power.
5. Communications to the computer shall be on two twisted pair, #20 awg stranded and an 18 awg standard wire. This cable shall be common to all other communicating devices in the parking facility.
6. Provide one master 24 hour level and 5 time programmable levels for time zones.
7. Provide a fourteen day battery back-up for communications memory buffer and time clock.
8. Provide a minimum of six inputs into the logic of the reader for data messages to the computer.
9. Provide communications to the IBM at a baud rate of 9600.
10. Void a card or group of cards out of memory.
11. Make valid a card or group of cards in memory.
12. Reader shall contain built-in self diagnostics and circuit indicator status lights.

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13. Reader shall provide relay access granted/denied messages and alarm status messages.
14. Reader shall buffer 255 messages in memory to assure that information will not be lost if the reader is in an off-line mode and not communicating with the computer.
15. Provide the following programmable passback features:
    a. Full Anti-passback will not allow a card to be used in the same mode (entry or exit) two times in a row and the gate will not open.
    b. Passive Anti-passback will allow a card to be used more than once in the same mode (entry or exit) and occurred and will allow access in or out.
    c. Sync Mode will automatically operate every time Full or Passive anti-passback is programmed. The Sync Mode will allow all cards to be used one time in an entry or exit operation before the passback mode takes effect.
    d. Timed Anti-passback will allow a card to be used only once in that reader for a programmable time from 1-15 minutes.
    Note: If communications is lost to the Port Controller, the Card Reader shall automatically switch from full or passive anti-passback to timed anti-passback.
16. Provide all necessary software and hardware to communicate with the central computer.

2.6 ENTRY AND EXIT TERMINAL

A. General: Provide Opus 2000 McGann Entry Terminal and Opus 4000 McGann Exit Terminal or Approved Equal.

B. Cabinet: Welded construction of 10 gauge aluminum with mounting holes accessible from inside the cabinet. Gasketed access doors for serviceability and loading of tickets with flush-mount T-handle locks; provide two keys per lock. Finish cabinet with two coats of polyurethane-polane vinyl texture enamel in manufacturers standard colors.

    1. Provide removable token dispenser and tray, to be located within the cabinet, with a capacity for at least 400 tokens.

C. Mechanical: The ticket dispensing mechanism shall be of quality constructed material with rust protective coating on exposed parts. A self-sharpening ticket cutter shall be supplied. The dispensing mechanism shall be removable as a unit, and all electrical connections shall be keyed plug. This unit shall use perforated fanfold tickets measuring 2" x 4". The magazine shall be of the removable type with a capacity of not less than 5,000 Toledo (or equal) tickets. At the moment a ticket is issued, it shall be imprinted with the hour, minute, month and date of issuance. The time recorder shall be constructed to allow for easy replacement of the time-keeping mechanism as a unit.

D. Electrical: On the approach side of the cabinet a backlit liquid crystal display shall be provided an illuminated clock face shall be readily visible to the customer as they take a ticket. TICKET issuance shall cause a buzzer to sound simultaneously and the ticket to be presented at a height and location permitting easy removal from throat of the machine by the incoming motorist. The time clock shall be driven by a synchronous motor mechanism for independent operation. Supply a cadmium plated connection box for all external connections and provide a 115 V.A.C. grounded convenience

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outlet, 500 watt heater, heater on/off switch, preset heater thermostat, dispense on/of power switch and clock on/off switch.

E. Entrance Lane Lockout Controller: The entrance lane equipment shall have logic circuitry which will preclude a customer from both a.) changing his card status from "out" to "in", and b.) obtaining a ticket.

2.7 FULL SIGN

A. Neon sign with 4 inch high letters in a weatherproof housing with built in sun shield. Finish white baked on enamel. Protect neon tube with high impact plexiglass lens. Mount sign on 42 inch high pedestal.

B. Full sign shall be capable of being activated either manually or automatically from the facility management software system. When the sign is activated, the access equipment may be deactivated to prevent patrons from gaining access.

2.8 INTERCOM SYSTEM

A. Intercoms will be located at card readers and as indicated in the "System Configuration" list. Intercom stations will be located in the Telecom room.

B. Intercoms at the card reader and ticket dispenser stations and pay-on-foot station shall include "Press for Assistance" signs.

C. Intercoms located in the cashier booths shall be capable of two-way communication with intercoms in all other cashier booths and manager's office.

D. Intercom master station located in the manager's office shall include call alert audio and light signal feature.

2.9 CENTRAL COMPUTER/PRINTER AND SOFTWARE

A. The Computer shall be a 486 DX66 with 8 MEGABYTES of RAM and a 520 MEGABYTE HARD DISK. Supply a 14" COLOR MONITOR. The printer shall be a LAZER QUALITY.

B. The SOFTWARE shall have the following features:

1. Shall communicate with all Auto Gates, Auto Rolling Grilles, Fee Computers Card Readers, and Pay-on-Foot Station.
2. Shall have a Main Menu to include:

    a. SYSTEM CONFIGURATION MENU
    b. SYSTEM MONITOR MENU
    c. SYSTEM COMMAND MENU
    d. SYSTEM PROGRAMMING MENU
    e. SYSTEM REPORT MENU
    f. SYSTEM DATA MANAGER MENU

C. System Configuration Menu: The system Configuration Menu shall be as follows:

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1. Log On: Provide up to ten user programmable passwords to gain access into the Main Menu and Sub-Menus.
2. Set Passwords: Each password can be programmed into any level of the Main Menu or Sub-Menus. Provide name insertion with the password of each person to be programmed.
3. Set Message Filters: Provide message filters for the information that is being received by the IBM. These filters provide the end user a means of controlling incoming message data from each Card Reader (access granted and egress) and Fee Computer (transaction audit trail). Programming shall provide the following filter options to the end user:

   a. Send data to Hard Disk (store).
   b. Send data to Printer.
   c. Send data to Display.

   End user may program any combination of the above filter options.

4. Set Gate Count System: Provide the following sub-menu's for count configuration to all lanes, areas and lots:

   a. Set Lanes: End user will be able to define which auto gates are assigned to a particular lot. Provide a lane assignment menu for the end user to number each auto gate by lane.
   b. Set Areas: End user will be able to define which areas are assigned to a particular lot. Provide an area assignment menu for the end user to identify the areas by number that are assigned to each lot.
   c. Set Lots: end user will be able to define the name of each lot, the lane number, if the lane is one-way or reversing and if the counting by that lane is forward exit, forward entrance or reversing. This menu shall also be user programmable and display the total capacity of the lot, total monthly reserved spaces, total available spaces, total monthlies currently in the lot, total transients currently in the lot, total illegal entries into the lot and total illegal exits out of the lot.

5. Set Reader Count System: Provide an auto-Sync feature to automatically reset ALL Reader Differential Counters at a pre-programmed time. The end user shall program the time of day the auto-Sync feature shall go into effect. The Differential Counters shall then reset to the number of spaces that were originally programmed.

   Provide the end user the means of programming the following:

   a. Provide six differential counters per lot to display the total monthly vehicles that can be in the lot by card access level at one time. The end user shall be able to program the maximum number of vehicles for each of the six levels. Provide this feature for seven additional jobs.

6. Set Time and Date: Provide user setting of current time and date.
7. Set Baud Rate: Provide a user programmable option to change the baud rate for information that is being received by the computer.

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8. Quit System: Provide a means for the end user to quit system and return to DOS.

D. System Monitor Menu: The System Monitor Menu shall allow the end user to monitor the following:

1. Monitor All Lanes: Provide a matrix that will display ALL lanes and will identify the following activity:
   a. Lot number.
   b. Lane number.
   c. Vehicle in lane.
   d. Overhead door up.
   e. Door in over-ride (locked in up position).
   f. Monthly patrons disabled.
   g. Lane on-line or off-line.
   h. Operating mode of lane.

2. Monitor One Lane Only: Provide an option by the end user to designate the Port Controller and Gate Number to be monitored.
   Provide surveillance to show the activity in the lane as follows:
   a. Presence B (Vehicle over B loop).
   b. Presence A (Vehicle over A loop).
   c. Overhead door up.
   d. Frequency of B loop.
   e. Frequency of A loop.
   f. Sensitivity of B loop.
   g. Sensitivity of A loop.
   h. Total A input gate open counts.
   i. Total B input gate open counts.
   j. Total remote input gate open counts.
   k. Monthly patrons disabled.
   l. Total illegal vehicles (tailgate).
   m. Overhead door in over-ride (door locked in up position.)
   n. Safety edge (rebound) feature is on or off.
3. One Lot Counts: Provide a means for the end user to monitor the following counts.

   a. Total vehicles.
   b. Total monthlies.
   c. Total vacancy.
   d. Total monthly reserve.
   e. Illegal entries.
   f. Illegal exits.
   g. Total vacancies for each area in every lot. Provide a minimum of ten areas per lot.

4. Monitor Monthly Facility Counts: Provide counters to display the total card users by level (total of 6) that park in the facility.
5. Monitor Monthly Peak Counts: Provide counters to display the total card users peak counts by level. Record these counts by hour and store them in a daily/monthly peak counts file.

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Note: Display on the monitor at all times the number of vacancies in the facility by level.

E. System Command Menu: The System Command Menu shall have the following Sub-Menus and shall allow the user to send these commands to one lane or all lanes on one port or all lanes on all ports:

1. Port Command Menu: The term Port Controller is used to identify a hardware and software device in this system. The Port controller will control all modes of anti-passback (except timed anti-passback) to the Card Readers.

   a. The Port Controller shall contain a buffer to hold incoming information that cannot be accepted by the computer at the time the information is being sent. The buffer shall hold at least 255 messages. Each Port controller shall maintain the current time and date. Command features shall override any differential counter control regardless of their present state.
   b. Provide the following commands:
      1) Set Anti-Passback off.
      2) Set Anti-Passback on.
      3) Set Passive Anti-Passback on.
      4) Set Auto Re-Sync Time: the end user shall program a time when the anti-passback will resync automatically every day.
      5) Set Port Controller Time.
      6) Set Port Controller Date.

2. Gate Command Menu: The Gate Command Menu will have the following features:
   a. Disable Monthly Card Readers.
   b. Enable Monthly Card Readers.
   c. Turn Facility Full Signs on.
   d. Turn Facility Full Signs off.
   e. Tune Loop Detectors.
   f. Remote Raise Overhead Door: This command will raise the overhead door and the door will close after the vehicle enters the facility.

3. Reader Command Menu: The Gate Command Menu shall have the following features:
   a. Validate a Single Card I.D.
   b. Validate a Group of Card I.D.'s.
   c. Void a Single Card I.D.
   d. Void a Group of Card I.D.'s.
   e. Remote Raise Overhead Door.
   f. Check Status of a Single I.D.
   g. Set Reader Time.
   h. Set Reader Date.

F. System Programming Menu: The System Programming Menu shall allow the user to program any card reader auto gate or fee computer directly from the IBM PC. Provide a means for the end user to create a program, save the program and/or send the

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program to a group of external devices or an individual device. Provide the following sub-menu's features:

1. Program Ports Menu: The Port Programming Menu shall have the following features:
   a. Zone 3 I.D.'s: Provide a second and third area on the campus where the card user may use their card again. These Controlled Areas (zones 2 & 3) will have at least
   b. One reader in and one reader out. Provide a means of entering an I.D. number of a group of I.D. numbers (as valid or invalid cards) for multiple zones.

2. Program Reader Menu: The Reader Programming Menu will have the following features:
   a. Program Level Codes: Provide programming for 8 level codes per reader. Level Code One shall be a 24-hour access level. Level codes 2-6 shall be user programmable to operate at different times of the day and different days of the week.
   b. Program Reader Options: Provide programming by the end user for the following features:
      1) Reader open sign from 1 to 33 seconds.
      2) Timed anti-passback from 1 to 15 minutes.
      3) Auto unlock of door or gate controlled by each card reader.
      4) Provide a means of programming this feature by time of day and day of week.
   c. Program Valid I.D. Numbers: Provide a means of programming one card or a group of cards into a one card reader, a group of card readers or all card readers.
   d. Card Log: Provide a user programmable card log that will include the following fields:
      1) I.D. Number
      2) Status of Card (unused, issued, lost or delinquent)
      3) Last Name
      4) First Name
      5) Middle Initial
      6) Date last revised and by whom.
      7) Address
      8) City
      9) State
      10) Zip Code
      11) Home Telephone Number
      12) Business Telephone Number
      13) License Plate #1
      14) License Plate #2
      15) Reader location that this I.D. number can be used in.

   e. Change I.D. Status: Provide a means for the end user to display and change the Status of the following fields:
      1) Account Number
      2) Customer's Last Name
      3) Customer's First Name

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4) Status (issued, lost, unused or delinquent)

f. Provide the user the means to search the card log by entering all or the first several characters of the last name, account number, license number, I.D. number or card status. The user may search from the start of the card log, or continue from a certain spot.

G. System Report Menu: The System Report Menu shall allow the user to obtain reports from the device (port controllers, readers and fee computers) or from the IBM hard disk. Provide the following sub-menus and features:

1. Port Report Menu: The Port Report Menu shall have the following features:
   a. Active devices: Provide a listing of all active ports on-line to the computer.
   b. In/Out Status Zone 1: Provide a listing of all card I.D. numbers and if they are in the facility or out of the facility. The facility shall be called Zone 1 on the report.
   c. In/Out Status Zones 2 & 3: Provide a listing of all card I.D. numbers and if they are in or out of the secondary area(s).

2. Reader Report Menu: The Reader report Menu shall have the following features:
   a. Time Zone: Provide a list of all time zones (by reader) listing time of day and day of week each group of cards are active in the reader. Provide this listing for all 8 time zones per reader.
   b. I.D. Status: Provide a list of all valid I.D. numbers (by reader) that are programmed in the system.
   c. Provide the user a means of obtaining the above reports a and b directly from each reader and/or view the information from the hard disk.

3. Auditor Report Menu: The Auditor Report Menu shall have the following features:
   a. Time Card
   b. User Group Report
   c. Entry/Exit Statistics
   d. Lane Report
   e. Length of Stay Statistics
   f. Provide the user a means of obtaining the above reports a-e directly from each fee computer and/or view the information from hard disk.

H. System Data Manager Menu: The System Data Manager shall allow the user to retrieve the stored information from the computer's hard disk. The system shall record all activity, card usage, fee computer reports and fee computer journal duplication and cashier key strokes that occur during a complete or incomplete transaction. This information shall be stored by time and date the information occurred. When the information is retrieved, the user may have the information displayed or printed-out. Supply the following sub-menus and features:

1. Reports Menu: The Reports Menu shall have a Reports Generator with four sub-menus as follows:

   a. System Generated Files: The system generated files will allow the user to retrieve the following information including time and date of occurrence.

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1) Retrieve information from one or more system. (User may load information from other like system and retrieve like information from one or more parking decks).
2) Retrieve information from one or more floppy or disk drives.
3) Retrieve information by port number.
4) Retrieve information by device number
5) Retrieve information by device type.
6) Retrieve information by card I.D. number or a group of I.D. numbers.
7) And/or by the following message strings:

    a) Computer start-ups
    b) Computer shut-downs
    c) Device power failed-memory ok or memory lost
    d) Port power failed-memory ok or memory lost
    e) Device that went off-line or on-line
    f) Ports that went off-line or on-line
    g) Printer went off-line or on-line
    h) Log-on or log-off of computer and include person's name
    i) Alarms acknowledged and/or cleared and include person's name
    j) Disk space below limit
    k) Egress or access granted
    l) Invalid card use
    m) Pass-back violation
    n) Invalid time zone attempt
    o) No vehicle on loop when card was used
    p) Time pass-back violation
    q) Pass-back area 2 violation
    r) Over stay violation area 1
    s) Late exit area 1

I. After selecting the above fields to be found, the user shall enter the starting time and ending time, the starting date and ending date and the day of the week the information is to be found from.

    1. System Count Files: The System Count files will allow the user to retrieve peak monthly counts or peak transient counts by date and time of day. User shall have an option of either a daily or weekly report.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install equipment and accessories in accordance with manufacturer's recommendations and final shop drawings, and as specified herein.

B. Anchor Bolts: Furnish anchor bolts and other connectors required for securing equipment to in-place work.

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1. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations.

C. Detector Loops: Cut 1/4 inch x 1 1/2 inch deep slots in concrete to the configuration shown on shop drawings. Install loops in accordance with manufacturer's instructions. After testing loop wires, seal slots with manufacturer's recommended sealant.

D. Furnish and install complete power and communication wiring in compliance with manufacturer's specifications and code requirements. Obtain and pay fees for electrical permits and approvals as required by local agencies.

E. Protection: Provide final protection necessary to ensure that the equipment will be without damage or deterioration at the time of acceptance.

3.2 TESTING/ACCEPTANCE

A. All equipment is to be tested for compliance to manufacturer's performance standard upon installation. In addition, before acceptance of the complete installation, the following performance standards must be met:

1. All mechanical components must be operational without downtime for a period of ten (10) working days.
2. All electronic equipment must be operational without downtime or programming problems for a complete monthly report cycle.
3. For each downtime period of four hours or more on the mechanical equipment one working day will be added to the acceptance cycle.
4. On electrical equipment, each downtime period of eight hours or programming problem that delays the daily report cycle will add two working days to the acceptance cycle.
5. Upon completion of system testing and before beginning the acceptance cycle, three copies of the manufacturer's operations/maintenance manuals will be provided to the Owner. Manuals shall include, but not be limited to, the following:
   a. General manuals of sufficient detail to enable the Owner to operate and maintain the PRCS.
   b. Cashier's manuals describing procedures and equipment functions suitable for training cashiers (8 copies required).
   c. Operations manuals for supervisory personnel describing data collection processing and transmission systems and equipment.
   d. All maintenance manuals -- first line and preventative procedures.
   e. Software programming manuals describing each item os software in the lane equipment and all report programs.

3.3 INSTRUCTION/SERVICE

A. The Contractor shall provide operational training classes for all levels of Owner personnel. The manufacturer shall also provide technical training classes for servicing the equipment at the facility where the equipment is manufactured.

B. The Contractor shall submit a list of spare parts and maintain the necessary on-site inventory to restore the system to operation within a two-day period. Owner and Architect will approve spare parts list. Spare parts which are not disposable in nature

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shall bear the same guarantee that covers materials and workmanship of new components or equipment. Guarantee period shall not commence until spare parts are installed. Spare parts either taken from inventory or supplied from the factory shall be logged in as to date of installation in the Contractor's service log.

3.4 MAINTENANCE RECORDS

A. Contractor shall maintain accurate and up-to-date records of service calls, preventive maintenance operations and equipment failures for each component and sub-system. Records in the form of a log shall become the property of the Owner at the end of the one-year period.

B. Extension of Maintenance Contract shall be at the option of the Owner. Contractor will notify the Owner for a request to extend sixty (60) days prior to expiration of base term. Increase in cost shall be limited to the percentage increase of the cost of living for that year.

END OF SECTION

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SECTION 12 36 00
COUNTERTOPS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall-hung counters and vanity tops.

1.02 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

C. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Complete details of materials and installation.

C. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

1.04 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.

1.05 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

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
   1. Laminate Sheet: NEMA LD 3, Grade HGS, 0.048 inch nominal thickness.
      a. Manufacturers:
         1) Arborite: www.arborite.com/#sle.
         2) Formica Corporation: www.formica.com/#sle.
         3) Lamin-Art, Inc: www.laminart.com/#sle.
         4) Panolam Industries International, Inc: www.panolam.com/#sle.
         5) Wilsonart: www.wilsonart.com/#sle.
         6) Approved Equal.
      b. Finish: Matte or suede, gloss rating of 5 to 20.
      c. Surface Color and Pattern: As selected by Architect from the manufacturer's standard line.
   2. Exposed Edge Treatment: Square, substrate built up to minimum 1-1/4 inch thick; covered with matching laminate.
   3. Back and End Splashes: Same material, same construction.

2.02 ACCESSORIES

A. Fixed Top-Mounted Countertop Support Brackets:
   1. Material: Steel.
   2. Finish: Manufacturer's standard, factory-applied, textured powder coat.

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3. Color: Black.
4. Products:
   a. Centerline Brackets; Front Mounting Countertop Support: www.countertopbracket.com/#sle.
   b. Approved Equal.
   c. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 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 except where top butts against cabinet or wall.
   3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Wall-Mounted Counters: Provide brackets as indicated on drawings.
   1. Provide (4) grommits. Coordinate final locations with the Owner in the Field.

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 INSTALLATION

A. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.

B. Seal joint between back/end splashes and vertical surfaces.

3.03 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.

B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.

C. Field Joints: 1/8 inch wide, maximum.

3.04 CLEANING

A. Clean countertops surfaces thoroughly.

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 14 05 00

GENERAL REQUIREMENTS FOR CONVEYING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

Contract Documents, including but not limited to, all documents indicated in the "Table of Contents" and the Contract Drawings, apply to this work.

Reference Specification Sections:

1. Divisions 00 and 01
2. 142100 - Elevators, Electric Traction

1.2 INTENT OF THE CONTRACT DOCUMENTS

The full intent, meaning and spirit of the Specification/Contract Documents is to provide a complete and finished product.

1. The Specifications establish the quality of materials and workmanship to be performed. They are not intended to describe every step or detail in the process of the elevator installation. Procedures, craftsmanship and materials of high quality shall be employed where not specifically delineated in the Specifications.

1.3 SUMMARY

The work of this project includes all labor, supervision, materials, parts, supplies, tools, equipment, transport, permits, expenses, and all unspecified incidental items, all as required to furnish and install the vertical transportation units specified in the above referenced specification sections, all in accordance with the requirements of the Contract Documents.

The Elevator Contractor shall provide interim maintenance for certain vertical transportation units which may be placed in service prior to completion of the entire project.

The Elevator Contractor shall also provide one (1) year of continuing maintenance for all vertical transportation equipment provided hereunder, for a period of not less than twelve (12) consecutive calendar months after final inspection and acceptance of all vertical transportation equipment provided.

1. The Owner shall have the right, as indicated herein, to extend the one (1) year continuing maintenance service period for a second period of 1, 2 or 3 years.
2. The Elevator Contractor shall have the right to adjust the price, at the start of the second continuing maintenance period and each subsequent year thereafter, in accordance with the terms indicated herein.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

All material, design, clearances, definitions, construction, workmanship, and tests provided hereunder shall conform to the requirements of the most stringent applicable provisions of the following codes, standards and authorities, as adopted, interpreted and amended by the Authority Having Jurisdiction, in effect on the date of the signed Contract

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issued for this work. Reference to the Code in Division 14 specification sections includes the following referenced codes and standards.

1. Building Code, as adopted by the Authority Having Jurisdiction.
2. ASME A17.1 "Safety Code for Elevators and Escalators", as adopted by the Authority Having Jurisdiction, including all applicable local Elevator Laws, Rules and Regulations.
3. ASME A17.2 " Guide for Inspection of Elevators, Escalators and Moving Walks,", as adopted by the Authority Having Jurisdiction, including all applicable local Elevator Laws, Rules and Regulations.
4. Accessibility Guidelines and Standards as adopted by the Authority Having Jurisdiction.
5. Requirements of the Fire Marshal Having Jurisdiction.
6. National Electrical Code - ANSI/NFPA 70, as adopted by the Authority Having Jurisdiction.
7. National Fire Alarm Code - ANSI/NFPA 72, as adopted by the Authority Having Jurisdiction.
8. Installation of Sprinkler Systems - ANSI/NFPA 13, as adopted by the Authority Having Jurisdiction.
9. Life Safety Code - ASME/NFPA No. 101, as adopted by the Authority Having Jurisdiction.
10. American Welding Society (AWS) - D1.1 - Structural Welding Code - Steel.
11. National Electrical Manufacturers Association (NEMA).
12. Underwriters Laboratories Inc. (UL).

1.5 DEFINITIONS:

Where "as shown", "as indicated", "as detailed" or words of similar import are used, it shall be understood that reference to the Drawings accompanying the Specifications is made, unless otherwise stated. Where "as directed", "as required", "as authorized", "as reviewed", "as accepted" or words of similar import are used, it shall be understood that the direction, requirement, permission, authorization, review, or acceptance of the Owner's Representative, General Contractor and/or Owner is intended, unless otherwise stated.

As used in the Contract Documents, "provide" shall be understood to mean "provide complete in place", that is, "furnish, install and make operable, in a code compliant fashion".

Reference to a device or a part of the equipment applies to the number of devices or parts required to complete the installation.

Reference to the “GC” or General Contractor in this section or related sections is a reference to the “General Contractor”, as applicable.

Reference to the “Owners Representative” in this section or related sections is a reference to any party, designated by the Owner, to be the “Owner’s Representative”, such as the Architect, General Contractor, Engineer, Consultant, etc.

Reference to vertical transportation unit/s applies to elevator/s as applicable.

Defective Elevator Work: Operational or control system failures; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; the need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions constitute "Defective Elevator Work".

1.6 SUBMITTALS

Shop Drawings and Project Data:

1. All submittals and questions shall be directed through the General Contractor for distribution to the proper parties.
2. Submit for approval all calculations, layouts, shop drawings and standard cuts, as indicated herein, via the electronic submittal program for the project. This data shall be submitted for approval and approved by the Owner's Representative prior to release for fabrication.
    a. Review of these submittals, by the Owner's Representative or General Contractor, does not relieve the Elevator Contractor of the duty to meet the requirements of the Contract Documents and the applicable Codes.

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b. Any comments noted or corrections requested are for clarification of the general character of the work. Correctness of drawings, measurements, quantities, conformity with Contract Documents, techniques of construction and coordination with other trades shall remain the complete responsibility of the Elevator Contractor.
c. Acknowledge and/or respond to drawing markup within seven (7) days of return; promptly incorporate required changes due to inaccurate data or incomplete definition so that delivery and installation schedules are not affected. Revision response is not justification for delay.

3. Include the following as a part of the elevator shop drawings:
   a. Complete dimensioned layouts, drawn to scale, of each installation in plan and elevation, indicating the following, as applicable to the equipment involved:
      1) Car, car sling, platform, and car buffer/s for traction elevators.
      2) Guide rails, including bracket locations, and maximum horizontal rail forces Weight of principle elevator components for traction elevators:
      3) Counterweight for traction elevators.
      4) Traction machine for traction elevators.
      5) Location of and the force at each reaction point, where the structure supports, or is subjected to impact from the equipment provided under this contract for traction elevators.
      6) Top and bottom car clearances and the top overtravel and bottom run-by for traction elevators.
      7) Lobby elevations indicating entrances and fixture locations for traction elevators.
      8) Heat generation of individual components for traction elevators.
      9) Location of telephone or communication outlets, car light feeds, fused disconnect switch, light switch, and feeder termination at controller for traction elevators.
      10) All other information required by Code or requested by the Architect for traction elevators.
   b. Complete drawings of hoistway entrances and doors for passenger elevators showing method of operation, details of construction and method of fastening to the structural members of the building.
   c. Complete drawings of passenger car enclosures and car gates for traction elevators, showing details of construction and the location of car equipment.
   d. Complete drawings of signal and control fixtures for passenger traction elevators, showing all switches, push buttons lights, signage and all other components of each signal or control fixture and operating device.
   e. Corridor elevations, showing the location of each corridor fixture in relation to the hoistway entrance frames and the finished floor for passenger traction elevators.
   f. Complete detailed fixture drawings for passenger traction elevators showing all switches, signage, and other components of each operating device.

Product Details:

4. Submit for approval the following descriptive brochures or bulletins, including photographic representations of the following elevator equipment that is intended to be utilized on this project, as applicable to the equipment involved:
   a. Controllers for traction elevators.
   b. Traction machines for traction elevators.
   c. Door operators for traction passenger elevators.
   d. Guide shoe/roller assemblies for traction elevators.
   e. Tape readers or other leveling devices for traction elevators.

Preliminary Elevator Information:

5. Provide the following within four (4) weeks of contract award:
   a. Preliminary drawings indicating all pit dimensions and support locations, including all pit reactions and reaction locations.

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b. Identify the location of and the dead load and live load fractions of the force at each reaction point, where the structure supports, or is subjected to impact from the equipment provided under this contract.
c.
d. Electrical requirements, including power supply data sheets, indicating equipment power demand, main line and auxiliary circuit breaker or fuse sizes and other pertinent electrical data
e. Heat output data for the elevator equipment.

Samples:

6. Submit for approval the following samples, as applicable to the equipment involved:
   a. Paint and enamel finishes, as required, for color selection.
   b. If plastic laminate is indicated in the technical elevator specification, provide plastic laminate finish samples for color and material selection.
   c. If removable cab panels are indicated in the technical elevator specification, provide two 12-inch square samples of the removable cab panels, showing the method of finishing the edges and the method of panel mounting.
   d. Two 6-inch square samples of each type of finish metal to be used.

Seismic Qualification Certificates (Where required): For vertical transportation equipment, accessories, and components, from manufacturer.

7. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
8. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
9. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

Certificates and Permits: Provide copies of all inspection/acceptance certificates and operating permits as required by local governing authorities to allow normal, unrestricted use of all equipment provided under this contract.

1.7 FINAL SUBMITTALS

Wiring Diagrams:

1. Upon completion of the installation, submit 3 hard copies and 1 PDF e-copy of the wiring diagrams for the for all equipment provided hereunder. Wiring diagrams shall be submitted prior to receiving final payment. Drawings shall include all field changes and one set of diagrams shall be a reproducible master. Diagrams shall include all information needed for field troubleshooting, adjustment, repair and/or replacement of components. Include all changes and additions made to the equipment during the design and construction periods. (These diagrams are the Owner's property).
   a. Show all dispatch and motion control wiring, with the number or color code of each wire clearly marked on the diagrams, including all systems and components.
   b. Symbols shall be listed corresponding to the identify or markings on both machine room/machine space and hoistway/truss apparatus of the systems specified. Include values of all resistors, capacitors and solid-state components and test voltages on diagrams.
   c. A legend sheet shall be furnished with each set of drawings containing the following information:
      1) Name and symbol of each component.
      2)
      3) Location on drawings, drawing sheet number and area of component.
      4) Location of vertical transportation equipment related apparatus, whether in the elevator control room, machinery space, hoistway/truss or pit.
   d. In the event field modifications are found necessary during installation, the diagrams furnished shall be revised to include all such field modifications.

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Operation and Maintenance Manuals: Upon completion of the installation, submit 3 hard copies and 1 PDF e-copy of the following operation and maintenance documentation for all equipment installed under this contract, via the electronic submittal program for the project:

2. Parts Manual: Provide a parts manual, indicating all components, identifying parts by name and location, include information required for ordering. Include documentation, relative to the following components, as applicable to the equipment involved:
    a. Elevators:
        1) Hoist machine & brake where applicable.
        2) Deflector and overhead sheaves where applicable.
        3) Safety, governor and tension sheave where applicable.
        4) Buffers.
        5) Guide shoe/roller assemblies.
        6) Controller and selector, including parts information on relays, printed circuit boards, reverse phase relays, switches, lamps, electrical cables, monitors, modems, diagnostic hardware, diagnostic software and overload protection devices.
        7) Solid state drives where applicable.
        8) Passenger elevator door assemblies (where applicable), including hangers, rollers, door motor, door operator, door clutch assembly, door closers, door drive arms, related hardware, sheaves, door guides, interlocks and safety door edge where applicable.
        9) Signal equipment, including car station, hall stations, position indicators, direction indicators, fire service panel, key switches and push-button assemblies.
        10) Car top inspection station, limit switches, solid state leveling control units, leveling switches and alarm bell.
3. Description of Equipment: Provide a complete description of equipment, including basic operating features, for all equipment installed under this contract, including all apparatus in the car operating panel/s and corridor call stations.
4. Maintenance Instructions: Provide complete maintenance instructions listing regular maintenance procedures, including as built wiring diagrams for the system, methods and procedures to be used and specified tolerances to be maintained.
5. Lubrication Charts: Provide complete lubrication charts, indicating all lubricating points, frequency of lubrication, methods for application and type of lubricant recommended.
6. Microprocessor Control Documentation: Provide complete information relating to the specific type of microprocessor controls installed on this project, including but not limited to the following:
    a. Owner's information manual containing general data on each component describing maintenance, repair and adjustment.
7. Operating Instructions: Provide complete written instructions, relative to each user accessible operating device.

Upon completion of the installation, provide the Owner's Representative with all Maintenance Control Program (MCP) documentation required by ASME A17.1, 8.6.1.2 "General Maintenance Requirements", as applicable to the equipment involved.

All "as built" record drawings, wiring diagrams, parts manuals, catalogs, instructions, keys, etc., shall be submitted and approved prior to final payment.

1.8 WORK REQUIRED BY DIVISIONS OTHER THAN DIVISION 14

It is the responsibility of the GC to ensure coordination of and that the design will support the following elevator related building work:

1. Elevator hoistway, pit and machine/control rooms.
    a. Hoistway and pit walls shall be clear, plumb and shall be constructed substantially flush with variations not to exceed ½" at any point.

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b. Code compliant access to the machine/control rooms with a self-closing, self-locking machine/control rooms door, with lock keyed to Owner's Key System.
c. Elevator machine/control rooms shall be enclosed with fire barriers with a fire-resistance rating not less than the required rating of the hoistway enclosure served by the machinery. Openings shall be protected with assemblies having a fire-protection rating not less than that required for the hoistway enclosure doors.
d. Hoistway and Pit shall be clear, plumb, substantially flush hoistway with variations not to exceed ½" at any point. Hoistway walls must not project beyond the sills and frames on the shaft side.

2. Structural steel (and pockets in concrete, if required) in the overhead of the hoistway to support the elevator machine frame for the machine room-less elevators and the machine beams for conventional traction elevators, designed and located, as directed by the Elevator Contractor.
3. Sufficient building structure to support the car and counterweight guide rail brackets.
4. Installation of inserts and sleeves, furnished under this division, providing such inserts and sleeves are supplied in time for installation, during building construction.
5. For CMU construction, solid grouting of two courses above and three courses below the anchor point of all rail brackets.
6. Divider beams, mounted to the building structure, designed for the loads imposed, between adjacent elevators.
7. Grouting under sills and around passenger elevator elevator hoistway entrances after placement.
8. Rough openings, 2'-0" wider and 1'-0" higher than the clear passenger elevator hoistway entrance opening, for hoistway entrances installed in poured concrete, pre-cast concrete or CMU hoistway walls.
9. Building of passenger elevator hoistway entrance door frames into walls, at the direction of the Elevator Contractor, after placement of hoistway entrance frames and sills.
10. Building corridors shall be so lighted that the illumination at the landing sills, when an elevator is in service, shall be not less than 100 lx (10 fc).
11. Structural lintels above the passenger elevator entrance frames, designed to support the entire weight of the walls above the hoistway entrance door frames.
12. Hoisting beam/s in the machine space at the top of each machine room-less hoistways.
    a. hoisting beams shall be located and designed for lifting capacities as directed by the Elevator Contractor.
    b. The maximum lifting capacity of the beam must be stenciled on each side of the hoist beam.
13. Wall cutouts for operating and signal devices.
14. Independent air-conditioning system for each elevator machine or control room and for the machine space at the top of hoistways for machine room-less elevators, to protect against the overheating of the electrical equipment. The system shall be capable of maintaining temperatures within the range established for the elevator equipment by the elevator equipment manufacturer.
    a. Maintain code required clearances about HVAC equipment in the machine/control rooms and at the top of hoistway machine spaces.
    b. Do not install HVAC equipment, including duct work, above elevator or electrical components in the machine or control rooms or at the top of hoistway machine spaces.
15. Venting: Provide for hoistway venting of smoke and hot gases to the outer air in case of fire, in accordance with requirements of the applicable Building Code.
16. 75-degree bevels on ledges, 2" or larger, at all side or rear elevator hoistway walls without hoistway entrances.
17. Legal access to the pits, including Code compliant pit ladders.
18. Fluorescent/LED machine/control room lighting, 30-foot candle minimum at the controller and pump unit and 20-foot candle minimum at the floor, with a switch located within 18" of the strike jamb side of the access door.
    a. Lighting shall be so positioned, to prevent shadows from being cast upon major elevator or HVAC equipment.
19. Fluorescent/LED machine space lighting at the top of each machine room-less elevator hoistway in the machine space, 20-foot candle minimum at the car top, with the car in position to service the machine, along with a switch located in the hoistway, within reach of the top floor hoistway entrance.
    a. Lighting shall be so positioned, to prevent shadows from being cast upon major elevator or HVAC components.

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20. "A-B-C" classification fire extinguisher, mounted in elevator machine/control rooms near the machine/control room entrance.
21. Individually GFCI protected duplex receptacles (Minimum of 2) (20 ampere minimum) in each elevator machine and control room.
22. Individually GFCI protected duplex receptacle (20 ampere minimum) at the top of each machine room-less elevator hoistway in the machine space.
23. Two externally guarded NEMA 4 pit lights for each elevator pit, with a light switch.
    a. Locate light switch near the top rung pit access ladder, within reach of the landing.
    b. Lighting level shall be a minimum of 10 ftc for the full area of the pit floor.
24. Individually GFCI protected NEMA 4 duplex receptacle (20 ampere minimum) in each pit, 3 feet above finished floor.
25. 120-volt, single phase, 60 hertz circuits, of the appropriate amperage, located in each elevator machine/control room, arranged to serve the following:
    a. Lighting, ventilation fan and individually protected GFCI receptacles for each elevator car enclosure (Separate circuit per elevator).
        1) One fused disconnect switch, lockable in the off position, located in the elevator machine/control rooms for each elevator's car light and ventilating fan circuit.
        2) Power feeder wiring and conduit to the car lighting and ventilating fan disconnect switches, and from the car lighting and ventilating fan disconnect switches to the elevator controllers, as directed by the Elevator Contractor.
    b. Lighting for each machine or control room; lighting at the top of each machine room-less elevator hoistway.
        1) One circuit breaker in the machine or control room for its respective elevator/s for each of the circuits indicated above, including power feeder wiring and conduit to the circuit breakers and from the circuit breakers to the utilization equipment.
    c. Lighting for each elevator pit.
        1) One circuit breaker in the machine or control room for its respective elevator/s for the circuit indicated above, including power feeder wiring and conduit to the circuit breaker and from the circuit breaker to the utilization equipment.
    d. Individually protected GFCI receptacles in each of the machine or control rooms and in the machinery space at the top of each of the machine room-less elevator hoistways.
        1) One circuit breaker in the machine or control room for its respective elevator/s for each of the circuits indicated above, including power feeder wiring and conduit to the circuit breakers and from the circuit breakers to the utilization equipment.
    e. Individually protected GFCI receptacle in each elevator's pit.
        1) One circuit breaker in the machine or control room for its respective elevator/s for the circuit indicated above, including power feeder wiring and conduit to the circuit breaker and from the circuit breaker to the utilization equipment.
26. 480 volt, 3 phase, 60 hertz main line power of adequate amperage to properly operate the elevator equipment provided hereunder.

27. Properly sized externally operable, fused mainline disconnect switches (480 volt, 3 phase), with time-delay fuses, lockable in the off position, located in the machine/control rooms, adjacent to the lock jamb side of the machine/control rooms door, including mainline circuit power feeder wiring and conduit to the main line fused disconnect switch and from the mainline fused disconnect switch to the elevator controller, as directed by the Elevator Contractor.
28. Elevator related sprinklers and necessary piping, valves, fittings, etc., in accordance with requirements of Code and the Authority Having Jurisdiction.
    a. Heat detectors within 2'-0" of each elevator related sprinkler, along with all related components, supervised and wired in accordance with NFPA 72, in accordance with requirements of Code and the Authority Having Jurisdiction.

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b. Sprinklers located within 2'-0" of the pit floor shall not be provided with a heat detector, as they are not permitted to cause the power to be removed from the elevator, upon their activation, in accordance with requirements of Code and the Authority Having Jurisdiction.
c. Shunt trip devices to disconnect power to the affected elevator, upon or prior to sprinkler activation, in accordance with requirements of Code and the Authority Having Jurisdiction.

29. Product Of Combustion Sensors:
    a. Smoke detection system, that is compatible with the elevator controllers, wired, zoned and supervised in accordance with requirements of Code and the Authority Having Jurisdiction, for the activation of Firefighters' Emergency Operation - Phase I.
        1) Smoke detectors are required: In the machine/control rooms; in each elevator lobby; and at the top of the hoistway, if a sprinkler is located at the top of the hoistway or if the hoistway smoke vent damper motor is activated by a smoke detector.
30. Devices relative to elevator security features, including card readers and access control units (ACU) and all other security equipment, not specifically indicated in the Elevator Technical Specification, as being provided by the Elevator Contractor.
31. All security device wiring and conduit from the building's security control room to a junction box in the elevator machine/control room for the operation of the elevator security features, not specifically indicated in the Elevator Technical Specification, as being provided by the Elevator Contractor.
32. Conduit, pull boxes, junction boxes and all required related conduit components from each of the elevator control/machine rooms to the Fire Command Center, as necessary for the operation of the elevator emergency control and signal panel and the elevator related communication system provided by Division 14.
    a. The diameter of the various conduit runs shall be coordinated with the Elevator Contractor, as different elevator contractors will have varying requirements.
    b. The Elevator Contractor will be directed, via the technical elevator specification, to provide the necessary wiring in these conduit runs
33. 120vac power supply with back-up supply Power supply for or the operation of the elevator emergency communication system.
34. Electric power for installing, testing and adjusting the elevators.
35. Sump and sump pump, including flush metal sump cover and all necessary related plumbing in the pit. Plumbing and disposition of discharged sump water shall be as directed by the Local Authority Having Jurisdiction (AHJ).
    a. Provide oil/water separators, if/as required by the Authority having Jurisdiction.
    b. Sump Pump must have the capacity to remove a minimum of 3,000 gallons per hour, per elevator.
    c. Provide a separate 110-volt circuit and single receptacle, adjacent to the sump in the pit, for powering the sump pump.
        1) Sump pump electrical circuit must comply with the requirements of NFPA 70.
        2) Individually protected GFCI receptacle, as required by ASME A17.1, in each elevator's pit shall not be used to power the pit sump pump.
36. Waterproofing of the pit walls & floor.
37. Where sprinklers are located in the hoistway:
    a. All electrical components within 4'-0" of the pit floor must be rated Weatherproof NEMA 4.
    b. Wiring shall be identified for use in wet locations in accordance with the requirements in NFPA 70.

1.9 PROJECT CONDITIONS

This Contract involves work on vertical transportation equipment in a new building that is adjacent to and connected to existing occupied and operating buildings which will remain in operation during the performance of the work. Accordingly, do not store material or other equipment related to the construction of the vertical transportation equipment provided under this contract so as to interrupt access and travel those adjacent, occupied and operating buildings.

NOT FOR BIDDING

Bidders are cautioned to be fully informed of the project details, before submitting a bid, and to include in the bid price the cost of all items contemplated in the scope of this specification. Also, to include all incidental work that might be required during the job. No allowance will be made subsequently in this connection, on behalf of the Elevator Contractor, for any Elevator Contractor error, omission or negligence.

Where dimensions are indicated or field measurements are required, they shall be field verified by the Elevator Contractor.

Arrange for any required space or construction revisions or Code exceptions/waivers required, for the proper code compliant installation, operation and maintenance of the vertical transportation equipment, including changes in other related work, subject to approval of the Owner's Representative.

Any discrepancies or ambiguities found in the specifications or on the drawings shall be reported in writing and resolved, prior to contract execution.

Submission of a bid will be considered evidence, that the bidder is acquainted with local facilities and conditions, the requirements of the documents and of all pertinent codes, condition of labor and material markets and has made due allowance in the bid for all contingencies.

Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.

Coordinate locations and dimensions of other work relating to vertical transportation equipment including access ladders and stairs, sumps, entrance sill supports, electrical service, electrical outlets, lights, and switches in pits and control/machine rooms and machine spaces at the top of the machine room-less elevators.

Prior to commencing vertical transportation equipment installation, review all Contract Documents and take field measurements, as necessary, to allow placement of the materials in the building and to assure compatibility of the manufacturer's equipment with the building design and construction. Verify critical dimensions, examine supporting structure, verify main line feeder voltage and all other conditions under which vertical transportation equipment work is to be installed. Notify appropriate Owner’s Representative or the General Contractor, in writing of any dimensional discrepancies or other conditions detrimental to the proper installation or performance of work.

In order to discover and resolve conflicts or lack of definition, which might create construction problems, bidders shall review contract documents and evaluate all structural, architectural, electrical and mechanical conditions, prior to bidding, for compatibility with their products. Discrepancies shall be resolved, prior to the bid. Owner or General Contractor will not pay charges, in addition to the base bid amount, for changes to structural, mechanical, electrical or other systems, required to accommodate bidders’ equipment.

1.10 WARRANTY – PERFORMANCE GUARANTEE

Warranty: The Elevator Contractor shall warranty, for a two-year period, that the materials and workmanship of the apparatus installed under this contract are first-class and in compliance with the Contract Documents in every respect. The Elevator Contractor shall make good any defects not due to ordinary wear and tear or improper use or care, which may develop during the “Two-Year Warranty Period”.

1. The “Two-Year Warranty Period” for each vertical transportation unit provided under this Contract shall commence upon the date of the Owner’s acceptance of that individual elevator and shall continue for a two-year period.
2. For components that are relative to multi-vertical transportation unit installations, such as remote monitoring and group control systems, the “Two-Year Warranty Period” shall commence upon the Owner’s final acceptance of the entire installation (all vertical transportation units) and shall continue for a two-year period.

NOT FOR BIDDING

Upon receipt of notice from the Owner, relative to a failure occurring during the "Two-Year Warranty Period", of any portion of the materials and/or work provided hereunder, the Elevator Contractor shall immediately replace, repair or otherwise correct such deficient materials or work, at no additional cost to the Owner.

No device shall be acceptable that will not give full satisfaction, without excessive maintenance and attention. If it becomes evident during the warranty period that any device is not functioning properly, or is not in accordance with the requirements of the Contract Documents, or if excessive maintenance and attention shall be employed to keep device operational, the Elevator Contractor shall immediately remove the device and install a new device meeting all requirements of the Contract Documents. This process shall continue until satisfactory operation of the installation is obtained, in accordance with the requirements of the Contract Documents. Period of warranty shall start anew for such parts, from date of completion of each new part installation performed, in accordance with foregoing requirements. The Elevator Contractor shall bear all related costs of material and labor required under this warranty clause.

Performance Guarantee:

1. The Elevator Contractor shall assume full responsibility to furnish and provide complete and functional vertical transportation units, in compliance with the requirements of the Code and the Contract Documents. Additionally, the Elevator Contractor shall:
    a. Provide the Owner or the Owner's Representative with final vertical transportation unit Inspection approval by all applicable Local, State and Federal Governing Authorities.
    b. Assume responsibility for all related costs necessary to correct vertical transportation unit equipment Code deficiencies, as cited by all applicable Governing Authorities.
    c. Correct all work that is not in compliance with the requirements of the Contract Documents, as cited by the Owner's Representative.

1.11 PERMITS, LICENSES, TESTS AND INSPECTIONS

Permits and Licenses: Obtain and pay for all required variances, permits and licenses and jurisdictional certificates of operation necessary for the execution of a complete, Code and Specification compliant, operable installation of all equipment provided under this Contract.

1. Provide all vertical transportation equipment shop drawings and other required vertical transportation unit drawings, stamped and sealed by a properly licensed professional engineer, acceptable to the Authority Having Jurisdiction, all as necessary to obtain the required permits, variances and licenses for the legal construction and operation of the equipment provided under Division 14.

Prior to requesting an acceptance inspection by the Jurisdictional Authority or the Owner's Representative, pre-test and verify in writing, not less than seven (7) days in advance of dates and times tests and inspections are to be performed, that the equipment has been pre-tested and is fully ready for final inspection.

Tests and Inspections required by the Authority Having Jurisdiction:

1. Arrange for all tests and inspections required by all applicable Jurisdictional Authorities.
    a. Pay for all tests and inspections required by all applicable Jurisdictional Authorities.
2. Provide all labor, test instruments and materials required to determine Code compliance of the work, during all required inspections by all appropriate Jurisdictional Authorities.
3. Perform testing and inspections during times approved by the Owner.
    a. Perform tests that are disruptive to normal building operation, as determined by the Owner, during hours and days approved by the Owner.
4. Provide copies of all test and inspection acceptance certificates and operating permits, as required by all applicable Jurisdictional Authorities, to allow Code compliant, normal, unrestricted use of the equipment provided under this contract.
5. Label each device, as required by Code, with calibration sticker indicating test results and date of test.
6. Provide a copy of all test results.

Tests and Inspections required by the Owner's Representative:

NOT FOR BIDDING

1. Provide all labor, test instruments and materials, required for Owner's final acceptance tests and reviews, as specified or required.
2. Demonstrate to the Owner's Representative:
   a. Installation compliance with Contract Documents.
   b. Contract speed and floor-to-floor performance in compliance with Contract Documents, with and without a Contract capacity load.
   c. Stopping accuracy and car ride, in compliance with Contract Documents.
   d. Door operation, in compliance with Contract Documents.
   e. Signal fixture operation in compliance with Contract Documents.
   f. Operating system operation in compliance with Contract Documents.
   g. Ride performance in compliance with Contract Documents.
3. Perform all other acceptance tests required by Owner's Representative, in order to demonstrate complete compliance with the requirements of the Contract Documents.

The Elevator Contractor shall promptly correct all deficient work that is not Code compliant or is rejected by the Owner or Owner's Representative, for failure to meet the requirements of the Contract Documents. The cost of all work performed under this clause shall be borne by the Elevator Contractor.

1. If the equipment is found to be defective or not in compliance with Code or the Contract Documents, and additional inspections are required, the cost incurred for the personnel to witness the additional inspection/s are the responsibility the Elevator Contractor.
2. After the correction of deficiencies, all work shall be in compliance with the Code and the Contract Documents.
3. Rejected work found to be out of compliance with the Code or Contract Documents, which is not corrected within 30 days of the written punch list, may be corrected by an alternative Contractor, at the Owner's direction, with the cost for the alternative Contractor back charged to the Elevator Contractor.
4. All expenses of repairing work of other Trades damaged by this correction of deficiencies shall be borne by the Elevator Contractor.

Laboratory Testing: Comply with Code, as required, for laboratory testing of equipment component parts.

When the Owner's Representative determines that the work is finally complete, in accordance with the Contract Document requirements, the Elevator Contractor shall then remove all of their tools, etc. from the job site, provide final documentation as required by the Contract Documents and process the close-out.

PART 2 - PRODUCTS

2.1 MOTOR HORSEPOWER RATINGS AND POWER SUPPLY

Motor horsepower ratings specified or indicated are the maximum acceptable for the proposed electrical service. If a motor is provided having a larger horsepower rating than the maximum specified in the technical portion of the Specification, then the Elevator Contractor shall be responsible for all cost, relative to the associated increased conduit, wire and breaker size required to accommodate the oversized motor.

1. Do not provide increased motor horsepower which together add more than five (5) percent to the load of an electrical distribution equipment item (i.e., Motor Control Center, Power Panel, etc.).

Before any equipment to be supplied under this section is manufactured, the Elevator Contractor shall verify the exact power characteristics available. Equipment shall be designed to operate on the power as verified.

2. Failure to verify the power supply will not relieve the Elevator Contractor of responsibility for the satisfactory operation of the equipment.

Design electrical equipment provided under this specification, to operate continuously, on an electric power supply having any voltage between ten (10) percent above or below the specified voltage

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2.2 GENERAL PRODUCT REQUIREMENTS

Provide products which are free of corrosion, undamaged and unused at time of installation, and which are complete with accessories, trim, finish, safety guards and other devices and details needed for complete code compliant installation and for intended use and effect.

When two (2) or more units of same class of materials, devices or equipment are required, provide units which are identical products of the same manufacturer.

2.3 LABELS AND NAMEPLATES

To the extent feasible and consistent with the following requirements pertaining to the appearance of the finished building, wherever a product is required to comply with a specified standard, grade, class, or type, a permanent label to this effect shall be applied to the product. Where this is not feasible, because of the nature of the product, the label shall be on or inside of each shipping container.

Manufacturer's or installer's name plates, logos, trademarks and other identifying markings shall not be affixed on surfaces exposed to public view.

Locate required labels and stamps on concealed surfaces, or where required for observation after installation, on an accessible surface, which in occupied spaces is not conspicuous, subject to approval by the Architect, General Contractor or Owner.

Each major component of mechanical and electrical equipment shall have, on a permanently attached plate, the manufacturer's name, address, model number, serial number, capacity, speed, ratings and similar essential operating data. Locate nameplates on easily accessible surfaces, which in areas exposed to public view, are not conspicuous.

2.4 SPECIAL MAINTENANCE/SERVICE TOOLS AND INSTRUCTIONS FOR USE

Provide all required service diagnostic tools and sundries with access to all engineering levels for diagnostic evaluations, system monitoring, all required AHJ testing, and field adjustments. Provide a permanent monitoring system for flat coated steel belts suspension means.

1. The cost to the Owner of these tools, monitoring systems and accessories shall be included in the quoted price of the equipment and be specifically listed in the proposal.
2. Diagnostic service tools may be hand held devices or they may be on-board integral components of the vertical transportation equipment controllers.
3. All diagnostic tools and monitoring systems including all accessories, documentation and sundries to permit the proper operation of the diagnostic tools shall be provided to the Owner upon completion of the project along with instructions for the operation of the tools, as pertains to all functions relating to the equipment provided. The Elevator Contractor shall maintain and update all diagnostic tools, accessories and instructions provided to the Owner. Should the Elevator Contractor’s contract for installation or for subsequent continuing maintenance service be cancelled for any reason by either the Owner or the elevator contractor, the Elevator Contractor shall be obligated to provide bulletins published for the equipment, continuing maintenance and updating of the diagnostic tools and monitoring systems to the Owner at the Elevator Contractor’s direct cost plus a reasonable charge for profit and overhead for labor and materials, for the life of the elevator.
    a. Labor charges shall not exceed the Elevator Contractor’s standard elevator mechanic hourly billing rates. In addition, the Elevator Contractor shall provide field and technical assistance and instruction to the Owner or Owner’s representatives or elevator maintenance company, upon the Owner’s request within a reasonable time following the Owner’s request, and be compensated in a similar manner as previously described.

NOT FOR BIDDING

2.5 KEYS

Where key-operated switches and/or key-operated cylinder locks are furnished in conjunction with any component of the installation, coordinate keying with the Owner's Representative or General Contractor and furnish three (3) keys for each individual switch or lock, stamped or permanently tagged to indicate function.

1. If other divisions of the Contract Documents have more stringent key requirements, the more stringent standard on a given key issue shall be enforced.

2.6 QUALITY ASSURANCE

Approved contractors and equipment suppliers, subject to compliance with the technical specification's requirements (Elevators):

1. Microprocessor dispatch and control systems: Galaxy (GAL), KONE, Motion Control Engineering (MCE), Otis, SmartRise, Schindler, TKE or approved equal .
2. Hoist machines (PMAC gearless): Hollister Whitney, Imperial, KONE, Otis, Schindler, TKE or Torin.
3. Traction elevator equipment, including hoist machines, brakes, slings, platforms, counterweights, buffers and other miscellaneous hatch, pit and machine room equipment: Hollister-Whitney, KONE, Otis, Schindler, TKE or approved equal.
4. Passenger elevator door operators and door hardware: GAL, KONE, Otis, Schindler, TKE or approved equal.
5. Door protective device: Formula Systems, KONE, Janus, Otis, Schindler, TKE or approved equal .
6. Emergency Communication System: Kings III, KONE, Rath, Otis, Schindler, TKE or approved equal.
7. Signal and operating fixtures for car and corridor: EPCO, Innovation Industries, KONE, Otis, Schindler, TKE or approved equal.
8. Passenger elevator car enclosures and entrances: Gunderlin, H&B, KONE, Otis, Schindler, TKE or approved equal.
9. Roller/Slide guide shoe assemblies: ELSCO, KONE, Otis, Schindler, TKE or approved equal.
10. Door Guides: Nylube or approved equal.
11. Keyed Locks and Switches: "Best-Lock", Illinois Lock, KONE, Otis, Schindler, TKE or approved equal. (Keyed to suit the Owner's requirements).

PART 3 - EXECUTION

3.1 INSTALLATION OF ELEVATOR SYSTEMS

General:

1. Manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the respective manufacturer's instructions unless more stringent requirements are specified.
2. Install equipment with clearances complying with applicable codes.
3. Provide guards required by Code and OSHA.
4. Provide welded connections for installation of work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.
5. Mechanical fastenings used throughout the equipment on parts subject to wear and requiring replacement shall be key and seat, nut, screw, or other removable and replaceable type not requiring physical deformation or field positioning. The use of rivets or similar devices will not be acceptable as mechanical fastenings for such parts.
6. Mount rotating and vibrating equipment and components on vibration-absorption mounts designed to effectively prevent transmission of vibrations to structure and thereby eliminate sources of structure borne noise from the elevator system.
7. Lubricate operating parts of systems, including ropes, as recommended by manufacturer.

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Character of Work:

8. Before work begins, submit prepared work schedule for acceptance and arrange with the Owner's Representative sequence of procedure; means of access the premises, space for storage; use of approaches, corridors, stairways and elevators; location of temporary partitions; and the like. The Owner's Representative shall be notified in writing, twenty calendar days in advance of starting work on elevators.
9. Perform work with competent mechanics skilled in this work and under the direct control and supervision of the elevator manufacturers' experienced foreman.
10. During handling and installation of work at project site clean and protect work in progress and adjoining work on a basis of perpetual maintenance. Apply suitable protective covering on newly installed work where reasonably required to ensure freedom from damage or deterioration at time of substantial completion.
11. Perform each installation so that its component parts will function together as a workable system, complete with accessories necessary for its operation.
12. Execute the work in conformity with the best workmanship practices.
13. Consult the drawings covering this installation and the installations of the various other trades in addition to the field layouts of the contractors for these trades and their shop drawings and be governed accordingly in laying out work.
14. Coordinate work with work of other trades, for proper time and sequence, to avoid construction delays. Use benchmarks, lines and levels designated by the General Contractor to ensure dimensional coordination of the work.
15. Mount rotating and vibrating equipment and components on vibration-absorption mounts designed to effectively prevent transmission of vibrations to structure.
16. Be responsible for the performance of and maintain supervision over sub-contractors and coordinate the work covered by this Specification.
17.
18. Furnish proven, latest technology equipment, parts or accessories specified.
19. Design the equipment so that the installation will conform and accommodate itself to the building structure and the building use.

3.2 PROGRESS OF WORK

Initial Project Schedule:

1. No later than fifteen (15) work days after signing of the contract, the Elevator Contractor shall submit for review by the Owner's Representative and approval by the Owner a detailed schedule showing delivery dates, commencement, the order and the completion dates.

Monthly Progress Schedules:

2. Submit in writing the following information to the Owner's Representative, on a monthly basis throughout the construction period:
    a. A completion schedule, including equipment delivery times and anticipated completion dates.
    b. A progress report, with the submission of each payment request, or upon request of the Owner's Representative, showing the progress being made and the percentage of the job completed, certifying to the Owner that labor and materials indicated on the request for payment have been provided.

3.3 WELDING AND USE OF TORCHES

Require welding at the Project site to be performed by welders, who are qualified by test, as required by Code.

Follow all prescribed regulations during burning and welding operations, including:

1. Protection of adjacent work.
2. Maintain a watch person, with the appropriate fire extinguisher, throughout the entire period of burning and welding operations.
3. Remove flammable materials from the vicinity of burning and welding operations.

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Fire prevention facilities shall include fire-proof barriers where cutting or repairing by torch is involved and fire extinguishers where flammable demolished materials accumulate.

3.4 CUTTING AND REPAIRING

Drill necessary holes in the steel, tile, or concrete work, as required, upon approval of the Owner's Representative or General Contractor. Do bolting to secure guide rails, machine supports and other equipment to the building structure or concrete work, only with prior approval of the General Contractor or Owner's Representative.

Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction, in a manner that will eliminate evidence of patching and refinishing.

3.5 RECEIVING AND UNLOADING OF MATERIAL

Receive and unload material at the job site, and immediately transport materials to the elevator machine room or other approved designated area.

3.6 MAINTENANCE FOR VERTICAL TRANSPORTATION EQUIPMENT WORK

Provide interim and continuing maintenance service, as specified herein.

1. Comply with ASME A17.1, Section 8.6, with regard to performance of all maintenance, repair, replacement, testing, and record-keeping for same.

Interim Maintenance (When required):

1. Interim maintenance, including 24-hour call back service, shall commence upon the date certain new vertical transportation units provided hereunder are initially accepted by the Owner or the Owner's Representative and turned over for use.
2. Interim maintenance service shall continue on the applicable vertical transportation units until the date of final acceptance of the entire vertical transportation equipment installation.
3. All requirements specified below for the 12 months continuing maintenance period shall apply to the interim maintenance work provided for the applicable vertical transportation units.

12 Months Continuing Maintenance:

1. After completion of the installation, and as a part of this Contract, provide full coverage preventive maintenance/warranty period service and 24-hour call back service on the vertical transportation equipment provided under this contract, for a period of not less than twelve (24) consecutive calendar months after final inspection and acceptance of all vertical transportation equipment provided hereunder.

Preventive maintenance includes the repair or replacement of component parts on a regularly scheduled basis to eliminate or minimize unscheduled equipment shutdowns.

Maintenance shall consist of monthly examinations of not less than one (1) hour per examination per unit, performed by competent and trained elevator journeyperson mechanics employed by the Elevator Contractor and includes necessary adjustments, repair, greasing, oiling and cleaning of the equipment and furnishing of necessary parts and supplies to keep the equipment in proper operation, except such work or material as may be required due to misuse, accidents or negligence not caused by the Elevator Contractor.

Take equipment out of service for scheduled routine preventive maintenance during non-peak usage of the equipment, as approved by the Owner or General Contractor.

Elevator service and emergency personnel shall contact the Owner's Representative prior to and after completion of maintenance and/or service, during regular or overtime working hours. Provide a written record (work ticket) after each

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visit, containing a complete description of the work performed. Obtain a signature on the work ticket from the Owner's Representative.

1. Comply with requirements of ASME A17.1, 8.6.1.2 "General Maintenance Requirements", including provisions for keeping a written "Maintenance Control Program" in place to maintain the equipment in compliance with the requirements of 8.6.
2. Provide a written record (work ticket) after each visit, containing a complete description of the work performed. Obtain a signature on the work ticket from the Owner's Representative.
3. All records shall become the permanent property of the Owner.

Provide call back service, twenty-four (24) hours a day, upon request of the Owner's Representative, within one (1) hour after notification, if operational problems develop or shut-downs occur between regular service periods.

1. Perform call back service, at no additional cost to the Owner or General Contractor.
2. Perform call back service in addition to the required, regularly scheduled preventive maintenance hours.

Maintain in inventory at all times, available for immediate delivery and installation, a sufficient supply of emergency parts for repair of each unit. Provide materials or parts to be used which are genuine original manufacturer's renewal parts.

Safety Precautions:

1. General Requirements:
   a. Safe working practices and procedures shall be employed at all times.
   b. In addition to the safety requirements of OSHA, the Elevator Industry Field Employees Safety Handbook, and any other safety procedures commonly adopted or required by the industry shall be followed.
2. Safety Requirements:
   a. All maintenance call back and service work shall be performed by the installer of the equipment provided hereunder, and not by any other service agency.
   b. Prior to performing maintenance, inspections and repair procedures, all hoistway entrances shall be barricaded, to ensure protection of hoistway openings, and to prevent unauthorized access to the equipment. All barricades shall be approved by the Owner's Representative, prior to their use.
   c. The lock out and tag procedure specified in the elevator industry field employee's safety handbook and required by OSHA shall be implemented, as required.
   d. Removal from service of an elevator for maintenance, shall be performed by qualified personnel only.
      1) Elevators shall be confirmed to be vacant of passengers.
      2) Non-functional units shall be barricaded.
   e. To prevent unauthorized operation of malfunctioning units, power shall be removed from the unit, by tagging and locking out the mainline disconnect. The unit shall remain shut down until all necessary repairs and/or adjustments have been made by the Elevator Contractor.
   f. Elevators: Subsequent to completion of maintenance, repair, inspection or service procedures, and prior to removal of the barricades, the unit shall be operated at each hoistway entrance to ensure correct functionality of the equipment.
   g. Accidents Involving Personal Injury:
      1) Subsequent to an accident involving personal injury and/or damage to property, the unit shall be shut down and barricaded.
      2) To prevent unauthorized operation, power shall be removed from the unit by tagging and locking out the mainline disconnect.
      3) The unit shall remain shut down until an inspection has been made by the local jurisdictional authority, and by the Owner's Representative.
      4) Upon completion of the inspections, and with the approval of the local jurisdictional authority and the Owner's Representative, the Elevator Contractor shall make the necessary repairs and/or adjustments prior to restarting the unit.
   h. Incidents Involving Damage to Property:

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1) Subsequent to an incident involving damage to property, but no personal injury, the unit shall be shut down and barricaded.
2) To prevent unauthorized operation, power shall be removed from the unit by tagging and locking out the mainline disconnect.
3) The unit shall remain shut down until an inspection has been made by the local jurisdictional authority, and by the Owner's Representative.

Reporting:

1. Require service and emergency personnel to report to the Owner's Representative upon arrival at the facility and again upon departure from the facility.
2.
3.
4. Provide work tickets, as approved by the Owner's Representative, for maintenance, inspection, repair, or adjustment work, for each unit worked on, specifying at a minimum, the following:
   a. Date.
   b. Start time.
   c. Complete description of work.
   d. Classification of work performed, i.e., Routine Maintenance; Repair Work; Annual Maintenance; Performance Testing; or Code Required Jurisdictional Tests and Inspections.
   e. Material and or parts used.
5. Meet with the Owner's Representative on a quarterly basis. During the meeting provide and review, with the Owner's Representative, maintenance and repair records for the proceeding 3-month period. Additionally, provide the Owner's Representative with a schedule, for approval, of all intended scheduled repair work, to be performed in the forthcoming quarter.
   a. The maintenance and repair records shall, at a minimum, include a record of the following:
      1) Preventive maintenance performed.
      2) Scheduled shut downs of the equipment for repair work.
      3) Equipment outages, due to component malfunction or failure.
      4) Attendance at additional meetings, by the Elevator Contractor, may be required by the Owner. Attendance at, and participation in these additional meetings, by the Elevator Contractor, at no additional cost to the Owner, shall be mandatory.

Regularly and systematically examine inspect, properly adjust, clean, lubricate, and if conditions warrant, repair or replace, all mechanical, structural and electrical vertical transportation equipment components, including but not limited the components indicated hereafter. Repair and replacement coverage is intended to be full and complete, and to include the cost of all labor and material for providing all vertical transportation equipment replacement components, including those not mentioned below.

1. Traction Elevators:
   a. Gearless traction machines (where applicable) and related components, including but not limited to: rotor, permanent magnets, seals, bearings, sheave, sheave shaft, castings, brake, brake drum, brake coil, brake contacts, linings, pins and bushings.
   b. Geared traction hoist machines (where applicable) and related components, including but not limited to seals, bearings, worm gear, ring gear, sheave, sheave shaft, castings, rope gripper, brake, brake drum, brake coil, brake contacts, brake linings, pins and bushings.
   c. Controller, selector, dispatching equipment, solid state drive units and all related equipment, including but not limited to relays, solid state components, resistors, condensers, transformers, contacts, leads, overloads, timing devices, computer devices, selector components, and all switches in the machine room, hoistway and pit.
   d. Motors, including but not limited to windings, rotating elements, permanent magnets, seals, bearings and bearings.
   e. Governor and Tension Sheave, including but not limited to governor sheave and shaft assembly, bearings, contacts, governor jaws and governor tension sheave assembly.

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f. Passenger elevator door operating equipment (where applicable) and all related components, including but not limited to door operating motor, mechanical operators' interlocks, gate switches, hangers, tracks, rollers, door gibs, clutches, and closers.
g. All sheaves, including bearings and shafts.
h. Machine beams and all related components.
i. Car and counterweight guide rails, guide rail brackets, buffers, buffer supports, guide shoes, guide shoe mounts and guide shoe rollers.
j. Counterweight and all related components, including but not limited to: counterweight frame, counterweight safety (if applicable), sub weights, hitch plates, and compensation system.
k. Car frame and all related components, including but not limited to: safety, platform and car sill.
l. Car and corridor operating and signal fixture components, including light bulbs.
m. Car fan and emergency lighting units.
n. Electrical wiring and traveling cables necessary for the operation of the vertical transportation equipment and associated accessory equipment.
o. Hoist, governor and compensation ropes and all related components, including but not limited to: shackles, springs and compensation devices.
p. All elevator related emergency circuits, including fire capture systems.
q. All other elevator components, not specifically mentioned above, but not otherwise specifically excluded herein.

Provide firefighters' emergency service recall tests for elevators as required by the governing Code.

Maintain the efficiency, safety and contract speeds of the equipment, including elevator floor to floor time and elevator door opening/closing times.

Routine maintenance shall include all necessary adjustments, greasing, oiling and cleaning of the equipment, including, but not limited to the following:

1. Lubrication:
   a. Lubricate all moving parts of the equipment requiring lubrication. Apply lubricants at intervals recommended by the equipment manufacturer. Provide lubrication more frequently, if dictated through use of the equipment.
      1) Utilize lubricants suitable for the purpose intended that meet or exceed the minimum requirements specified by the manufacturer of the equipment to which the lubricant is applied.
      2) The use of excess lubricants shall be avoided.
      3) Remove and properly dispose of used and oily wiping materials from the building on the same day that they are used (Follow OSHA Guidelines).
2. Adjustments and Repairs:
   a. All parts of the machinery and equipment requiring adjustment shall be adjusted at regular periodic intervals to ensure compliance with the requirements of the Code the Specification and the originally designed performance standards.
   b. The frequency of adjustments shall be determined by the Elevator Contractor based upon the equipment location and usage. Monthly inspections shall be made to determine whether adjustments are necessary.
   c. Replace or repair components during the course of scheduled preventive maintenance, when such replacement will prevent an unscheduled equipment shutdown and/or ensure the continued safe normal operation of the equipment or which otherwise will extend the useful life of the equipment. Make all replacements using original manufacturer's parts or Owner approved equal.
3. Housekeeping:
   a. The interior of the elevator control rooms, hoistways, pits shall be periodically cleaned to prevent an accumulation of lubricants, lint, dirt, refuse and other contaminants.
      1) Regularly brush lint and dirt from the guide rails, car top, bottom of platform and remove dirt and accumulated trash from pits and control room and machine space floors.
      2) Take necessary actions to prevent oil and grease from creating unsightly appearances on the equipment and accumulating on the floor of equipment rooms and elevator pits.

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3) The frequency of cleaning shall be determined by the Elevator Contractor based upon the elevator location and usage. Monthly inspections shall be made to determine whether cleaning is necessary.
4) Cleaning of the equipment shall occur at regular intervals sufficient in frequency to maintain a professional appearance.

b. Where necessary, non-flammable solvents shall be used to remove excess lubricants, lint, dirt, refuse and other contaminants.
c. Provide and maintain industry standard parts cabinets for the orderly storage of replacement parts.
d. Keep the premises free of accumulation of waste material, soiled wiping cloths and trash a basis of perpetual maintenance.
e. Store combustible materials in a closed metal container.
f. Report to the Owner the need for cleaning and/or janitorial services for all items not covered by the contract or which are otherwise not the responsibility of the Elevator Contractor (Confirm name and phone number for reporting purposes).

4. Functional Performance:
a. The correct function and physical condition of all operating and safety devices shall be periodically checked to ensure safe operation in compliance with the requirements of the Code and Specification.
b. Equipment shall be maintained to comply with OEM specifications, all applicable ASME A17.1 requirements, the requirements of National Electrical Code, local building codes, and the local jurisdictional authority. In addition, the requirements of this section shall also apply.
c. Any components or items failing to comply with the requirements of the specification shall be repaired, adjusted or replaced, as required.
1) All repairs or replacements shall be made with components complying with OEM specifications, or equivalent.
2) Unless prior written consent has been provided by the Owner's Representative, used or reconditioned parts shall not be used.
d. Elevators:
1) Leveling and door operation shall be maintained within specified tolerance.
2) Proper operation of all signal fixtures shall be maintained.
3) Proper operation of all safety features shall be maintained.
4)
5) All components shall be kept free of oxidation or corrosion, an excess buildup of lubricants, lint, dirt, refuse and other contaminants.
6) Operating speed shall be periodically checked to ensure compliance with the requirements of the Code and Specification.
7) Cab interiors and hoistway door panels shall be periodically checked to ensure compliance with the requirements of the Code and Specification.

Conduct quarterly evaluations of equipment performance, including unit speed, elevator door operations, unit riding quality, elevator leveling, elevator floor to floor time and systems operation, including elevator traffic handling and response time.

1. Following such evaluations, perform adjustments, repairs or replacements required to maintain the manufacturer's operating performance standards.
2. Provide written results of each quarterly evaluation to the Owner's Representative.

When, as a result of an examination, corrective action is found to be the responsibility of the Elevator Contractor, proceed immediately to make (or cause to be made) replacements, repairs and corrections. When such work is determined not be the Contractor's responsibility, provide the Owner's Representative with a written report, for further action.

1. Items of an emergency nature shall be communicated to the Owner's Representative immediately and followed up in written form.

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Adjust the equipment as necessary in accordance with the check list and when the operation of the equipment varies from its normal or originally designed performance standards.

1. Utilize qualified individuals, properly equipped with tools and instruments, employed by the Elevator Contractor for adjustments.
2.
3. Parts or assemblies which have worn (or otherwise deteriorated) beyond "normal" adjustment limits shall be replaced.

Replace items during the course of scheduled preventive maintenance, when such replacement will prevent an unscheduled elevator shutdown and/or ensure the continued safe normal operation of the elevator which otherwise will extend the useful life of the elevator. Make all replacements using original manufacturer's parts.

Repairs:

1. Repairs which are the responsibility of the Elevator Contractor: Make (or cause to be made) all repairs stipulated herein, made necessary due to normal wear and use of the elevator system. Absorb all cost for labor, materials, expenses, and supplies which occur as a result of the stated repair.
2. Repairs, necessitated because of equipment misuse, or which are otherwise the responsibility of the Owner: Make (or cause to be made) repairs, when authorized by the Owner's Representative, on a firm price or T & M basis, where such repairs are not included in the contract documents. Provide all labor, materials, and supplies at the negotiated billing rates. On completion of all repair work, the Elevator Contractor shall submit to the Owner's Representative for payment an invoice detailing the nature of the work performed and related charges. The repair billing rate, time required and material required shall be set forth in the bid amount.
3. Submit a written proposal prior to any billable repairs being made and obtain formal approval to proceed.
4. Billing rates that will apply to these repairs through the course of installation and new product service shall be submitted with the original contract bid.
    a. Repairs (Owner's Responsibility):
        1) The following specific misuse damage is the Owner's responsibility:
            a) Water damage, unless caused by the Elevator Contractor.
            b) Fire damage, unless caused by mal-adjusted components; short circuits within the equipment; overheated components, or otherwise caused by the Elevator Contractor.
            c) Elevators: Damage to elevator doors, fixtures, wall panels, ceiling panels, flooring, etc. caused by vandalism or being struck by foreign objects, etc., unless caused by the Elevator Contractor.
            d) Elevators: Malfunction of elevator doors caused by foreign objects in the sill tracks or dismounting of the doors due to impact with carts, unless caused by mal-adjusted components, or otherwise caused by the Elevator Contractor.

Periodic Tests:

1. Perform all periodic Safety Tests of the vertical transportation equipment components, as required by Code. The periodic tests shall be conducted as indicated by the Code. Test results shall be witnessed as required and recorded on forms supplied by or acceptable to the Owner's Representative. Provide certified copies of the complete test forms to the Owner's Representative.
2. Provide the services of an elevator mechanic to enable an inspecting authority to perform any required vertical transportation equipment inspections.

SPARE PARTS

1. Provide cabinet and maintain adequate level of components, unique to project, failure of which could result in extended down time, or loss of which could require extended time period for replacement.

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3.7 REPLACEMENT PARTS SUPPORT

Elevator contractor shall make available to the Owner or Owner's representative all parts required to service and maintain the vertical transportation equipment installed.

Elevator contractor shall not have established company policies which would prevent the Owner or Owner's representative from obtaining service parts on a timely basis. In no event shall the Elevator Contractor or Elevator Manufacturer charge prices for service parts to the Owner or Owner's representative shall not be more than that charged to any other customer of the Elevator Contractor for the same or substantially similar goods in similar quantities. The Elevator Contractor or Elevator Manufacturer shall maintain availability of service parts to the Owner or Owner's representative for a period which matches the reasonable life of the elevator equipment.

3.8 OWNER'S OPTION – MAINTENANCE PERIOD EXTENSION

Provide lump sum pricing with the construction bid (three separate prices) for an extension of the initial 12-month preventive maintenance period indicated above.

1. Include the following three maintenance period extension lump sum prices:
    a. Extension of the maintenance period for twelve (12) months, after expiration of the initial 12 months of maintenance included in the base Construction Contract.
    b. Extension of the maintenance period for twenty-four (24) months, after expiration of the initial 12 months of maintenance included in the base Construction Contract.
    c. Extension of the maintenance period for thirty-six (36) months, after expiration of the initial 12 months of maintenance included in the base Construction Contract.

At any time during the 1st twelve (12) month maintenance period, the Owner shall have the right to exercise the option for an additional twelve (12) month, twenty-four (24) month or thirty-six (36) month maintenance period, to start immediately upon the expiration of the 1st twelve (12) month maintenance period, for all equipment provided under this Specification Section and maintained by the Elevator Contractor during the 1st twelve (12) month maintenance period.

Payment for maintenance service provided under this option shall be made to the Elevator Contractor, on a monthly prorated basis, as maintenance service is provided.

1. The monthly maintenance fee shall be determined by dividing the lump sum in the bid by the number of months in the option accepted by the Owner.

The following annual price adjustments shall be made during the course of this optional twelve (12) month, twenty-four (24) month or thirty-six (36) month maintenance period:

1. Maintenance pricing for the optional twelve (12) month, twenty-four (24) month or thirty-six (36) month maintenance period shall be adjusted upon the start of maintenance provided under this option and, if an optional maintenance period longer than twelve (12) months is accepted, on an annual basis each year thereafter. Adjustment to the maintenance price shall be based upon the following formula:
    a. 20% of the monthly contract price shall be increased or decreased by the percentage of increase or decrease shown by the index of Wholesale Commodity Prices for Metals and Metal Products, published by the Department of Labor, Bureau of Statistics, for the month within which falls the start of maintenance provided under the optional twelve (12) month, twenty-four (24) month or thirty-six (36) month maintenance period, as compared with the index for the 1st day of the 1st month of the prior twelve (12) month maintenance period.
        1) For successive annual adjustments the base comparison index for the adjustment shall be the index for the first month of the prior one-year maintenance period.
        2)
    b. 80% of the monthly contract price shall be increased or decreased by the percentage of increase or decrease in the straight time hourly labor cost, for the month within which falls the start of maintenance provided under the optional twelve (12) month, twenty-four (24) month or thirty-

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six (36) month maintenance period, as compared with the straight time hourly labor cost in effect during the 1st day of the 1st month of the prior twelve (12) month maintenance period.

c.

1) For successive annual adjustments the base comparison labor rate for the adjustment shall be the labor rate for the first month of the prior one-year maintenance period.

All work provided during the additional twelve (12) month, twenty-four (24) month or thirty-six (36) month maintenance period shall comply with the terms, conditions and requirements of Sub-Part 3.6 “MAINTENANCE FOR ELEVATOR WORK”.

3.9 PROTECTION

Cleaning And Protection: During the execution of work at the project site clean and protect work in progress and adjoining work on a basis of perpetual maintenance. Apply suitable protective covering on newly installed work, where reasonably required, to ensure freedom from damage or deterioration at time of substantial completion; otherwise, clean and perform maintenance on installed work as frequently as necessary throughout the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

Limiting Exposures of Work: To extent possible through reasonable control and protection methods, supervise performance of work in a manner and by means which will ensure that none of the work, whether completed or in progress, will be subjected to harmful, dangerous, damaging, or otherwise deleterious exposures during construction period. Such exposures include (where applicable, but not by way of limitation) static loading, dynamic loading, internal pressures, external pressures, high or low temperatures, thermal shock, high or low humidity, air contamination or pollution, water, ice, solvents, chemicals, light, radiation, puncture, abrasion, heavy traffic, soiling, bacteria, insect infestation, combustion, electrical current, high speed operation, improper lubrication, unusual wear, misuse, incompatible interface, destructive testing, misalignment, excessive weathering, unprotected storage, improper shipping/ handling, theft and vandalism.

Where an elevator is operating in a multiple hoistway, and construction or modernization work is to be performed in an adjacent portion of that multiple hoistway, that portion of the elevator’s hoistway where the work is to be performed shall be fully separated in accordance with the requirements of the latest version of the Elevator Industry Field Employees’ Safety Handbook.

At time of substantial completion of vertical transportation equipment work or portion thereof, provide suitable protection coverings, barriers, devices, signs or such other methods or procedures to protect vertical transportation equipment work from damage or deterioration. Maintain protective measures throughout remainder of construction period until instructed to remove them by the Owner's Representative.

3.10 PAINTING AND FINISHES

Refer to other applicable specification sections, including those of Division 14.

3.11 TEMPORARY ELEVATOR SERVICE

If requested, by the General Contractor, commission the elevator into temporary service, for the General Contractor's use, at a time not to exceed 120 calendar days after the date of substantial completion.

Provide temporary elevator, consisting of the completely installed permanent elevator, modified as follows:

1. Do not install the handrails.
2. Cover the cab floor with 1/4-inch-thick plywood. Place protection between the finished floor and the plywood covering.
3. Place heavy protection pads over the cab walls. Cover finished surfaces not covered by the protection pads with material of sufficient weight and quality to protect the surface from damage during temporary use.

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a. If protection pads are included, the protection pads used for the temporary elevator shall not be the protection pads provided to the Owner, or GC for compliance with the "Car Enclosure" requirements of this document.

After the necessary work, to place the elevator in temporary service is completed, secure the necessary inspections and permits and deliver the completed Temporary Elevator Acceptance form to the General Contractor for approval. Upon receipt of the signed Temporary Elevator Acceptance form, place the elevator in service and maintain it, as specified.

Maintain the temporary elevator, during its period of use. Perform maintenance service, during regular working hours of regular working days, except by special arrangement between the General Contractor and the Elevator Contractor. Provide labor, supervision and material for maintenance, consisting of regular examinations and service of the installation, by competent trained employees of the Elevator Contractor.

1. Provide necessary labor and material for repair, adjustment, greasing, oiling and cleaning of equipment, as necessary for safe consistent elevator operation, except such parts as may be necessary due to misuse, accidents or negligence, not caused by the Elevator Contractor.

The General Contractor shall bear the entire cost of protecting and operating the temporary elevator, including but not limited to the following:

1. Labor and material for installation of and removal of protection components.
2. Maintenance, performed by the Elevator Contractor.
3. Replacement cost of such parts as may be necessary, because of negligence or damage, not caused by the Elevator Contractor.
4. The cost of an operating engineer or elevator mechanic, for operating the elevator, as required.
5. Repairs and or renovation, as necessary to place the elevator back into like new condition, prior to final acceptance by the Owner or GC.

Upon completion of the temporary service period, and at a time designated by the General Contractor, remove the items used for protection, install the handrails, and otherwise prepare the elevator for final acceptance.

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SECTION 14 21 00

ELEVATORS, ELECTRIC TRACTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 GENERAL PROVISIONS

A. Reference Specification Section: Section 14 05 00 "General Requirements for Conveying Systems"

1.3 SCOPE OF WORK

A. The work to be performed under this section includes all labor, supervision, materials, parts, supplies, tools, equipment, transport, permits, expenses, accessories, and all incidental items not specified, but reasonably required for the construction of a complete, operable and Code compliant elevator installation, as indicated herein.

1.4 GENERAL DATA - PUBLIC ELEVATOR

A.	Service:	Passenger, Designed for Class "A" Freight Loading
B.	Type:	Permanent Magnet AC Gearless
C.	Machine Location:	In Hoistway Overhead (MRL)
D.	Motor Control:	VVVF AC (Flux Vector)With AC Regeneration Feature
E.	Operation:	Selective Collective Automatic
F.	Rated Speed:	150 fpm
G.	Rated Capacity:	3500 Pounds
H.	Motor HP:	20 - Maximum
I.	Power Supply:	480 Volt - 3 Phase - 60 Hertz
J.	Roping Config:	As Per Manufacturer's standards
K.	Car Interior Size:	6'-8" Wide by 5'-5" Deep Nom.
L.	Stops:	Three (3) Ground, Second Level, Third Level
M.	Front Openings:	Three (3) Ground, Second Level, Third Level
N.	Travel:	Refer to Drawings

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O. Door Size: 3'-6" Wide by 7'-0" High

P. Door Type: Single Speed Center Opening

PART 2 - PRODUCTS

2.1 PASSENGER ELEVATOR CAR ENCLOSURE

A. Provide manufacturer's standard passenger elevator enclosure, constructed in accordance with applicable requirements of the Code, of an approved design, and sized to fit the car platform including, but not limited to the following:

1. Shell: The car shell walls shall be formed of minimum 16 gauge cold-rolled stretcher-leveled, furniture grade steel sheets, assembled together. All walls shall be reinforced for rigidity and present true surfaces free from warp and buckle. The walls shall be designed so that no more than 3/8“ deflection is realized with a force of 100 lbf applied. Wall panels and square corners shall be secured to each other by means of bolts to present a light proof joint. Bolts shall not be visible on the car interior surfaces. All joints that must be field assembled shall be guaranteed against squeaks, and be drawn up tight, with bolts fitted with washers and lock-washers. The entire car assembly including frame and platform shall operate entirely free from squeaks and metallic sounds.
2. Welding: Welding metal shall be of the same kind as the parts that are joined. Welds which are exposed shall be the same color and have the same finish as the metals which are joined. Concealed structural or reinforcing members shall be of well finished sheet stock or rolled shapes.
3. Door posts, transom and stationary return panels: Manufacture door posts, transom and return panels of minimum 14 gauge stretcher leveled, No. 304 stainless steel, with a No. 4 finish, brushed in a vertical direction.
    a. Include necessary cutouts for operating and signal devices.
        1) Recess car operating panel/s into the return panels, with operating panel cover surface applied.
        2) Recess a car position indicator, with a flush lens, in each car operating panel.
4. Car Interior Finish Components:
    a. Walls: Plastic Laminate.
    b. Ceiling: Stainless Steel
    c. Flooring: Rubber floor tile by Flooring Contractor.
    d. Advise the Architect of the maximum allowable car interior component weight (including flooring).
5. Car Doors:
    a. General: Provide car door panels with hanger assemblies and related hardware including header, car door rollers, tracks, and door bottom gibs.
    b. Construction: The car door panels shall be of a hollow metal flush panel construction, manufactured of 16 gauge cold-rolled stretcher-leveled, furniture grade sheet steel, not less than 1 1/4" thick. Each door panel shall be hung on two point suspension sheave type ball bearing hangers similar to those specified for the hoistway door panels except that each sheave shall be of sound reduced design. The door panels shall be rigid and reinforced for installation of hangers, door operating equipment, door reopening device, hardware, and unlocking zone devices. Each door panel shall be guided at the bottom by two nylon or composition gibs engaging door threshold grooves with a maximum clearance of .020". Gibs shall have fire stops bent and be easily replaceable without removing door panels from hangers. Rubber bumpers shall be provided for the doors similar to those specified for the hoistway doors.
    c. Door Finish: The doors shall have their interior surface faced with 18 gauge No. 304 stainless steel with a No. 4 vertical brushed finish. Facing shall be extended around the edges of the panel and returned ¾” minimum around the outside of the hoistway face.
        1) No seams, screws or binding strips shall be visible from within the car.
    d. Door Operator Mounting: Provide a door operator header constructed of at least 3/16" thick steel and shaped to provide stiffening flanges at top and bottom, extending its entire length.

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e. Door Tracks: Provide tracks for hangers comparable to those supplied for the hoistway doors. Tracks shall be fastened to the header at frequent intervals to insure permanent track alignment.
f. Gate Switch: Equip car doors with electric contact which prevents operation of car until doors are closed as defined in ASME A17.1 unless car is operating in leveling zone or hoistway access switch is used. Locate door contact to prevent its being tampered with from inside of car. Car door contact shall have successfully met requirements of ASME A17.1.
g. Passenger Restraining Device: Provide passenger restraining devices in conformance with the Code, to prevent opening of car doors from inside the elevator, if the elevator is outside the locking zone.

6. Threshold: Manufacture threshold of extruded nickel silver, provide a non-slip surface with machined grooves to accept door guides.
7. Overall car enclosure height: Refer to Drawings.
8. Interior cab enclosure height to suspended ceiling: Refer to Architectural Drawings.
9. Suspended Ceiling and Frame:
   a. Provide suspended ceiling as approved by the Architect.
      1) Suspend the ceiling frame system on all four (4) sides from the car top and provide intermediate support members, as required, to support the ceiling panel sections without sagging.
      2) Design the ceiling panel sections to be removable to permit required cleaning and maintenance of the light fixtures and ceiling panels, and for safe access to the top emergency exit.
10. Canopy: Construct canopy panels of minimum thickness 12 gauge cold-rolled stretcher-leveled, furniture grade sheet steel.
    a. Provide an emergency exit.
    b. Reinforce the canopy and emergency exit, as required to meet Code.
11. Steady Plates: Steady plates shall be installed between the canopy and side stiles to prohibit shake or shifting of the elevator cab during running and door operations. Steady plates shall have a minimum of three (3) post wise adjustments and shall be equipped with rubber isolation.
12. Emergency Exit: The canopy shall be provided with a Code compliant, hinged emergency exit, opening clear of the crosshead and car door operator. Emergency exit cover shall be hinged on one side by a full length hinge, and held in place by non-removable fastening devices at each corner opposite the hinged edge, and shall be openable from top of car only, without special tools. All non-hinged sides of the exit panel shall lap the exit opening by 3/4". The emergency exit shall be equipped with electrical contacts which will prevent operation of the elevator when the exit door is open.
13. Car Interior Lighting:
    a. Provide car interior lighting as approved by the Architect.
    b. Provide safety lamp guards on all lamps
    c. Maintain a minimum uniform illumination level of 20 FTC at the cab floor.
    d. Provide a car light switch in the main car operating panel service cabinet, to control the car interior lighting.
14. Car Top Lighting and Outlets:
    a. Provide at least 2 electric light fixtures on top of the elevator. The 2 light fixtures combined shall provide an illumination level of not less than 10 fc at the car top. The light fixtures shall be permanent and be of the fixed or portable type and shall be equipped with guards.
    b. Provide a 2 pole 3 wire, GFCI duplex receptacle, rated for 15 amperes and 125 volts on top of the elevator.
15. Canopy and Shell Wall Finishes:
    a. All sheet steel canopy surfaces shall be cleaned and receive a rust preventative treatment.
       1) Provide interior canopy sheet steel surfaces, with a minimum of one (1) prime coat and two (2) finish coats of white shop applied baked enamel.
       2) Provide exterior cab canopy sheet steel surfaces, with a minimum of two (2) prime coats and one (1) finish coat of light grey shop applied baked enamel.
    b. All sheet steel shell wall surfaces shall be cleaned and receive a rust preventative treatment.

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1) Provide interior shell wall sheet steel surfaces, with a minimum of one (1) prime coat and two (2) finish coats of black shop applied baked enamel.
2) Provide exterior cab shell wall sheet steel surfaces, with a minimum of two (2) prime coats of shop applied baked enamel.

16. Shell Wall Soundproofing:
    a. Provide all exterior surfaces of the cab steel shell walls a shop applied coating of a fire retarding mastic sound insulation material, approximately 3/32" thick, on all surfaces, except mounting flanges and surfaces less than 3" in width.
17. Finished flooring: By Division 9.
    a. Prepare the car platform sub-surface, as required, to accept the flooring so that no imperfections are visible.
    b. Top of finished flooring shall be flush with the top of the car threshold.
    c. Provide all required assistance to the flooring contractor and all required standby labor, relative to the installation of the finished flooring in the car enclosure.
18. Ventilation: Provide a three-speed ventilation fan.
    a. Provide Code compliant vent slots in base of car.
19. Protection pads and pad buttons: Provide one (1) set of protection pads for each various car enclosure configuration, as directed by the Architect.
    a. Manufacture protection pads of ¼ inch thick (minimum) glass fiber insulation securely sewn between flame resistant vinyl coated covering or equal construction, as approved (Insulation shall conform to ASTM C612).
    b. Provide metal eyelets, in each protection pad, spaced to suit pad buttons.
    c. Design pads to cover the entire wall surfaces, except operating devices, to the extent allowed by code.
    d. Provide stainless steel protection pad buttons in the elevator enclosure, located as inconspicuously as possible, spaced not more than 18" apart, as directed by the Architect.

2.2 HOISTWAY ENTRANCES - HORIZONTAL SLIDING

A. Provide manufacturer's standard elevator landing entrances constructed of the best quality cold rolled, stretcher leveled cabinet grade steel or stainless steel, as indicated herein, of specified USS gauges. Entrances shall bear the code required UL Label and be constructed in accordance with an approved design, sized as indicated, complete with doors, frames, sills, sill support angles, strut angles, door hanger housings and supports, hanger cover plates, dust guard apron, toe guard, fascia plates and such other items required to provide the equipment type and operation specified.

1. Hollow metal doors: Provide hollow metal doors, not less than 1 1/4" thick constructed of 16 gauge high quality, cold rolled, stretcher leveled cabinet grade steel, with replaceable sight guards.
    a. Door Finish:
        1) Door panels shall be provided with a rust resistant treatment and a factory finish of two coats of baked on primer.
        2) Finish door panels on the corridor side with 18 gauge No. 304 stainless steel, with a No. 4 finish. Facing shall be extended around the leading and trailing edges of the panel and returned around the outside of the hoistway face of the door panel. No seams, binding strips or screws shall be visible from the corridor.
    b. Sight Guards: Fabricate sight guards of steel with a black enamel finish.
        1) Remove all burrs and sharp edges from sight guards.
    c. Door Reinforcement: Reinforce door panels inside with continuous vertical members. Doors shall be reinforced to accept the required operating mechanism and hardware.
        1) Provide door panels with metal labels, secured with rivets, indicating conformance with the fire test requirements of the A17.1 Code.
    d. Floor Designations: Stencil paint floor designation numbers not less than 100 mm (4 inches) high, on hoistway doors, fascias or walls as required by Code. The color of the paint used shall contrast with the color of the surfaces to which it is applied.

2. Door Guides: Each door panel shall be provided with two removable synthetic bottom guides arranged to run in the sill grooves, with a maximum clearance not to exceed .020". The guide mounting shall

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permit the easy replacement of guides without removing the door from the hanger assembly. Fire stops on guides shall be used.

3. Safety retainers:
   a. Provide the center of each section of door with one removable, code compliant safety retainer, manufactured of 6" wide steel plate, arranged to run in the sill grooves, with a running clearance at the bottom of ¼" and with no contact with the sill groove side walls.
   b. Provide safety retainers at the top of the door panels in accordance with code requirements.

4. Frames:
   a. Manufacture frame head and jamb sections of 14 gauge No. 304 stainless steel, with a No. 4 finish.
      1) Brush side jambs in a vertical direction.
      2) Brush head jamb in a horizontal direction.
   b. Provide frames with bolted connections between head and vertical jamb sections, assembled with bolts, washers and locking nuts or lock washers. Provide a tight fit between jambs and head frame, with practically unnoticeable joints on the sides and a minimal half "V" joint on the face. Do not use filling compound. Return frames to the wall.
      1) Provide entrance manufacturer's standard head frame face height (between 2" and 2 ½" high) for the elevator hoistway entrance frames
      2) Provisions shall be made for fastening frames to the sills and to the hanger supports. The connection at the hanger support shall insure the alignment of the head jamb or buck with the hanger support. There shall be at least two (2) fastenings on each side jamb between the jamb and the sill.
      3) Each jamb section, installed in a masonry wall, shall be fitted with at least three (3), equally spaced, concealed adjustable anchors.

5. ADA Floor Designations: Provide raised stainless steel tactile and Braille floor designations on flush mounted plates at each hoistway entrance on both sides of jamb, with the raised surface of a material and finish, and the background of a color, as selected. Permanently mount plates in recesses, having a clearance fit not greater than 1/32" at the perimeter. Design and locate plates as required by ADA. Attach plates with concealed mechanical fasteners.
6. Elevator Identification at Designated Floor: Provide raised stainless steel elevator number designations on flush mounted plates, at each hoistway entrance at the Designated Floor on both sides of jamb, with the raised surface of a material and finish, and the background of a color, as selected. Permanently mount plates in recesses, having a clearance fit not greater than 1/32" at the perimeter. Attach plates with concealed mechanical fasteners.
7. Sills: Provide extruded nickel silver sills, with non-slip surface and machined grooves for door guides, securely fasten sills to the floor beams without any visible fastening or holes on top area of sills.
8. Sill Support Angles: Provide steel sill supports, designed for the specified loading type, of sufficient size and strength to properly support the sills, strut angles and door frames. Fastenings and bracing shall be corrosion resistant.
9. Strut Angles: Provide strut angles extending from the sill to the beam above and securely anchored to building construction. Fastenings and bracing shall be corrosion resistant.
10. Door hanger housing and support: The hanger housing support shall be formed of 3/16" thick steel plate and shall extend between and be bolted to the vertical steel struts with not less than two machine bolts at each end. The bottom of the hanger support shall have a horizontal stiffening flange at bottom of not less than 2" deep and a vertical stiffening flange at top not less than 3" high to receive the fascia plate.
    a. The door hangers shall not be an integral part of the door panel.
    b. The door hanger track shall not be an integral part of the door hanger housing.

11. Provide fascia plates, hanger cover plates, toe guards and dust guard aprons as follows:

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a. Fascia plates: Fascia plates shall extend from top of each door hanger support to the sill of door opening above. Elevators with rear or front entrances, that are located above or below the terminal entrances, at the opposite side of the hoistway, shall have fascia plates provided, as necessary, throughout the entire travel of the elevator, in order to provide the code required clearance from the loading side of the car platform and the fascia plate, as indicated in the Code. The plates shall be leveled and reinforced on the back to be free from waves and buckles. Fascia plates shall be secured at hanger support and at sill with oval head machine screws spaced not over 12" on centers. The hoistway face of fascia plates shall be flush with hoistway edge of sill.
b. Hanger cover plates: Sectional hanger cover plates shall be of the removable type. Hanger covers shall be secured in place and be easily removed without the use of special tools. Hanger cover plates shall be manufactured in sections no longer than 3'- 6".
c. Toe guard: A toe guard apron shall be provided, according to Code, below the sill of the bottom landing, and then returned to the wall, at the Code required angle with the vertical.
d. Dust guard apron: A dust guard apron shall be provided extending 6" above the top of hanger housing at the top landing, and then returned to wall, at the Code required angle.
e. Apron and dust guard shall be secured to sill and hanger housing respectively and shall be firmly secured to the hoistway wall.
f. Hanger covers, fascia plates, toe guards and dust covers shall be of 16 gauge galvanized sheet steel and shall extend the minimum of 2" beyond each side of the door opening width.

12. Provide door hardware, including but not limited to the following:
    a. Hanger tracks of high-carbon cold rolled or drawn steel, shaped to permit free movement.
    b. Provide hangers for hoistway door panels and have means to transmit motion from one door panel to the other. Fasten the hangers to the door sections. Provide with reinforcements at the point of attachment. The hanger shall have provisions for vertical and lateral adjustment. The hanger shall be of the two-point suspension type, consisting of nylon or other non-metallic tired sheaves fitted with dustproof, grease packed ball or roller bearings mounted on a malleable iron or steel bracket. The hanger sheaves shall operate at a relatively low rotational speed, and shall roll on a high-carbon, cold-rolled or drawn steel track shaped so as to permit free movement of sheaves without regard to vertical adjustment of sheave, bracket or housing. Beneath the track and each hanger sheave, provide a hardened steel up-thrust roller capable of withstanding a vertical thrust equal to the carrying capacity of adjacent upper sheave. The up-thrust shall have fine vertical adjustments, and the face of the roller shaped so as to permit free movement of the hanger sheave. The up-thrust roller shall have ball or roller bearings. Provide the hanger sheaves with steel fire stops to prevent disengagement from tracks. Fit each hanger sheave with a felt, or similar material, wiper to provide a light lubricating film between the sheave and hanger track.
        1) Do not use hangers that are constructed integrally with the door panels.
    c. Door closers: Provide sill mounted spring operated door closers or spirator type closers mounted in the door header.
        1) The hoistway doors shall be self-locking and self-closing at all times when not engaged with the car doors.
13. Door Stops: Provide means for stopping doors at their limits of travel in the open and close direction, without slamming or jerking. The landing door shall not open past the entrance frame.
14. Interlocks, unlocking devices and contacts:
    a. Equip each hoistway door with true interlock, functioning as hoistway unit system, to prevent operation of car until all hoistway doors are locked in closed position as defined by ASME A17.1. Interlock shall prevent opening of hoistway door from corridor side, unless car is at rest at landing, is operating in leveling zone at landing, or hoistway access switch is used.
        1) Hoistway door interlock shall have successfully met requirements of Rule 2.12.6 of ASME A17.1. Securely fasten approved devices to the entrances, and arrange to operate the interlocks without objectionable noise, shock or jar.
            a) Wiring installed from the hoistway riser to each door interlock shall be NEC type (SF-2), or equivalent.
            b) Type SF-2 cable terminations in the interlock housing shall be sleeved with glass braid jackets.
15. Emergency Unlocking Devices: Provide emergency unlocking devices at each landing, or as directed by the Authority Having Jurisdiction
16. Hoistway Access Switches: Provide hoistway access switches at the top and bottom landings.

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a. Each hoistway access switch shall be an individual fixture with its own surface mounted 1/8" thick #304 stainless steel fixture cover plate and recess mounted box.
b. Mount the hoistway access switches in wall cutouts in the corridor walls adjacent to the top and bottom terminal entrance frames, with the center of the fixtures within 8" of the clear entrance opening and 5'-6" above the finished corridor floor.

2.3 DOOR OPERATOR

A. Provide manufacturer's standard door operators, including but not limited to the following operational features and components:
1. Heavy duty, high speed door operators, with solid state, closed loop motor control, designed to open and close the doors within the times stated in the performance requirements and also close the doors at a reduced speed as required to limit the kinetic energy to that permitted by Code.
2. Door operator motor of the high-internal resistance type, capable of withstanding, without damage, high currents resulting from stall conditions. All door operating arms shall be constructed of ample steel members, the pivot of which shall have ball, roller, or bronze brushed bearings. Operator shall permit easy and smooth operation of the doors at each landing regardless of the weight difference of the doors at each landing.
3. Provisions for the car and hoistway doors to be operated simultaneously by an electric power door operator. Provide smooth operation in both the opening and closing directions and electric cushioning to stop at the full open and closed positions.
4. Provisions for the doors to open automatically when the car stops at a landing.
5. The doors shall be arranged to automatically close at an adjustable predetermined time interval after opening, unless closing is prevented or interrupted by the car door reopening device or the door open button in the car operating panel. A passenger entering or leaving the car shall decrease the length of time the doors remain open. The pressing of a landing call button at a landing where the car is parked shall automatically open the doors.
6. The doors shall be prevented from closing, or be reopened if not fully closed, by actuation of a door reopening device on the car doors or by pressing of the "Door Open" button in the car. The interval of time that the doors remain open at intermediate landings for a car button call shall be less for a stop made in response to an intermediate landing call.
7. Door-opening and closing speeds shall be independently adjustable.
8. Adjustable timing shall be provided to establish independent minimum passenger transfer times for car stops, hall stops, main lobby stops, and door reversal operations, however, the minimum door opened time adjustments shall meet ADA requirements.
9. Door Failure Feature: If the car and landing doors fail to open within an adjustable time period preset initially at twenty (20) seconds after the car is stopped at a landing for which a car call is registered, the door opening signal shall be canceled and the elevator shall answer other car calls. If there are no other car calls registered, the elevator shall return to the main landing without stopping for landing calls.

2.4 CAR DOOR REVERSAL DEVICE

A. The car door reversal device shall be a combination 2D & 3D detection means system. The elevator door protection system shall consist of a Light Curtain, an Approaching Object Detection Means and a Controller. The system shall be designed to detect persons and objects that are in the path of the elevator cab doors or approaching the elevator cab door entrance in accordance with ASME A17.1. The system shall also be designed to ignore stationary persons or objects that are not entering the elevator. The beams shall project across the car opening detecting the presence of a passenger or object. If door movement is obstructed or objects are detected in the approach zone , the doors shall immediately reopen. A mechanical reopening device shall not be acceptable.
1. If an object has been detected in accordance with ASME A17.1 Detection of Approaching Objects or Detection of Objects in the Door Path when the doors are fully open, the hoistway door and car door shall not close or, when the doors are closing, the car door and hoistway door at the landing shall initiate

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a reversal without intentional delay beyond system response time, and shall fully reopen or reopen a minimum of 915 mm (36 in.). If the doors fail to fully close within 10 seconds in addition to the door close data plate value, the doors shall fully reopen.

2. The reopening device(s) shall be permitted to be rendered inoperative when the closing kinetic energy is reduced in conformance with ASME A17.1 requirements for detection of approaching objects within 450 mm (18 in.) of the point at which the leading edge of the leading door panel contacts the door jamb or opposing door panel. Additionally, when 20 seconds have transpired after the detection means of approaching objects first detects an object when an object is detected in the path of the doors, the 20 seconds duration shall reset. When objects are detected within 20 mm (0.75 in.) of the point at which the leading edge of the leading door panel contacts the door jamb or opposing door panel the reopening device(s) are permitted to be rendered inoperative.
3. When the reopening device(s) has been rendered inoperative as detailed above, a continuously sounding audible signal shall be provided with a sound level of 10 dBA minimum above ambient and shall not exceed 80 dBA. The sound level shall be measured 1 m (40 in.) above the landing floor, 500 mm (20 in.) from the door face, along the centerline of the entrance opening, with the doors open. The signal shall sound during door closing until the doors are fully closed. In no case shall the sound level exceed 85 dBA inside the cab and within 300 mm (12 in.) from the centerline of the entrance and 1 m (40 in.) above the floor.
4. Detection of Approaching Objects: The reopening device(s) shall be designed to detect a cylindrical target(s) approaching the entrance opening of the landing-side doors as required ASME A17.1. The approaching object detection means shall be effective until the leading edge of the doors is within 450 mm (18 in.) of the fully closed position and shall be permitted to be effective up to the fully closed position.
5. Detection of Objects in the Door Path. The reopening device(s) shall be designed to detect rectangular prisms positioned as required by ASME A17.1. The device(s) shall be designed to detect prisms positioned anywhere within the opening width of the entrance on the floor and oriented with the 80 mm (3.15 in.) dimension parallel to the floor, the 150 mm (6 in.) dimension perpendicular to the door, and the 50 mm (2 in.) dimension perpendicular to the floor either wholly located between the vertical planes established by the landing-side face of the hoistway door and the car-side face of the car door or centered between the two planes if the distance between the two planes is less than 150 mm (6 in.).
6. Self-Monitoring of Detection Means. The system shall be designed to be self-monitoring. After the door has reached its fully opened position and before door closing is initiated, the detection means shall be self-checked to verify the detection means is operational. If the self-check outcome is unsuccessful, power closing of the door(s) shall be at reduced kinetic energy conforming to ASME A17.1.

2.5 OPERATING PANELS IN CAR

A. The car operating panels shall include, but not be limited to the following features and operating devices:
   1. A series of vandal resistant car call push buttons, manufactured in an approved design, of stainless steel, with a white translucent molded plastic lens in the center of each button.
      a. The buttons shall be equipped with LED lights which illuminate when pressed, indicating that the floor call has been registered and automatically extinguish when the elevator arrives at the selected floor.
   2. Hinged cover plates shall swing open for access away from the car entrance.
      a. Manufacture device cover plates of No. 304 stainless steel, with a No. 4 finish, brushed in a vertical direction.
      b. The entire back surface of the fixture cover plates shall be flush with the surfaces of the front return panel or side wall surface, as applicable.
   3. Digital position indicator at the top of the cover plate.
   4. Raised Braille tactile symbols on flush mounted plates, located adjacent to each operating button or switch. Fabricate plates of a material and finish to match the fixture cover plate. Braille plates shall be attached with concealed mechanical fasteners and when installed shall have a clearance fit, of no greater than 1/32" at their perimeter.
   5. Door open button.
   6. Door close button.
   7. Alarm bell button, which illuminates when activated.

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8. Keyed in-car stop switch.
9. The emergency alarm button, door open button, door close button and In-car stop switch shall be located in a group below the car dispatch buttons.
10. Firefighters' emergency service/operation components behind a locked cover, including Phase II key switch; call cancel button; visual and audible signals; door open/close buttons; and all other related components and instructions required by ASME A17.1.
11. Provide the following manufacturers standard keyed switches and devices in a service panel with a locked, flush stainless steel hinged door, along with three (3) keys for each lock. Provide any other switches or devices, that are required for the proper, Code compliant operation of the elevator: All switches shall include engraved lettering, a minimum of 1/4" high, identifying each device and indicating each position of the switch.

    a. Car light switch and car fan switch, with "Off" "Low" "Med" and "High" designations, each switch keyed alike.
    b. Inspection switch, uniquely keyed, to permit making normal operation inoperative, for the purpose of using hoistway access switches.
    c. Independent service switch, uniquely keyed.
    d. Two pole, three wire, GFCI duplex receptacle, rated for 15 amperes and 125 volts.
12. Provide the following raised letter or engraved instruction and information signs on flush mounted plates as required. Fabricate plates of a material and finish to match the fixture cover plate. Flush mounted plates shall be attached with concealed mechanical fasteners and when installed shall have a clearance fit, of no greater than 1/32" at their perimeter.
    a. Code required warning and no smoking signs.
    b. Car capacity.
    c. Jurisdictional Serial Number (if applicable).
    d. Owner designated car number.
13. Provide a certificate window, manufactured of Lexan, with a back mounted certificate frame in the car operating panel service cabinet door. The surface of the window shall be flush with the surface of the car operating panel service cabinet door.
    a. Size certificate window to suit the certificate of the appropriate jurisdiction, mounted in the proper orientation, for horizontal reading of the information on the certificate.
14. Auxiliary Lighting System: Provide an auxiliary lighting fixture, with a flush mounted translucent Lexan translucent lens, integral with and at the top of car operating panel. The system shall automatically provide emergency light in the car, upon failure or abnormal interruption of the normal lighting service and shall comply with the requirements of ASME A17.1.
15. All other features, devices and signage required as may be required for the specified and Code compliant operation of the elevator.

2.6 CAR EMERGENCY SIGNALING DEVICES

A. Provide a Kings III, RATH® SmartView Two-Way Elevator Visual Communication System, or approved equal, emergency communications device mounted in the car station panel. Emergency communications device shall comply with Americans with Disabilities Act (ADA) and with the currently adopted edition of ASME A17.1 Safety Code for Elevators and Escalators requirements. Emergency In-Car Signaling Devices for two-way communications shall, at a minimum, conform to the following:
    1. A push button to actuate the communications means shall be provided in or adjacent to a car operating panel. The push button shall be visible and permanently identified with the phone symbol in conformance with ASME A17.1. The identification shall be on or adjacent to the phone push button. The communications means shall be initiated when the push button is actuated.
    2. On the same panel as the phone push button, a message shall be displayed that is activated by authorized personnel to acknowledge that communications are established. The message shall be permitted to be extinguished where necessary to display a new message or when the communications are terminated.

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3. On the same panel as the phone push button, messages shall be displayed that permit authorized personnel to communicate with and obtain responses from a trapped passenger(s), including a passenger(s) who cannot verbally communicate or hear.
4. On the same panel as the phone push button, a message shall be displayed that is activated by the authorized personnel to indicate when help is on the way. The message shall continue to be displayed until a new message is displayed or the communications are terminated.
5. The communications means shall provide on demand to authorized personnel information that identifies the building location and elevator number.
6. The communications, once established, shall be disconnected only when authorized personnel terminate the call or a timed termination occurs. A timed termination by the communications means in the elevator, with the ability to extend the call by authorized personnel, is permitted if voice notification is sent by the communications means to authorized personnel a minimum of 3 min after communication has been established. Upon notification, authorized personnel shall have the ability to extend the call; automatic disconnection shall be permitted if the means to extend are not enacted within 20 s of the voice notification.
7. The communications means shall not use a handset in the car.
8. The communications shall not be transmitted to an automated answering system. The call shall be answered by authorized personnel.
9. Operating instructions shall be incorporated with or adjacent to the phone push button.
10. A means to display video to observe passengers at any location on the car floor, to authorized personnel for entrapment assessment, shall be provided.

2.7 CAR CALL STATIONS AT LANDINGS

A. General: Provide ADA/Code compliant corridor push button stations:
   1. Refer to Elevator Drawings for corridor push button station locations.

B. Corridor pushbutton stations shall be as approved by the Architect, including but not limited to the following features and devices:
   1. Vandal resistant LED lit pushbuttons, including the following pushbuttons:
      a. "Up" pushbutton at bottom terminal landings.
      b. "Down" pushbutton at top terminal landings.
      c. "Up" and "Down" pushbuttons at intermediate landings.
   2. Operating device pushbuttons manufactured of stainless steel, with a white translucent molded Lexan lens, in the center of each button, in an approved design. The buttons shall illuminate with LED's when pressed, indicating that the call has been registered and automatically extinguish, when the call has been responded to.
   3. Raised tactile plates containing Braille symbols and words or arrows indicating 'Up' or 'Down', as applicable, on flush mounted plates, located adjacent to each floor call pushbutton. Fabricate tactile plates of a material and finish to match the fixture cover plate. Tactile plates shall be attached with concealed mechanical fasteners and when installed shall have a clearance fit, of no greater than 1/32" at their perimeter.
   4. Due to the environmental conditions the fixtures may be exposed to, additional actions to make the fixtures and components weather resistant to withstand the elements to which this equipment will be exposed are required. This may include but not be limited to the following:
      a. Sealing around the back of the various components.
      b. Application of Conformal Coating on all circuit boards.
      c. Sealing around the back of the position indicator to prevent moisture intrusion

C. Include the following additional features in each corridor push button station at each landing:
   1. Fire pictograph as indicated in ASME A17.1, engraved or etched into each cover plate, at the top of each fixture.

D. Include the following additional features in certain corridor push button stations at the "Designated" Floor.

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1. Firefighters' Emergency Operation Phase I key switch, with Code compliant visual signal and engraved Firefighters' Emergency Operation, Phase I instructions in one corridor push button station at the "Designated" Floor .

E. Provide all other features, devices and signage as may be required for the specified and Code compliant operation of the elevator.

F. Locate corridor call station devices in accordance with the appropriate codes and ADA standards.

G. Cover Plates: Manufacture corridor call station fixture cover plates of No. 304 stainless steel with a No. 4 finish.

H. Fixture Enclosure Boxes: Completely enclose corridor pushbutton station contacts, devices and lamps in steel boxes with an enamel or galvanized finish. Equip boxes for proper adjustment to the wall and provide lamps with light tight compartments.

I. Power: Transformers from the elevator control system shall furnish power for the corridor pushbutton stations.

2.8 SIGNAL DEVICES

A. Digital Car Position Indicator with Directional Arrows:
1. Provide a manufacturer's standard LCD screen or LED digital car position indicator with directional arrows mounted horizontally, at the top, as an integral part of car operating panel. Numerals shall be white. Numeral height shall be ADA compliant. The change in illumination from one floor indication to another shall occur rapidly when the car is approximately midway between floors.
2. The directional arrows, incorporated in the position indicator, shall indicate direction of car travel. The arrow size shall be ADA compliant. The directional arrow in the fixture shall be illuminated to indicate the direction the car is or will immediately be traveling. If, upon arrival at a landing, the direction in which a car will travel upon leaving that landing is not definitely predetermined, its directional arrows shall be extinguished until the direction is established.
3. Audible (In Car) Passing Tone: Provide an audible passing tone which sounds, within the elevator car, to signal as the car passes a floor or stops at a floor served by the elevator. The audible signal shall be adjustable, at any volume level between 20 and 30 decibels, with a frequency of no higher than 1500 HZ.

B. Traveling Lanterns: Provide a manufacturer's standard ADA compliant, in-car traveling lantern in cab entrance column (visible from the floor area adjacent to the hall call buttons), to signal the arrival of the car.
1. Locate the traveling lanterns centerline 6'-0" above the car floor.
2. Provide arrival chimes.
   a. Chimes shall sound once for the "UP" direction and twice for the "DOWN" direction, as the elevator doors are opening. The audible signal that sounds, when the elevator stops at the floor and the doors open, shall be audible at a minimum of 20 decibels, from a dis-tance of 10 feet from the respective elevator.

C. Voice Announcements in the Car:
1. Provide automatic voice announcement system.
   a. Voice announcements shall be made, as specified herein.
   b. Announcements made in an English speaking male and/or female voice, each system shall incorporate the latest solid state, digitized technology with non volatile memory to produce high quality voice announcements.
   c. The system and its memory shall be such that a minimum of 5 (50-word) future messages may be field added to the system.

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1) The recorded messages shall be stored in a non volatile memory bank.

d. The unit in each elevator car shall have a speaker, speaker grill and speaker enclosure located in the car top. Holes shall be factory drilled for the speaker installation. Speaker enclosure shall be properly insulated.

e. Provide encoders and power packs as required for the elevators in each system. During any loss of power or other malfunctions, messages shall not be destroyed or lost.

f. Systems shall include a file directory of all messages and have means for testing the announcements before the systems are placed in actual operation.

g. Volume control: Each elevator shall have a separate volume control switch for raising or lowering the volume. Each audible system shall be no less 20 decibels, with a frequency no higher than 1500 Hz for the male voice.

2. Initially installed verbal announcements shall be made:

a. When a car stops at a landing, indicating the appropriate floor identification announcement.

1) Automatically append “going up” or “going down” to floor announcement whenever direction inputs are activated.

b. When the elevators are recalled on Firefighters’ Emergency Operation, Phase I, indicating:

1) “This car is now in firefighters return service. When the doors open, please exit in a safe and orderly manner.”

a) Message to be repeated until the elevator arrives at the "Designated" or "Alternate" floor and the doors open.

b) Message to be repeated until the elevator arrives at the "Designated" or "Alternate" floor and the doors open.

c. When normal power is lost and the emergency power source is activated, indicating:

1) “This car is transferring to emergency power. When the doors open, please exit in a safe and orderly manner."

a) Message to be repeated until the elevator arrives at the "Designated" or "Alternate" floor and the doors open.

d. When the elevator doors are prevented from closing for an adjustable predetermined time, indicating:

1) “Please allow the doors to close.”

a) Message to be repeated until the electronic infrared door reversal device is cleared of the object blocking it.

3. Submit voice announcement language for approval by the Architect, prior to fabrication.

D. Provide all other miscellaneous signal lights and alarms indicated throughout this section or required by code.

E. Locate all signal devices in accordance with the appropriate codes and ADA standards.

F. Manufacture corridor operation and signal device fixture cover plates of No. 304 stainless steel, with a No. 4 finish.

G. Fixture Enclosure Boxes: Completely enclose signal device contacts and lamps in steel boxes with an enamel or galvanized finish. Equip boxes for hall landing devices for proper adjustment to the wall and provide lamps with light tight compartments.

H. Power: Transformers from the elevator control system shall furnish power for the elevator signal system.

2.9 TRACTION ELEVATOR CONTROLLERS

A. Provide approved manufacturer's standard solid state, microprocessor type control equipment for the elevators, contained in a NEMA 1 enclosure, designed so that dust and dirt will not interfere with the operation of panel components. Provide enclosure with lockable hinged doors. Provide ventilating louvers, with filters and an exhaust fan to dissipate controller heat. The controller shall be of the front wired type only, with no components capable of being serviced from the back of the panel. Design controls for elevator starting and stopping, and to prevent damage to hoist motor from overload or excess current. Provide for controls to automatically

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disconnect power supply, apply brake and bring car safely to rest, in the event of a power failure or in the event of safety device operation.

B. Design all control equipment in accordance with the requirements of the latest edition of CAN/CSA B44/ASME A17.5, and include the following functions and operational features:
   1. Smooth acceleration and deceleration by means of a "Variable Voltage" Solid State closed loop motor control, and by dynamic braking, to a complete stop, before brake application.
   2. Utilization of both distance and velocity feedback systems.
   3. A self-leveling feature that will automatically bring the elevator to the floor landings, under no load to full rated load, without hunting.
   4. Self-leveling shall, within its zone, be entirely automatic and independent of the operating device and shall correct for overtravel, undertravel and rope stretch. The elevator shall be maintained approximately level with the landing, irrespective of load while loading and unloading.
   5. Features that will prevent the car from running under all conditions, as indicated in the Code, including but not limited to the following:
      a. If any hoistway door or gate is open or unlocked.
      b. Failure of any static control device, speed measuring circuit, or speed pattern operating circuit to operate as intended.
      c. Occurrence of a single accidental ground or short circuit.
   6. Coordinated fault protection which protects the entire power circuit against short circuit conditions, limited faults arising from partial grounds, partial shorts in motor armature, or in the power unit itself, protects drive motor against sustained overloads and provides semiconductor transient and incoming line phase sequence protection.
   7. Phase Reversal and Failure Protection: Provide means which will not allow power to be applied to the drive machine in the event of phase reversal, phase failure, low voltage or high voltage which might result in elevator malfunction.
   8. In addition to other components and features, provide the following ASME A17.1 compliant features and devices in the controller:
      a. Necessary devices to run the elevator in inspection operation.
      b. Emergency stop switch. This emergency stop switch when opened shall disconnect power from the brake and prevents the motor from running.
      c. Means from the controller to electrically lift and control the elevator brake to safely bring the elevator to the nearest available landing, in the event of a power outage.
      d. Means from the controller to reset the governor over speed switch and also trip the governor.
      e. Means from the controller to reset the emergency brake when set because of an unintended car movement or ascending car over speed.
      f. Means from the controller to reset elevator earthquake operation.
   9. Provisions to limit acoustical noise in machine room to 70 db during normal operation, measured at minimum distance of five (5) feet from elevator equipment.
   10. Provisions to limit structure borne noises to 60 db, measured at the top landing, five (5) feet from the hoistway doors.

C. All panel wiring shall be neatly formed and tied. Control and signal wires shall be brought to accessible washer type or solder terminals or studs. The wiring of the panel shall be the flame resisting type.

D. The power circuit relay and contactors shall be equipped with contacts designed to prevent fusing.

E. The voltage requirements of the elements in the cabinet shall be adapted to the building supply voltage through step down transformers with taps, power transistors, diodes, etc.

F. Incorporate in cabinet, all switches, contactors, relays, electronic timing devices, time delay devices, solid state components, printed circuit boards, computer modules and fuses.

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G. Provide an adjustable out of service timer that will automatically take the car out of group service, if the car is delayed in leaving the landing, while there are calls existing. The car shall not respond to hall calls while in this mode of operation.

H. Provide door protection timers for both the open and close directions to protect the door motor.

I. Provide a timer to limit the amount of time a car is held at a floor due to a defective hall call or car call, including stuck pushbuttons. Call demand at another floor shall cause the car to eventually ignore the defective call and continue to provide service to other floors.

J. Provide an adjustable electronic door timing device, to control the time the door remains open when a car stops at a landing, independently adjustable for response to car calls and response to hall calls.

K. Mount cabinet securely on substantial self supporting steel frames designed for floor or wall mounting, located in accordance with Code.

L. Provide computer devices, components and related hardware with the following isolation and protection:
1. Isolate the inputs from external devices, such as hall buttons and isolate the outputs to external devices, such as indicators, by means of opto-isolation or similar modules.
2. Provide for separate regulated power supplies to serve each microprocessor computer chassis.
3. Provide isolation and protection as required for the proper operation of computer devices and components.
4. Properly shield cabinets containing memory equipment against line pollution.
5. Include built-in noise suppression devices which provide a high level of noise immunity on double sided printed circuit boards, and on all solid-state hardware and devices.
6. Provide power supplies with noise-suppression devices.
7. Design control circuits so that one side of power supply is grounded to provide for testing.
8. Design the system so that it will start properly when power is restored in the event of a power failure or interruption.
9. Provide system memory, so that data is retained in the event of power failure or disturbance.
10. Design or protect equipment to provide electromagnetic interference (EMI) shielding within F.C.C. guidelines.
11. Provide extender boards, when computing devices are used inside a computer chassis, to facilitate access to the printed circuit cards utilized.

2.10 OPERATION

A. Selective Collective Automatic Operation:
1. Provide Selective Collective Automatic Operation, as defined in ASME A17.1, for all stand alone single elevators which serve more than two (2) landings, including but not limited to the following:
   a. Operating devices for the automatic elevator shall include a series of car call buttons corresponding to the landings served and hall call button fixtures. The operating devices shall be connected to the microprocessor based controller equipment governing floor selection and direction of travel to provide the operation as specified.
   b. A microprocessor based system designed to automatically operate the elevator when one or more car call buttons have been pressed, provided that all safety circuits are closed (in the elevator able to operate mode).
   c. Design the system for operating the elevator from pushbuttons at the landings and car buttons marked for the corresponding landings.
   d. Pressure on a car or landing button shall dispatch or call the car to the landing if interlock circuits have been established.
   e. If a lower floor landing button is pressed while the car is making an upward trip, the call shall remain registered. After the car has reached the upper landing and the interlock circuits have been reestablished, the car shall automatically reverse and respond to the lower landing call.
   f. The elevator shall operate similarly for the down direction of travel. A time limit relay shall be provided to hold the car at the landing where it has stopped, for a predetermined period.

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g. When all calls are completed, the elevator shall park at the last floor served, with its doors closed. Pressing a landing button at the same floor at which the car is parked shall automatically open the car hoistway doors.

2. Provide the following additional features and functions:
   a. Door operation as previously specified.
   b. Load weighing, with an automatic load weighing device, located on the crosshead or beneath the car platform. The load weighing device shall have independent adjustable load settings for by pass and dispatch.
      1) When the load in the car attains a predetermined percentage of the rated capacity load of the elevator, the devices shall operate to bypass landing calls until passengers leaving the car reduce the load below the pre-set value. All passed landing button calls shall remain registered until answered during a following trip. The initial adjustment of load setting shall be approximately 80% of rated load for by pass. The device shall be inoperative when the elevator is on independent operation or firefighters' emergency service.
   c. Independent Operation: Provide a key switch located in the main car operating panel, which when keyed to the "ON" position, shall cause the car to respond only to calls registered on the car operating panel/s and bypass all calls registered on the corridor call button fixtures. Constant pressure of the door close button shall cause the doors to close and the car to respond to the registered car calls. The release of the door close button during the door close cycle shall cause the doors to re-open. The doors shall not close if a car call has not been registered. A system which allows the car doors to close automatically with the registration of a car call, when independent service is activated, shall be rejected.
   d. Seismic controls as required by ASME A17.1.
   e. Specified security features.
   f. Brake Failure Monitoring: Provide for controller to detect the failure of the brake to lift. Detection of failure shall take the elevator out of service at the next landing and remain out of service until condition is corrected.
   g. Protection Against Ascending Car Overspeed and Unintended Car Movement: Provide protection against ascending car overspeed and unintended car movement, in accordance with the requirements of Code.
   h. Inspection operation and hoistway access switches, to initiate movement of the elevator, to operate in conformance with the Code.
   i. All other features required for the specified, safe and code compliant operation of the elevators.

2.11 OPERATION RELATED DEVICES

A. Provide the required encoders, selectors and/or hoistway switches required by the operational systems and Code requirements.
   1. Switches shall be equipped with engaging arms provided with polyurethane tired rollers for engagements with cams.
   2. Landing system shall provide high speed signals and positioning data through use of solid state components. Mechanical type or mechanically driven selectors and or landing systems will not be accepted.
   3. Provide normal terminal stopping switches consisting of positive mechanically operated electrical contacts. Switches shall be equipped with engaging arms provided with polyurethane tired rollers for engagements with cams. These devices shall automatically bring the elevator to a stop at the top and bottom terminal landings with any load up to and including 125% of the contract capacity from any speed attained in normal operation. This device shall operate independently of any other operating devices and shall continue to function until the final limit switch operates.

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4. Provide final limit switches consisting of positive mechanically operated electrical contacts. Switches shall be equipped with engaging arms provided with polyurethane tired rollers for engagements with cams, located at the top and bottom of the hoistway that shall be arranged to automatically stop the car and counterweight within the predetermined over travel limits, independently of all other operating devices.
5. Provide stop switches per the Code. Pit stop switches shall be capable of being padlocked in the off position only.

2.12 MOTOR CONTROL

A. Provide voltage control which utilizes voltage obtained from a fully integrated, digital, closed loop Variable Voltage, Variable Frequency AC Flux Vector microprocessor controlled drive unit with an AC regeneration system. The drive shall be provided with means for, switching arrangements to permit the passage of regenerated power and a smoothing reactance to eliminate completely mechanical vibrations and structure borne sound from ripple voltage transients. Provide filter equipment to provide transient reflected wave forms on the elevator feeders under normal and standby conditions similar to those experienced with motor generator sets, for the successful operation of installed computer equipment without uninterrupted power.
   1. The solid state motor control system shall govern the starting, stopping and direction of travel of the elevator and provide the operation specified. Control shall be accomplished by a solid state motor control for each elevator with which the voltage applied to the hoisting motor is variable. Control equipment shall be magnetic, suitable for the motors and type of operation specified and shall provide smooth acceleration from stop to full speed, deceleration and landing stops under any load condition.

B. Solid state motor control unit shall operate with high efficiency and low power consumption, have sufficient capacity to handle peak currents typical of elevator service and contain a balanced, coordinated fault protection system.

C. The equipment shall be designed to operate at 90% 110% of the normal line voltage and plus or minus 3% of feeder frequency without damage or interruption of elevator service.

D. The static motor drive unit shall be especially designed for elevator service and must comply with the A17.1 Code. At no time shall the motor be used in a plugged mode, nor shall load absorbing ballast resistors be used except for emergency stopping as a result of line loss.

E. Provide means to prevent damage to circuit elements (solid state boards, etc.) during high speed stops (emergency stop button activation, etc.). An elevator will not be accepted if upon a high speed stop, equipment component failure is realized.

F. Provide protective devices to prevent damage to complete power circuit and the power semi conductors under the following conditions: Over or under voltage; Short circuit or bolted fault conditions; Limited faults arising from partial grounds, partial shorts in the motor armature or in the power unit itself.

G. Protect the drive motor against sustained overloads. A solid state overload circuit shall be used.

H. Protect motor and power unit against instantaneous peak overload.

I. Provide semi conductor transient protection.

J. Provide phase sequence protection to insure incoming line is phased properly.

K. Noise Suppression for Solid State Devices:
   1. Provide solid state devices designed for a high level of noise immunity. Provide suppression devices incorporated in the power supplies and inputs and outputs associated with solid state components.
   2. Protect building system power line against line voltage transients by providing each elevator drive system with a isolation transformer, chokes for the motor and devices to limit distortion.

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a. Total harmonic distortion (THD) shall be limited to the following at any motor speed from 50 to 100 percent.
   1) Equipment input voltage waveform: Less than 3% THD.
   2) Equipment input current waveform: Less than 10% THD.

3. Measure distortion requirements at secondary of building system transformer used to provide power to elevator system.
4. The Elevator Contractor shall provide, at no additional cost, any additional devices required to meet the above THD limits.

2.13 CAR TOP INSPECTION STATION

A. Provide for code compliant car operation from the car top, when the car is on inspection service.

2.14 PERFORMANCE REQUIREMENTS

A. Prior to acceptance by the Owner, adjust the elevators to meet the following performance requirements.
1. Speed: +/ 3% of contract (rated) speed under any load condition or direction.
2. Capacity: Safely lower, stop and hold up to 125% rated load.
3. Automatic Self Leveling: Provide a self leveling feature that will automatically bring the elevator to the floor landings within a tolerance of 1/4" under no load to full rated load without hunting. Self leveling shall, within its zone, be entirely automatic and independent of the operating device and shall correct for overtravel, and undertravel and rope stretch. The elevator shall be maintained approximately level with the landing, irrespective of load while loading and unloading. The elevator shall not have roll-back when starting, under any load conditions.
4. Door Operating Time
   a. 3'-6" wide single speed center opening:
      1) Between 1.5 and 1.8 seconds, start of opening to fully open.
      2) Between 1.8 and 2.1 seconds, start of closing to fully closed.
5. Specified door close speeds notwithstanding, the kinetic energy generated by the force of the closing door and all of its hardware shall not exceed the limits set by Code, during any closing operation. Additionally, the force required to stop the closing door from rest shall not exceed 30 lbf (133 N).
6. Vibration, Acceleration and Deceleration Control:
   a. Elevator equipment shall be installed and adjusted to meet the performance specified herein within the following parameters.
   b. Horizontal vibration within cars during all riding and door operating conditions shall not exceed 15-mg, peak-to-peak.
   c. Vertical vibration within cars during all riding and door operating conditions shall not exceed 15-mg, peak-to-peak.
   d. Maximum jerk shall not exceed 7 feet/second^3.
   e. Acceleration and deceleration shall be constant and not exceed 5 feet/second^2.
   f. In accomplishing the above requirements, Contractor shall maintain a comfortable elevator ride with smooth acceleration, retardation and soft stop. Door operation shall be quiet and positive with smooth checking at the extremes of travel.
7. Noise Control:
   a. Measured noise levels in the elevator shall not exceed:
      1) Sound in car at rated speed with fan operating: 65 dBa.
      2) Sound in car with door opening, closing or reversing: 67 dBa.
8. Floor-to-Floor Travel Time:
   a. Travel time includes car start to car stopped level at the next successive floor, under any loading condition or travel direction, without "hunting" at the floor level, not including door operation time.
      1) A maximum of 1.0 second shall be allowed from door close to car start.

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b. Floor-to-Floor Travel Time Matrix follows:

Feet Travel	11 ft.	12 ft.	13 ft.	14 ft.	15 ft.	20 ft.	30 ft.	Each additional 10 feet
Floor-to-Floor Travel Time								
Speed 150 fpm	7.5 Sec.	7.9 Sec.	8.3 Sec.	8.7 Sec.	9.1 Sec.	11.1 Sec.	15.1 Sec.	4.0 Sec.

2.15 BATTERY POWERED ELEVATOR LOWERING DEVICE

A. Provide a battery powered elevator lowering device, including all wiring and components, to automatically lower the elevator, at inspection speed, to an available floor in the event of a main power supply failure, allowing for rescue of passengers who would otherwise be trapped in the elevator.
   1. When operating on the battery lowering device, all operating and electrical protective devices shall function as prescribed by code.
      a. The procedures to test, service and repair the battery powered elevator lowering shall be documented and located in the elevator control/machine room

2.16 FIREFIGHTERS' EMERGENCY OPERATION

A. Provide Firefighters' Emergency Operation (phases I & II) in accordance with the requirements of ASME A17.1 and the requirements of the local AHJ.
   1. Confirm the assignment of alternate and designated floors with the local fire authority, by way of the GC.
   2. Connect the elevator smoke detection system to the elevator control systems, for activation of Firefighters' Emergency Operation (Phase 1).
      a. Elevator smoke detection system to be provided by divisions other than Division 14.

2.17 AC PERMANENT MAGNET GEARLESS MACHINE, SUPPORTS & SHEAVES

A. Provide a permanent magnet, synchronous design, AC gearless traction elevator machine, mounted at the top of the hoistway. The traction driving sheave and brake disk shall be mounted to the motor shaft. Machine shall be mounted to a structural bed plate of sufficient design for compliance with ASME A17.1.
   1. Motor: The motor shall be one hour rated, class F insulation, shall operate on AC current and be designed to develop the required high starting torque with a low starting current. The motor shall be suited in all respects to the VVVF AC flux vector, regenerative motor control used. All parts shall be capable of meeting the severe requirements of elevator service.
      a. The motor shall have sufficient capacity and have suitable characteristics, in connection with the type of control used, to produce an average rate of acceleration under full load of not less than 3.5 feet (1.07 meters) per second per second and not more than 7 feet (2.13 meters) per second per second measured from the start of the car motion to the time of attaining 80% of the contract speed. The rate of acceleration shall permit adjustment after installation is made and the final adjustment shall be such as not to produce any objectionable physiological effects on the passengers.
      b. Machine shall be totally enclosed, self-cooling without the use of auxiliary fan(s) for cooling.
      c. The motor shall be designed and be of ample size, so that forced air cooling is not required.
      d. The speed of the elevator, with the controls intended to operate at full speed, shall not vary more than 3% of the normal rated speed under all loads within the capacity range.
   2. Shaft: The hoisting machine shaft shall be supported by two bearings mounted on a bedplate or integral with the machine frame. The shaft shall be of forged steel or close grain electric furnace cast steel.
   3. Bedplate: The bedplate shall be of cast iron or steel in one piece, either separate, or integral with the machine frame, or may consist of heavy structural shapes welded together. The bedplate shall be

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designed to provide the rigidity required to maintain accurate alignment of parts. Accurately machined surfaces shall be provided to seat all parts secured to the bedplate or machine beams. The use of brackets or other extensions bolted to the bedplate as supports for principal parts will not be permitted. All parts shall be bolted in place with finished bolts or cap screws. Dowels may be used to ensure proper positioning of parts.

4. Bearings: The bearing pedestals shall be rigidly fastened to, or be integral with the main structure of bedplate or the machine frame. The bearing mounting and method of machine and assembly shall be such as to insure accurate bearing alignment. Bearings shall be of the ball or roller bearing type. The bearings shall be dust tight and shall incorporate sealed for life technology, or be arranged for grease lubrication and fitted with grease gun connections and drain plugs.
5. Demountable Sheave: The demountable traction sheave shall be of hard alloy cast iron, semi-steel or cast steel of approved composition and shall measure between 220 and 240 Brinell, with true running, smooth turning grooves and flanges. The sheave shall be free from cracks and/or other imperfections. The traction sheave shall be of a suitable diameter for the hoisting ropes/ belt steel cords provided, not less than forty (40) times the diameter of the hoisting ropes/belt steel cords.
    a. The sheave shall be suitably grooved to produce required traction and shall be thick enough to provide for future groove wear.
    b. Permanently and legibly mark the sheave to show the groove bottom diameter and the minimum remaining thickness of metal for regrooving.
6. Braking System: Provide machine with two independent braking systems (service and emergency), designed as to be effective to the extent of stopping the car during emergency stop and holding the car under all conditions of loading or operation.
    a. Each of the two independent braking systems shall be individually controlled and shall have the capacity to stop and hold the car with 125% of its rated load in accordance with the A17.1 Code.
    b. The brake disk/drum shall have the wearing surface and edge of flange turned smooth, and the wearing surface shall run true within a minimum variation of .005 inch. Service and emergency brake operation shall be designed and operate as per ASME A17.1.
    c. Provide means from the controller to reset the emergency brake, when set because of an unintended car movement or ascending car over speed.
    d. The brake linings shall be of a suitable asbestos free fireproof friction material shaped to the shoes so that the disk will run free of contact with the shoes.
    e. The brake shall lift prior to movement of the car after the landing and car door interlocks have been closed. The car shall stop electrically prior to the application of the machine brake.

B. Machine Beams & Sheave Supports:
1. Provide all required manufacturer's standard machine supports and sheave supports.
    a. Sheaves shall be securely mounted to their supports in proper alignment with the traction drive sheave and each other.

C. Deflector And Idler Sheaves:
1. Provide all required deflector and idler sheaves, including suitable sheet metal guards with service openings.
    a. Each sheave shall be of hard alloy cast iron, cast steel or semi-steel, with true running, smooth turning grooves and flanges. Each sheave shall be of suitable diameter as required by the manufacturer, but not less than the diameter required by Code for the ropes/belts utilized. The rope grooving for each sheave shall provide a smooth rope/belt bed. Mark each sheave as required by Code.
    b. Provide sealed for life sheave bearings.
    c. Provide each sheave with a sheave guard of such construction as to withstand shock and prevent the ropes from leaving their respective grooves.

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2. Isolate the AC gearless traction elevator machine assembly from the building structure with isolation pads, washers and bushings as designed and manufactured, specifically for this project's requirements, by "Fabreeka" Vibration and Shock Control.
   a. The vibration isolator manufacturer's representative shall determine isolator sizes and mountings, and shall provide field supervision and inspection to assure proper installation, adjustment and performance. The neoprene thickness and durometer shall be sized appropriate to the loading to achieve no greater than 10 Hertz natural resonance.
      Mounting bolts used through pads shall be completely separated from the equipment using elastomeric grommets.

2.18 CAR GOVERNOR

A. Provide manufacturer's standard self-resetting governor assembly including tension sheave assembly, governor rope and all required supports, sheaves, guards, rope retainers, and mountings for the entire governor system. The governor shall be provided with an electrical overspeed switch to cut off power to the hoist motor and apply the brake if the elevator overspeeds in either direction before governor tripping speed is reached, as per ASME A17.1.
   1. The governor shall be of the self-resetting type, designed and constructed so that no access to the governor in the top of the hoistway is required for resetting the governor or overspeed switch.
   2. Governor rope gripping device shall be so designed that no appreciable damage to or deformation of the governor rope or car safety device shall result from the stopping action of the device in operating the car safety. The rope grip jaws for a governor used with Type B Safety shall be of the parallel jaw type of such shape and length that pull through action of governor rope as required by Code will result in a minimum amount of rope abrasion.
   3. Sheave: The governor sheave shall be of hard alloy cast iron, cast steel or semi steel, with true running machine finished groove and flanges. Sheave shall be free from cracks, sand holes or other imperfections.
   4. Bearings: The governor sheave shaft bearings shall be manufacturer's standard sealed for life bearings. Means of lubrication shall be provided for all rotating parts and pins.
   5. Rope and Tension Sheave: The governor, rope and tension sheave with weight(s) shall be mounted in such locations as to eliminate danger of accidental damage to the equipment. The tension sheave assemblies in the pits shall permit free vertical movement of sheave while maintaining a uniform predetermined governor rope tension. The tension sheave shall be similar In diameter to the governor sheave and shall be provided with similar type bearings. The governor rope system, including the governor and tension sheave, shall be arranged so that the carrier will not release due to system dynamics when the elevator is subjected to an emergency stop in the up direction.
   6. Protective Coating: Governor parts, with the exception of finished surfaces, shall be finished at the factory with not less than one prime and one finish coat of machine enamel. Field painting of governor parts shall not be permitted.
   7. Data Plate: The governor data plate, permanently affixed to the governor, shall be of corrosion resistant metal, located so that it can be easily read without removal of guards.

2.19 SUSPENSION MEANS AND GOVERNOR ROPE

A. All Cars Utilizing Traction Steel Hoist Ropes: Provide 8x19 or 8x25 sealed construction traction steel hoist ropes of a design compliant with ASME A17.1, suitable for the duty of the elevator equipment specified herein. All hoist ropes of a complete set installed on any one elevator shall be from the same identical factory run. The appropriate handling, socketing and inspection procedures outlined in the Inspectors Manual A17.2 shall apply.
   1. Properly secure the ends of hoist ropes to the car and counterweight headers (or to dead end hitch plates) with adjustable rope shackles having individual tapered babbitted sockets. Fit each hoist rope shackle with a suitable shackle nut, lock nut and shackle cotter pin. Shackle hoist ropes in a manner to allow adequate take up for future stretch and provide shackle springs
      a. Code compliant wedge type shackles are permitted.

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B. Flat coated steel belts, along with manufacturer's standard belt attachments and related flat coated steel belt components are acceptable, in lieu of hoist ropes, for machine room-less elevators.
   1. Flat Coated Steel Belts:
      a. Steel suspension ropes shall not be less than 9.5 millimeters in diameter.
      b. Suspension means shall be rated FT-1 or greater in accordance with test requirements of UL 62 and UL 1581.
   2. Flat Coated Steel Belt Monitoring System:
      a. Provide a system to continuously monitor the integrity of the flat coated steel belts.
      b. The "Flat Coated Steel Belt Monitoring System" shall be considered part of the elevator system and shall become property of the Owner upon completion of and acceptance and payment for the elevator construction work

C. All Cars: Provide traction steel governor rope suitable for the governor furnished, with code required rope guards.

D. All Cars: Provide hoist rope/belt and governor rope data tags of corrosion resisting material.

2.20 ASCENDING CAR OVERSPEED & UNINTENDED CAR MOVEMENT

A. Provide manufacturer's standard electrical and mechanical devices and features for protection against ascending car overspeed and unintended car movement, in accordance with the requirements of ASME A17.1.

2.21 PLATFORM AND SLING

A. Platform: Provide manufacturer's standard code compliant elevator platform constructed of a steel frame and steel stringers, factory and field welded together into one integral unit, with the stringers so located, as to accommodate the capacity of the elevator and the type of loading, so that wheel loads will not deform the sub or finished floor.
   1. Construct the flooring as follows:
      a. Bottom Layer: Code compliant sheet steel fireproofing.
      b. Second Layer: 5/8" thick fire-retardant-treated (FRT) plywood.
      c. Third Layer: 5/8" thick fire-retardant-treated (FRT) plywood.
      d. Finish Floor: By Division 9.
   2. Design platform in accordance with the type of loading specified, to receive the type of finished flooring indicated. Provide substantial supports for all auxiliary apparatus, such as traveling cable hangers, safety device, load weighing devices, etc.
   3. Condition the platform sub floor surface so that it is clean, smooth, firm and free from dirt or any other damaging material; fill all cracks and holes, plane, scrape, or sand smooth all ridges or other uneven surfaces.
   4. Platform Apron: Provide a 48" long, code compliant platform apron.

B. Sling: Provide a sling constructed of steel shapes, bolted together, consisting of cross head and bolster with channel uprights, gusset plates and diagonal bracing.
   1. Connect the sling to the counterweight frame by steel hoist ropes/belts which run over the hoist machine traction sheave. The ropes/belts shall be of a sufficient number to obtain the factor of safety required by Code.

2.22 CAR SAFETY DEVICE

A. Provide manufacturer's standard governor actuated mechanical car safety device mounted under the car platform and securely bolted to the car frame. The car safety shall be Type "B" flexible guide clamp conforming with the Code identifications and classification of car safety devices.

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1. Data Plate: The car safety marking plate shall be of corrosion resistant metal and, in addition to the data required by the Code, shall indicate the manufacturers' name and manufacturer's catalog designation number for the safety.
2. Release: Safeties shall be released by lifting the car by means of the hoisting machine.
3. Operation: The car safety shall be operated by a speed governor, located overhead, driven by a governor rope suitably connected to the governor rope releasing carrier. The governor shall be equipped with rope grip jaws designed to clamp the governor rope so as to actuate the car safety upon a predetermined downward overspeed.

2.23 COUNTERWEIGHT

A. Provide manufacturer's standard counterweight consisting of a steel frame with metal filler weights guided by roller guide shoes.
1. Provide all required counterweight guards, as per Code.
2. Adjust weight as necessary to equal car weight plus approximately 40% to 50% of rated load, as directed by the manufacturer.
3. Filler weights shall be held securely in alignment with tie rods passing thru holes in the weights and frame members. Equip rods with double locknuts secured by cotter pins at each end.

2.24 GUIDE RAILS

A. General: Provide car and counterweight guide rails manufactured of hot rolled structural steel "T" section, machine finished members, conforming to the requirements of the Code, with guiding surfaces accurately planed or ground to a sufficiently precise tolerance to be classified as "Class A".
1. Provide car and counterweight guide rails of a sufficient size (weight per foot) to allow for Code compliant vertical spacing of the car and counterweight guide rail brackets, based upon the specific loads imposed upon the guide rails.
   a. All Cars: In no case shall the minimum car guide rail weight per foot be less than 15 lbs/ft (Nominal).
   b. Cars H1 Thru H6: In no case shall the minimum counterweight guide rail weight per foot be less than 15 lbs/ft (Nominal).
   c. All Cars Other Than H1 Thru H6: In no case shall the minimum counterweight guide rail weight per foot be less than 12 lbs/ft (Nominal).
2. Extend the car and counterweight guide rails from the pit floor channels to a point, 2 inches below the underside of the top of the hoistway.
3. Attach to and support the car guide rails on the car buffer footing channel.
   a. Manufacture the car buffer footing channel of structural steel of a sufficient size to support the impact loads of the car guide rails, upon setting of the car safety, and the impact loads of the car buffer/s at maximum strike speed.
   b. Design the car buffer footing channel to extend the full distance from back-to-back of the car guide rails.
4. Attach to and support the counterweight guide rails on the counterweight buffer footing channel.
   a. Manufacture the counterweight buffer footing channel of structural steel of a sufficient size to support the weight of the counterweight guide rails and the impact loads of the counterweight buffer/s at maximum strike speed, additionally, if a counterweight safety is provided, the impact loads of the counterweight guide rails, upon setting of the counterweight safety.
   b. Design the counterweight buffer footing channel to extend the full distance from back-to-back of the counterweight guide rails.
5. Provide the guide rails with tongued and grooved joints, with a smooth running surface.
   a. Machine the back of each guide rail to provide a seating surface for the steel fish (splice) plates.
   b. Join the guide rails with 3/4" minimum thick fish (splice) plates.
      1) Provide lock washers for all fastenings.
   c. Fill and file uneven guide rail joints on each side of the joint to provide a smooth running surface.
6. Securely fasten the guide rails to the building structure with code compliant steel rail slip clips and brackets.

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a. Isolate the steel guide rail brackets from the building structure with isolation pads, washers and bushings as designed and manufactured, specifically for this project's requirements, by "Fabreeka" Vibration and Shock Control.
b. The vibration isolator manufacturer's representative shall determine isolator sizes and mountings, and shall provide field supervision and inspection to assure proper installation, adjustment and performance.

7. Install and align the car and counterweight guide rails so that the faces of the rails are plumb, within 1/8" from top to bottom of hoistway.
   a. Provide metal shims for alignments.
      1) Design and install the metal rail shims to remain in position, in the event the fastening bolts loosen.
      2) Space rail brackets horizontally, to allow no less than 1/4" of rail shims between the rail bracket and rail mounting.
8. Machined surfaces of the guide rails shall be provided with a corrosion preventive coating.
   a. Before the elevator is placed in service, the coating shall be removed.
9. Upon final acceptance of the elevator, the guide rail backs and supports shall be clean, free from rust, and any signs of abrasions and painted black.

B. Provide all car and counterweight guide rail support brackets, mounted to the building structure, as required by Code and approved by the Structural Engineer.
   1. All guide rail joints shall be so located as not to interfere with supporting clips and brackets.
   2. Provide lock washers for all fastenings.

2.25 GUIDE SHOE ASSEMBLIES

A. Roller Guide Shoes: Provide roller guide assemblies for the car and counterweight.
   1. Mounting: Guide shall be provided with adjustable mountings and rigidly secured in accurate alignment.
   2. Roller Assembly: Each roller guide shall consist of rollers assembled on a metal base and designed and mounted so as to provide continuous contact of all rollers with the corresponding three finished rail surfaces under all conditions of load and operation. The roller guide shall operate quietly under all conditions, and shall be equipped with polyurethane roller wheels. Each roller shall rotate on precision grade sealed bearings and be held in contact with the rail surfaces by fully adjustable stabilizing springs. Provide adjustable stops for control of postwise float.
      a. Car rollers shall not be less than 6" diameter.
      b. Counterweight rollers shall not be less than 3 ¼" diameter.
      c. Provide 6-wheel roller guide assemblies for the car and counterweights.
      d. Fabreeka pad material shall be used as roller guide tires.
         1) The vibration isolator manufacturer's representative shall determine isolator sizes and mountings, and shall provide field supervision and inspection to assure proper installation, adjustment and performance.
   3. Balancing: Balance elevator car in both side to side and front to back directions.

2.26 CAR AND COUNTERWEIGHT SPRING BUFFERS (With Rated Speed Not In Excess of 200 fpm)

A. Provide spring buffers designed for the duty required and suitable for space conditions available.
   1. The stroke of the buffers shall be such that the retardation, averaged over the entire stroke, shall not exceed 32.2 ft/s2 when struck at 115% of rated speed.
   2. Provide buffer footing/jack support channels, as indicated above under “Guide Rails”.
   3. Metal Oxide Waterproofing: The pit will be furnished with metal oxide waterproofing by a division other than Division 14. Elevator Contractor shall follow the following procedures:

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a. Install the footing channels in the pit directly on the structural concrete pit floor, prior to the application of the metal oxide waterproofing.
b. Coordinate with the General Contractor, relative to the timing of the application of waterproofing, to ensure that the elevator work in the pit is performed, prior to the application of the metal oxide waterproofing.
c. Provide a bituminous coating on any steel surface that will be contacted by the metal oxide waterproofing material.

4. Buffer marking plates shall be constructed of corrosion resistant metal. In addition to the data required by Code, the marking plates for the buffers shall indicate the manufacturer's name, buffer identification number and the elevator car speed. Buffers shall be tested in accordance with the Code.
5. Provide pipe stands suitable for the depth of the pit, struts, braces and other supports, as required for the proper support of the buffers.

2.27 SUPPORTING STRUCTURE

A. Provide all structural steel machine and sheave support beams, framed into structural building steel, if required. Provide bearing plates and anchors as required to mount beams and support steel securely in place. Provide shelf angles in web of beams for metal decking for floor support, as required.
1. Design machine beams for not less than the sum of the following loads:
a. The load resting on the beams, which shall include the complete weight of the machine, sheaves, controller, governor, and any other equipment, together with that portion of the machine room floor supported thereon; and
b. Two times the sum of the tensions in all wire ropes supported by the beams with rated load in the car.
2. Structural slabs for supporting machines are not acceptable.

B. Provide isolation to prevent sound and vibration transmission to the building structure.

C. Prior to bidding this work, review the Structural Drawings for the project and advise the GC in writing of any additional structural supports, not indicated on the Structural Drawings, that may be required for support of guide rails, in a Code compliant fashion.
1. All additional structural steel required for supporting elevator guide rails, that is not indicated on the Structural Drawings and is not identified in writing to the GC, as omitted from the Structural Drawings, prior to the bid, shall be provided by the Elevator Contractor.
2. Where the rails can be made adequate with the use of larger guide rail sections, larger guide rail sections may be provided.

D. No attachments may be made to hoistway walls, unless approved by the Structural Engineer.

E. Provide all brackets required for elevator equipment, mounted to structural building components.

F. If inserts are to be utilized for rail brackets, furnish same, together with detailed drawings and instructions indicating their exact location in the hoistway and instructions for their installation, in ample time for their placement at the proper location during construction of the elevator hoistway.
1. No attachments shall be made to masonry walls unless walls have been reinforced.

G. Provide all brackets, bolts and fastening devices for the proper installation of all elevator equipment.

2.28 LUBRICATION

A. Provide every part subject to movement friction with sealed bearings or provisions for lubrication.

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PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
1. Refer to Section 14 05 00.

B. Sheet Steel Accessories:
1. Securely fasten dust covers to the door hanger housing and building construction. Hanger covers shall be used at all landings. Dust covers shall be used over the top terminal landing door only.
2. Securely fasten toe guards to the bottom terminal landing.

C. Operating Devices:
1. Locate operating devices in accordance with ADA.

D. Guide Rails:
1. Guide rails shall be plumb and parallel with a maximum deviation of 1/8” from the top to the bottom of the hoistway.
2. Alignment shall be done with steel shim plates.
3. Shims shall be designed so that if the bolts become loose the shims will stay in place and not fall out.
4. Protect guide rails against rust during construction by paint or grease and shall be thoroughly cleaned and smooth before the car is put into operation.

E. Guide Rail Brackets:
1. Fasten guide rail brackets to concrete structure with proper inserts and insert bolts, through bolts, adhesive anchors (such as "Hilti HVA Adhesive Anchor System"), or as approved.
2. Fasten guide rail brackets to structural steel with through bolts.
3. Attach guide rails to brackets with through bolts and steel clips.

F. Entrances:
1. After guide rails are set and aligned, the entrance frames shall be installed in perfect alignment with the guide rails. Finished wall shall then be completed.
2. The work shall be erected with accuracy and all supporting members shall be rigidly secured to the structural parts of the building. All parts shall be plumb and leveled.
3. Sills shall be set level with the finished floor and the inner edges plumb, so that there will be no variation in the distance between the edge of all sills and the edge of the car platform. Hanger supports shall be erected in perfect alignment, with the edges of the sills, sill grooves and head jambs to insure smooth operation of the doors.
4. Doors and hangers shall be accurately adjusted and all working parts carefully cleaned and lubricated. Guide grooves in the thresholds shall be cleaned. The entire installation shall be cleaned after erection.
5. Frames and sills shall have protective coverings applied at the factory to prevent damage to the material and finish by this or other trades. The coverings shall be maintained complete, until their removal is directed by the Owner's Representative. After coverings have been removed, the exposed surfaces shall be cleaned.

3.2 ELECTRICAL WORK

A. General: Completely insulated wiring shall be furnished and installed to connect all parts of the equipment furnished by the elevator contractor. All wiring shall be copper and shall conform to the requirements of the latest edition of the National Electrical Code. Include rigid conduit or EMT, at least 1/2" diameter, and short

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lengths of flexible conduit. Conduit or EMT shall terminate in junction boxes. Conduit, EMT, wiring duct, conduit fittings, enclosures and junction boxes shall be galvanized steel or aluminum. All wiring shall have a flame retarding moisture resisting outer cover and shall be run in metal conduit, flexible metallic tubing, or wire ducts. Provide rigid steel conduit for all raceways embedded in concrete slabs. Raceway terminal fittings must provide conductor passageways free from burrs, shoulders or other projections which will reduce internal passage area or cause abrasion of conductors being pulled through.

B. Execution: Install all power wiring in raceway systems with proper strain relief. No exposed wiring or conduit shall be run in finished areas without prior written approval of owner.
   1. All electrical components within 4'-0" of the pit floor shall be rated NEMA 4.
   2. Splice cables and wires only in outlet boxes, junction boxes or pull boxes. (Note - Wire splicing is not permitted in raceways or wire ducts).
   3. Install cable supports for all vertical feeders in accordance with the NEC. Provide Kellems Grip type supports which firmly clamp each individual cable and tighten due to cable weight.
   4. Terminate conduit or EMT at junction boxes.
   5. Bring all wiring and traveling cables to accessible numbered terminal blocks at their terminals in the machine room, the elevator car junction box, the hatch junction box, stations within the cab, the supervisory control panel and on the controller.
   6. Provide all required traveling cables. Traveling cables shall have flame retarding and moisture resisting outer cover. They shall be flexible, with a wire rope steel core to relieve strains in the individual conductors. Suspended the traveling cables properly to relieve strains in the individual conductors. Provide the required quantity of conductors, plus at least 10 percent spares.
      a. Run traveling cables in conduit or duct from the bottom of the car to the car top junction box.
      b. Hang travel cables so that the proper size loop may be obtained.
      c. Provide suitable shields or pads, wherever necessary, to prevent contact between the traveling cables and the hoistway construction.
      d. Provide all required pairs of shielded conductors for the operation of the specified elevator related features and functions, including security and communications devices.
      e. provide 2 coaxial cables for security use.
      f. Conductors shall be numbered to correspond to numbered terminals at the car and control/machine room.
   7. All terminal strip connections shall be identified with corresponding reference numbers from cable termination chart and electrical straight line diagrams.
   8. Terminal blocks shall be coded to identify the circuits. Multi-conductor cables shall have the conductor color coded and numbered.
   9. Unless otherwise specified, control wiring shall be copper, minimum size #18 AWG. Wire size shall be large enough so that the voltage drop under inrush conditions will not adversely affect operation of the controls.
   10. Provide wiring free from short circuits or grounds and insulation resistance between external conductors, and between conductors and ground of not less than one megohm.
   11. Provide 3-phase power monitor for elevator power supply which monitors phase loss, low and high voltage, phase reversal, phase unbalance, and has manual and automatic reset positions. (Device will be kept in manual position during normal operation).
   12. Provide flame-resisting type intra-panel wiring.

3.3 PAINTING

A. Equipment furnished under this division, except that presenting a non corrosive, enameled or similar finished surface shall be factory painted with not less than one shop applied priming coat and one shop applied finish enamel coat, in the manufacturer's standard color.

B. Painting of the Pit and Machine/Control Room Floors:
   1. Upon completion of the elevator work, seal the pit and machine room floors with gray enamel floor paint, treated with aggregate for slip resistance.
   2. Provide two coats, applied by roller-coat.

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C. Painting Procedures:
1. Surfaces to be painted shall be clean and dry. Remove dirt, oil, grease, stains, rust and any other foreign substance.
2. Surfaces that have been shop prime painted shall have any chipped or abraded places, weld scars and rust spots touched up with metal primer.
3. Protect adjacent work and materials by suitable covering or other method during work progress.
4. Upon completion of painting in each space, remove protective coverings and coatings and touch up any damaged paint finish.
5. Application shall be according to the manufacturer's recommendation. Finish work shall be uniform, of approved color, smooth and free from runs, sags, defective coverage, clogging or excessive flooding. Edges of paint adjoining other materials or colors shall be sharp and clean without overlapping.

3.4 CLOSEOUT

A. Final Cleaning and Touch-up:
1. All debris shall be removed from the elevator equipment spaces and elevator work related spaces; elevator equipment and elevator equipment space surfaces shall be wiped clean; and elevator equipment paint finished surfaces shall be touched up and restored if damaged or defaced, to coincide with completion of each phase.
2. Completed installation shall be free of dirt, debris, scratched or otherwise marred equipment finishes, squeaks, rattles and/or other objectionable sounds.

B. Demonstration:
1. Instruct Owner's personnel in proper use, operation, and daily housekeeping maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of operational failure and other building emergencies.

C. Refer to Division 01 for additional completion and closeout procedures.

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SECTION 21 12 00
STANDPIPE SYSTEMS

1.0 GENERAL

1.1 Related Documents

A. Drawings, Hydraulic Calculations, and general provisions of the Project Manual shall apply to this Section.

B. See Hydraulic Calculations following specification.

1.2 Summary

A. Work Included: The Work of this Section includes, but is not limited to the following:

1. This specification applies to the new installation of the Class I manual dry standpipe system in the Legislative Hall Parking Garage building in Dover, DE.

2. Drawings supplied with this specification shall be used as a reference for the requirement and location of system components.

3. At the time of the bid, all exceptions taken to these Specifications, variances from these Specifications and all substitutions of equipment specified shall be listed in writing and forwarded to the Architect and the Building Owner via the general contractor. For equipment substitutions, the "Request for Alternative Manufacturer" form shall be submitted. Any such exceptions, variances, or substitutions, which were not listed at the time of bid and are identified in the submittal, shall be grounds for immediate disapproval without comment.

B. Refer to the overall bid package for the overall scope of the project.

C. The Work includes all labor, materials, tools, transportation, and temporary construction necessary to design, fabricate, install, test, and flush a fully operational and code compliant, standpipe system. The scope is to be indicated by the following and as shown on the design drawings:

1. Install a new standpipe system within the new parking garage.

2. Install fire stopping materials at all penetrations of fire-resistance rated walls and all floor/ceiling assemblies. Rated walls include but are not limited to corridor walls, mechanical and electrical rooms, storage rooms, and shafts.

3. Hose valves shall be in installed in locations to avoid mechanical damage.

D. Drawings supplied with this specification shall be used as a reference for the requirement and location of system components. Work includes visiting the site to observe the existing conditions, and confirmation of the required quantities of devices and specific options for locations of the same.

E. The Work includes all fees and activities required to secure approvals for necessary State and Local permits.

F. The Work includes submitting detailed Working Plans and Product Data to the Engineer for review prior to submitting same to local officials for approval and permit.

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G. The Work includes submitting As-built Plans and closeout documentation to the Engineer for review prior to scheduling Owner demonstration training.

H. The Work includes training Owner's personnel on the operation of the system, required maintenance tasks and frequencies, and the locations of all spare tools and equipment, valves, pressure switches, risers, low point drains, nitrogen compressors, and equipment necessary to maintain and operate the standpipe systems.

1.3 Performance Requirements

A. Standpipe System, a Class I manual dry standpipe system shall be installed to provide hose connections for fire department use at each intermediate landing within the three (3) stair enclosures. The fire department pumping apparatus shall provide the necessary flow and pressure to properly operate the system.

B. The standpipe system shall be installed as indicated on the plan drawings. The standpipe system shall be installed in accordance with NFPA 14.

C. Pipe sizes shall be determined by hydraulic calculations in accordance with NFPA 14. Verify that field modifications to the system, which require the addition of fittings and pipe, do not affect the hydraulic demand of the standpipe system.

1. If, given the available water supply as indicated above, the standpipe system cannot be designed in compliance with this specification and the applicable codes and standards, provide a report to the Owner documenting the design options that have been investigated. Additionally, copies of the hydraulic calculations, which demonstrate the inability of the water distribution system to supply the necessary water for the sprinkler system demand, shall be submitted for each option.

D. The standpipe system shall be designed according to the following:

1. As required by the jurisdiction, a minimum 5 psi safety margin shall be provided between the residual water supply pressure and the required standpipe system demand pressure at the calculated system design flow.

2. Class I Manual Dry Standpipe System Design:
   a. Flow Rate per Hose Valve: 250 gpm
   b. Number of Hose Valves in Operation: 4
   c. Discharge Pressure: 100 psi
   d. Total Flow: 1000 gpm
   e. Safety Margin: 5 psi

3. Calculate pressure loss due to elevation and friction loss through all fittings, pipes, valves, and backflow prevention devices in accordance with NFPA 14.

E. Components shall be capable of producing piping systems with 175-psig (1200-kPa) minimum working-pressure rating, unless otherwise indicated.

1.4 Order of Precedence

A. Should conflicts arise out of discrepancies between documents referenced in this specification, the most stringent requirement shall apply; however, should a level of stringency be indeterminable, the discrepancies shall be resolved as follows:

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1. State and local codes shall take precedence over this specification.

2. The National Fire Protection Association Standards shall take precedence over this specification.

3. This specification shall take precedence over the drawings.

1.5 Submittals

A. Pre-Installation Documentation: Prepare and submit electronic submittal packages to the general contractor to be distributed to the Building Owner and the Architect for approval prior to submitting same to local officials for approval and permit. Resubmit portions or entirety of submittal to address Engineer comments prior to submitting package to local officials for approval and permit. The pre-installation submittal package shall include:

1. Product Data: For each product specified in Part 2. Submittal shall indicate listing and approvals, selected options, finishes, etc. and electrical characteristics.

   a. Contractor shall uniquely identify each item to be submitted, where multiple products or finishes are shown for a manufacturer's data sheet.

2. Working Plans: Minimum 1/8"=1'-0" scale inclusive of information required by NFPA 14 requirements.

   a. Where Working Plans deviate from the signed construction documents prepared by the fire suppression consultant, the Contractor shall submit Working Plans sealed and signed by a registered Professional Engineer (P.E.) in Delaware.

   b. A single Professional Engineer (P.E.) registered in Delaware shall be the Engineer of Record for the project, therefore, where the Contractor modifies any portion of the signed construction documents; all components of the Working Plans shall be sealed and signed by a single registered P.E. in Delaware.

3. Hydraulic Calculations: Prepared in accordance with NFPA 14 requirements. Minimum one (1) calculation for each standpipe system. One (1) calculation required when standpipe system pipe sizing and arrangement remains typical.

   a. Where the Hydraulic Calculations deviate from the signed construction documents prepared by the fire suppression consultant, the Contractor shall submit Hydraulic Calculations sealed and signed by a registered Professional Engineer (P.E.) in Delaware.

   b. A single Professional Engineer (P.E.) registered in Delaware shall be the Engineer of Record for the project, therefore, where the Contractor modifies any portion of the signed construction documents; all components of the Working Plans shall be sealed and signed by a single registered P.E. in Delaware.

B. Acceptance Documentation: Submit the following to the Owner, Engineer and authorities having jurisdiction once system installation is complete, including field quality control and commissioning activities, and is otherwise "ready" for authority approval.

1. Field Test Reports and Certificates: indicate and interpret test results for compliance with performance requirements and as described in NFPA 14. Include "Contractor's Material and Test Certificate for Aboveground Piping". Make submittal after commissioning and prior to acceptance testing.

2. Statement of Completion: Upon completion of the installation of the automatic sprinkler system, a signed written statement, substantially in the form as follows:

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"The undersigned, having been engaged as the Sprinkler Contractor for the Legislative Hall Parking Garage Building in Dover, DE, confirms that the standpipe system equipment was installed in accordance with the diagrams, instructions, directions, and technical specifications provided to us by the Manufacturer and the Building Owner."

C. Acceptance Documentation: Prepare and submit electronic copies of closeout documentation packages to the Engineer for review prior to scheduling Owner demonstration and training. Resubmit portions or entirety of submittal to address Engineer comments prior to scheduling demonstration and training. The closeout submittal package shall include:

1. Maintenance Data: The maintenance manual shall describe in detail the purpose and function of all standpipe system devices and valves. The manual shall also include all necessary inspection, testing and maintenance forms. The Sprinkler Contractor shall provide the Building Owner with one (1) copy of NFPA 25, Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems, in addition to the maintenance manual.

2. As-Built Drawings: Showing all field changes from original Working Plans. Submit full-size hard copy and electronic AutoCAD files on USB drive. Coordinate AutoCAD version with Owner at time of submittal.

3. As-Built Hydraulic Calculations: Showing all field changes from original Working Plans.

4. Valve Chart: Provide a drawing on 11-inch x 17-inch paper identifying the location of the control valves for the standpipe system shown on the floor plan of the building. This valve chart shall be framed and permanently installed in the valve room.

5. Statement of Warranty.

1.6 Coordination

A. Coordinate the installation of the standpipe system modifications and testing of associated equipment with all related trades, contractors, equipment maintenance and testing representatives, the Engineer, the Owner and the authorities having jurisdiction.

B. The Fire Protection Contractor shall furnish and install all sprinkler pressure switches, valve supervisory switches, and electric bells. The Fire Alarm Contractor shall be responsible for all wiring connections to all sprinkler pressure switches, valve supervisory switches and electric bells. The Fire Protection Contractor shall be responsible for adjusting the pressure switches and the valve supervisory switches to report a change in status.

C. Coordinate standpipe and hose connection location and installation with other portions of the Work to minimize the risk of mechanical damage.

D. Coordinate standpipe installation with other portions of the Work to comply with NFPA 14 requirements.

E. Coordinate and receive approval from Owner and/or Engineer for the routing of piping before installation.

F. Coordinate standpipe system with building structure.

1.7 Quality Assurance

A. Equipment and devices shall be listed and labeled for the intended use by UL.

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B. Electrical components, devices, and accessories shall be listed, approved, and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

C. All materials and equipment shall be new and unused.

D. All equipment shall be first quality and capable of complying with all requirements of this specification and shall have been continuously offered for sale and in service in commercial applications for at least one year. Obsolete equipment shall not be used.

E. Installer Qualifications: Licensed in the State of Delaware and experienced in the installation of standpipe systems in facilities similar to the Work described herein and has obtained design and inspection approvals for similar projects from authorities having jurisdiction.

F. Foreman: Provide proof of competence of both their company and the individual foreman that will be assigned to this project, in the area of installing standpipe systems for at least five (5) years and acceptable to Owner. Once assigned, the foreman shall not be changed without the approval of the Owner.

G. Service Organization: Capable of providing a service technician on-site within 4 hours of a request for on-site service.

H. The standpipe system shall comply with all applicable state and local codes, including:

1. Building Code of the City of Dover in the State of Delaware (DBC), which adopts and amends the International Building Code, 2009 Edition

2. Fire Prevention Code of the City of Dover in the State of Delaware (DFC), which adopts and amends the International Fire Code, 2009 Edition.

3. The Delaware State Fire Prevention Regulations, which adopt:

a. The Fire Code (NFPA 1 – 2021 as amended)

b. The Life Safety Code (NFPA 101 – 2021 as amended)

I. Products, installation, and testing shall be in accordance with the applicable provisions of the latest published edition of the following as referenced by the aforementioned codes and standards:

1. NFPA 14-2019, Standard for the Installation of Standpipe and Hose Systems

2. NFPA 25-2017, Standard for Inspection, Testing and Maintenance of Water-Based Fire Protection Systems

3. NFPA 70-2017, National Electrical Code

4. NFPA 72-2019, National Fire Alarm Code

1.8 Scheduling

A. The Contractor's Foreman shall act as primary point of contact and responsible-in-charge for coordinating the Pre-Acceptance Test with the other portions of the Work, Owner, and the Engineer.

B. The Contractor's Foreman shall act as primary point of contact and responsible-in-charge for coordinating the Final-Acceptance Test with the other portions of the Work, Owner, Engineer and the AHJs.

NOT FOR BIDDING

C. Upon award, the Contractor shall provide a schedule to the Owner and Engineer for the milestones and construction progress.

1.9 Extra Materials

A. Furnish extra materials described below that match the products installed and that are preserved for long-term storage in accordance with manufacturer instructions (e.g. packaged with protective covering) and identified with labels describing the contents.

1.10 Warranty

A. Guarantee equipment installed to be free from defects in workmanship and inherent mechanical defects for a period of two (2) years from the date of substantial completion of the project. See Part 1 "Submittals".

1.11 Qualification of Bidders

A. All contractors connected with this project shall provide proof of competence of both their company and the individual foreman that will be assigned to this project. The Contractor shall have been in the business of installing standpipe systems for at least five (5) years, acceptable to the fire suppression consultant and the Owner. Once assigned, the Contractor's foreman shall not be changed without the approval of the fire suppression consultant and the Owner.

B. Contractor shall be licensed in the State of Delaware and experienced in the installation of standpipe systems and has obtained design and inspection approvals for similar projects from authorities having jurisdiction.

C. The Contractor shall have on-staff a minimum NICET Level III certified technician who is experienced in providing standpipe system installation services.

D. Each proposed bid shall be professionally presented, be bound, and shall include a title page and index.

E. As a minimum, all bidding contractors shall include the following in the standpipe system bid:

1. The names and qualifications of the Contractor's foreman, project manager and project engineer who shall be in responsible charge during the entire project installation. Contractor's qualifications shall include years in business, service policies, warranty definitions, and prior experience with similar installations.

2. A list of at least three (3) similar installations with addresses of properties, contact names and types of system equipment installed.

3. The price for the system as specified and the prices for required and recommended alternatives. The prices for fabrication and on-site installation of each system shall include all subcontractor and manufacturer's (as it applies) on-site representative labor costs. The Contractor shall list all deviations and/or exceptions to these specifications as proposed alternatives.

4. Nonconformance to the Qualification of Bidders requirements outlined in this specification shall be cause for immediate dismissal of the Bid Documents without comment.

5. The award of the contract shall be based on the submitted information and all considerations in the best interests of the Building Owner. Once the contract is awarded, no requested changes for equipment, suppliers or subcontractors shall be accepted unless justification is made in writing.

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Once assigned, the Contractor's foreman shall not be changed without the approval of the fire suppression consultant and the Building Owner. Upon written request from the Contractor, the fire suppression consultant and the Building Owner may authorize changes, but at their sole choice and discretion. The Contractor shall be at risk for any attempt to substitute the equipment suppliers or subcontractors accepted. All cost for removal, relocation, or replacement of a substituted item shall be at the risk of the Contractor.

2.0 PRODUCTS

2.1 Manufacturers

A. Subject to compliance with the requirements of this section, product selection shall be limited to those offered by manufacturers included in the "Available Manufacturer" lists in each Part 2 article. Substitution of the products listed requires approval by the Owner in writing prior to installation. The contractor shall submit a "Request for Alternative Manufacturer" form, completed in full, for approval by the Owner and engineer. (Applicable form will be provided).

B. Where lists are not indicated, products, subject to compliance with the requirements of this section, may be obtained from an approved domestic manufacturer.

C. All products are to be approved and labeled for use by UL and/or FM Global.

2.2 Pipe and Tube

A. Standard-Weight Steel Pipe: ASTM A135, and A795, Type F, Grade A; Schedule 40 galvanized steel.

1. Threaded ends for all piping 1-inch through 2-inch .

2. Cut-grooved ends or roll-grooved ends for all piping 2 ½-inches and larger

3. All piping, couplings, and fittings shall be painted. One (1) coat of primer and two (2) coats of epoxy paint. Paint shall be suitable for exterior environmental application.

2.3 Pipe and Tube Fittings

A. Dry Standpipe System Fittings and couplings shall be galvanized.

B. All piping, couplings, and fittings shall be painted. One (1) coat of primer and two (2) coats of epoxy paint. Paint shall be suitable for exterior environmental application.

C. Cast-Iron Threaded Fittings: ASME B16.4; Class 125 or Class 250 pattern as required by application.

D. Malleable-Iron Threaded Fittings: ASME B16.3; ASME B16.4; Class 125 or Class 250 pattern as required by application.

E. Steel Threaded Couplings: ASTM A865; ASME B16.4; Class 125 or Class 250 pattern as required by application.

F. Steel Welding Fittings: ASTM A234/A 234M, ASME B16.9, or ASME B16.11; 300-psi pressure rating.

NOT FOR BIDDING

G. Cast-Iron Threaded Flanges: ASME B16.1; ASME B16.4; Class 125 plain face or Class 250 raised face pattern as required by application.

H. Steel Flanges and Flanged Fittings: ASME B16.5; ASME B16.4; Class 125 plain-face or Class 250 raised face pattern as required by application.

I. Flange Gaskets and Bolts

1. Plain-face Flanges: ASME B18.2.2 heavy-series hex-nuts and ASME B18.22.1 plain washers with ASME B16.21 1/8" full-face rubber gasket.

2. Raised-face Flanges: ASME B18.2.2 heavy-series hex-nuts and ASME B18.22.1 plain washers with ASME B16.20 1/8" spiral wound gasket.

J. Mechanical Grooved-End Fittings:

1. Assembly Pressure Rating: 300-psi.

2. Fittings and Couplings: UL 213; ASTM A536 ductile iron body.

3. Couplings: UL 213; ASTM A536 ductile iron rigid or flexible pattern as required by application.

4. Gaskets and Bolts: Pre-lubricated EPDM gaskets with ASTM A183 zinc-plated nuts and bolts.

5. Available Manufacturers
   a. Reliable Co.
   b. Tyco Co.
   c. Victaulic Co.
   d. Viking Co.
   e. Or approved equal.

K. Mechanical Tees: The use of mechanical tees shall not be permitted.

2.4 Valves

A. General: Minimum 175-psig (1200-kPa) non-shock working-pressure rating unless higher pressure rating is required by application or otherwise indicated. Valves for grooved-end pipe may be furnished with grooved ends instead of flanged ends.

B. Gate Valves; NPS 2-inch (DN50) and Smaller: UL 262; cast-bronze, threaded ends; solid wedge; OS&Y; and pre-grooved rising stem. NPS 2-1/2-inch (DN65) and Larger: UL 262, iron body, bronze mounted, tapered wedge, OS&Y, and pre-grooved rising stem. Include replaceable, bronze, wedge facing rings and flanged ends.

1. Available Manufacturers
   a. Reliable Co.
   b. Tyco Co.
   c. Victaulic Co.
   d. Viking Co.

NOT FOR BIDDING

e. Or approved equal.

C. Indicating Valves; NPS 2-inch (DN65) and Smaller: UL 1091; butterfly or ball-type, bronze body with threaded ends; and integral indicating device and pre-wired supervisory switch. NPS 2-1/2-inch (DN65) and Larger: UL 1091; butterfly-type, ductile-iron body with grooved ends; and integral indicating device and pre-wired supervisory switch.

1. Available Manufacturers
   a. Reliable Co.
   b. Tyco Co.
   c. Victaulic Co.
   d. Viking Co.
   e. Or approved equal.

A. Ball Drip Valves: UL 1726, automatic drain valve, NPS 3/4 (DN20), ball check device with threaded ends. Automatic ball drip valve shall be installed on the pipe to the fire department connection to prevent water being trapped in the pipe which may become subject to freezing.

1. Available Manufacturers
   a. Reliable Co.
   b. Tyco Co.
   c. Victaulic Co.
   d. Viking Co.
   e. Or approved equal.

1.2 Hose Connections

A. General: UL listed/or FM approved nominal 2 1/2-inch angle hose valve connection.

B. Pressure Rating: 300-psi minimum unless otherwise indicated or required by application.

C. Finishes: shall be coordinated with Architect and Owner, but shall include the following:

1. Corrosion-resistant.

D. Available Manufacturers

1. Elkhart Brass
2. FPPI
3. Potter Roemer.
4. Or approved equal.

1.3 Pressure Gauges

A. Water Pressure Gauges: UL 393, 3-1/2- to 4-1/2-inch- diameter dial with dial range of 0 to 250 psig.

NOT FOR BIDDING

B. Available Manufacturers

1. Brecco Corp.

2. Dresser Instruments.

3. US Gauge

4. Or approved equal.

1.4 Fire Alarm Monitoring Devices

A. General: NEMA enclosure suitable for intended application; include tamper resistant cover with switch that transmits signal upon removal of cover; 250-psi pressure rating; two sets, single-pole double-throw form C contacts.

B. Valve Supervisory Switches: UL 753 with normally closed contacts and compatible with valve stem to be monitored.

C. Available Manufacturers

1. Grinnell Corp.

2. Potter Electric Signal Co.

3. System Sensor Div.; Honeywell, Inc.

4. Or approved equal.

1.5 Pipe Sleeves

A. General: Provide pipe sleeves where piping passes entirely through walls, floors, and partitions. Secure sleeves in position during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, and roofs. Provide 1-inch minimum clearance between exterior of piping and interior of sleeve or core-drilled hole. Firmly pack space with mineral wool insulation. Seal space at both ends of the sleeve or core-drilled hole with plastic waterproof cement, which will dry to a firm but pliable mass, or provide a mechanically adjustable segmented elastomeric material. Penetrations of fire-rated barriers, wall and floor assemblies shall be sealed with a listed through penetration firestopping assembly.

1. Sleeves in Masonry and Concrete Walls, Floors, and Roofs: Provide hot-dip galvanized steel, ductile-iron, or cast-iron sleeves. Core-drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in the core-drilled hole are completely grouted smooth.

2. Sleeves in Other Than Masonry and Concrete Walls, Floors, and Roofs: Provide 26-gauge galvanized steel sheet.

1.6 Nitrogen Generator

A. UL listed nitrogen generator capable of providing 98% nitrogen purity.

B. Self-contained unit with steel enclosure and membrane type nitrogen generator.

NOT FOR BIDDING

C. Nitrogen generator shall have bypass alarm and leak monitoring.

D. Riser-mounted ECS SMART Vent (PSV-D/DE)

E. ECS Protector SMART Gas Analyzer (SGA-1)

F. Handheld Gas Analyzer (PHGA-1)

G. Available Manufacturers

1. Model ECS AG-6500

2. Or approved equal

1.7 Fire Department Connection (FDC)

A. Provide a check valve with automatic ball drip valve between the fire department connection and the connection to the fire protection water supply.

B. Provide a UL listed / FM Approved wall-mounted fire department connection with polished chrome finish.

C. Provide a 5-inch Storz-type connection with a 90 degree elbow.

2.0 EXECUTION

2.1 Examination

A. Coordinate examinations with the Owner.

B. Coordinate location on piping and hose connections prior to preparing pre-installation submittal.

C. Examine walls and partitions for suitable thickness, fire- and smoke-rated construction, framing and other conditions where piping and hose connections will be installed prior to preparing pre-installation submittal.

2.2 Preparation

A. Prepare and submit an electronic “Pre-Installation Documentation” submittal package stamped by a registered Professional Engineer to the fire protection consultant for review prior to submitting same to local officials for approval and permit. Resubmit portions or entirety of submittal to address the fire protection consultant’s comments prior to submitting package to local officials for approval and permit. See Part 1 “Submittals” for submittal content.

B. Obtain authority approval and permits with reviewed “Pre-Installation Documentation” submittal package.

2.3 Piping Applications

A. Use the following:

1. NPS 6-inch (DN150) to NPS 2-1/2-inch (DN65): Schedule 40 galvanized steel pipe with cut-grooved ends; steel, grooved-end fittings with rubber gaskets; and grooved joint couplings.

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2. NPS 2-inch (DN50) and Smaller: Schedule 40 steel pipe with threaded or cut-grooved ends, cast- or malleable-iron threaded fittings, and threaded joints.

3. ASTM A53 and ASTM A135: Sprinkler System Piping.

B. Use threaded or grooved-end fittings to make changes in direction, branch takeoffs from mains and reduction in pipe sizes. Mechanical fittings are not permitted for branch line connections or sprinkler connections.

2.4 Piping Installation

A. Refer to manufacturer's specifications and NFPA 14 for basic piping installation.

B. Pitch dry standpipe system in accordance with NFPA 13.

C. Install exposed piping in normally occupied areas as tight to ceiling as possible. Rise with elbows in series as necessary to adjust final height of piping. Cut hanger rods to length that allows nuts to be tightened flush with ceiling and leaves band hangers at the highest elevation possible.

D. Use threaded or grooved-end fittings to make changes in direction, branch takeoffs from mains and reduction in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2-inch (DN50) and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.

F. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2-inch (DN65) and larger connections as required for proper connection.

G. Install auxiliary drains for complete system drainage. All drain piping shall be routed to a location approved by the Owner.

H. Hangers and Supports: Install according to NFPA 14.

I. Install piping with cut-grooved joints according to manufacturer's written instructions. Construct rigid piping joints through masonry penetrations. Provide flexible couplings within 1-foot of each side of the floor/ceiling assembly on vertical sprinkler supply risers.

J. Install pressure gauges on risers or feed main and on both sides of every check valve. Include pressure gauges with connection not less than NPS 1/4 (DN8) and with soft metal seated 3-way valve, plugged at one end and arranged for draining pipe between gauge and valve. Install gauges to permit removal and install where they will not be subject to freezing.

K. Flanges and unions with special transition fittings with pressure ratings the same as or higher than the systems pressure rating may be used in aboveground applications, unless otherwise indicated.

L. Pipe Painting

1. Piping that is exposed shall be painted. Painting shall be provided by a qualified contractor. Piping is to be primed with a metal primer and two coats of finish are to be applied. The contractor shall provide a color sample for approval prior to commencing painting. All piping and fittings shall have a finished painted color of red throughout where required.

2.5 Joint Construction

NOT FOR BIDDING

A. Refer to manufacturer's specifications for basic piping joint construction.

B. Steel-Piping, Grooved Joints: Use Schedule 40 steel pipe with cut-grooved ends; steel, grooved-end fittings; and groove couplings. Assemble joints with couplings, gaskets, lubricant, and bolts according to manufacturer's written instructions.

C. Dissimilar-Piping-Material Joints: Construct joints using adapters or couplings compatible with both piping materials. Use dielectric fittings if both piping materials are metal.

D. Refer to Manufacturer's specifications for grooved pipe fittings, pipe-flange gasket materials and welding filler metals.

E. Joint compound or tape shall be applied to male pipe threads only for all threaded joints.

F. Transition Couplings: AWWA C219, sleeve type, or other manufactured fitting the same size as, with pressure rating at least equal to, and with ends compatible with piping to be joined.

2.6 Valve Applications

A. Drawings indicate valve types to be used.

2.7 Valve Installation

A. Install valves in accessible locations with indicators clearly visible from floor level. Where valves are located above ceilings or accessible through access panels, provide and install signs to identify locations.

B. Maintain riser control assemblies at 7'-6" above the finished floor. Where this installation height is not feasible, an alternate location shall be proposed by contractor for review and approval by the fire suppression consultant and the Building Owner prior to installation.

C. Hose valve connections shall be installed at each intermediate landings.

D. Maintain hose valve connections at 3'-6" above the finished floor. Where this installation height is not feasible, an alternate location shall be proposed by contractor for review and approval by the fire suppression consultant and the Building Owner prior to installation.

E. All valve locations shall be subject to AHJ approval

2.8 Fire Alarm Monitoring Device Installation

A. Install valve supervisory switches to be connected to the Fire Alarm system.

B. Coordinate installation, wiring connections, and testing with the Fire Alarm System Contractor.

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2.9 EXTERIOR WALL PENETRATIONS

A. Include escutcheons and watertight annular-space “soft” seal of appropriate size for the intended hole and pipe diameters, as recommended by the seal manufacturer. Seal material shall be of an approved type.

2.10 Labeling and Identification

A. Install signs, labeling, and pipe markers on all valves, equipment, drains, and piping in accordance with NFPA 14.

B. Signs and label styles and locations shall be coordinated with and approved by the Owner and the authorities having jurisdiction prior to installation.

C. Install hydraulic design information signs on the “main system riser”.

D. Provide exterior signage for fire department connection.

2.11 Field Quality Control

A. Perform hydrostatic test of entire standpipe system and inspect piping according to NFPA 14, "System Acceptance" Chapter. Coordinate hydrostatic test date and time of test with the Owner and the authorities having jurisdiction.

B. Perform water discharge test as required by the AHJ.

C. Replace piping system components that do not pass test procedures and retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.

D. Report test results promptly and in writing to the Owner, Engineer, and the authorities having jurisdiction. See Part 1 “Submittals”.

2.12 Cleaning and Protection

A. Clean dirt and debris from equipment.

B. Wipe all excess pipe joint compound from threaded pipe joints.

C. Wipe all excess oil from the exterior surface of piping.

D. Protect equipment from damage until substantial completion by other trades that may be working in building.

2.13 Commissioning

A. Verify that specialty valves, trim, fittings, controls, and accessories are installed and operate correctly.

B. Verify that specified tests of piping are complete.

C. Verify that damaged equipment is replaced with new, correct type.

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D. Verify that fire department connections have threads compatible with the local fire department equipment and fire department connections and associated piping is adequately braced and restrained.

E. Verify that labeling, identification, and signage is installed.

F. Energize circuits to electrical equipment and devices.

G. Coordinate with fire alarm contractor to perform acceptance test with new valve monitoring devices and sprinkler system alarm devices. Operate as required.

H. Report completion of commissioning promptly and in writing to the Owner, Engineer and the authorities having jurisdiction. See Part 1 "Submittals".

2.14 Acceptance Tests

A. Coordinate with fire alarm contactor for acceptance tests. Operate as required. Demonstrate system components to authority having jurisdiction as necessary.

2.15 Project Closeout Procedures

A. Submit Project Closeout Documentation; see Part 1 "Submittals".

B. Schedule Owner demonstration and training with the Owner. Provide at least ten (10) working days' notice.

C. Demonstrate equipment, specialties, and accessories with the Owner. Review operating and maintenance information with the Owner.

END OF SECTION

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SECTION 21 13 16
DRY-PIPE SPRINKLER SYSTEMS

1.0 GENERAL

1.1 Related Documents

A. Drawings, Hydraulic Calculations, and general provisions of the Project Manual shall apply to this Section.

B. See Hydraulic Calculations following specification.

1.2 Summary

A. Work Included: The Work of this Section includes, but is not limited to the following:

1. This specification applies to the new installation of the automatic sprinkler system in the Legislative Hall Parking Garage building in Dover, DE.

2. Drawings supplied with this specification shall be used as a reference for the requirement and location of system components.

3. At the time of the bid, all exceptions taken to these Specifications, variances from these Specifications and all substitutions of equipment specified shall be listed in writing and forwarded to the Engineer and the Building Owner via the general contractor. For equipment substitutions, the "Request for Alternative Manufacturer" form shall be submitted. Any such exceptions, variances, or substitutions, which were not listed at the time of bid and are identified in the submittal, shall be grounds for immediate disapproval without comment.

B. Refer to the overall bid package for the overall scope of the project.

C. The Work includes all labor, materials, tools, transportation, and temporary construction necessary to design, fabricate, install, test, and flush a fully operational and code compliant, automatic dry-pipe sprinkler system. The scope is to be indicated by the following and as shown on the design drawings:

1. Install a complete new automatic sprinkler system throughout the building.

2. Install fire stopping materials at all penetrations of fire-resistance rated walls and all floor/ceiling assemblies. Rated walls include but are not limited to corridor walls, mechanical and electrical rooms, storage rooms, and shafts.

3. Sprinkler guards to be installed for all sprinklers below obstructions and where the sprinklers are subject to mechanical damage.

D. Drawings supplied with this specification shall be used as a reference for the requirement and location of system components. Work includes visiting the site to observe the existing conditions, and confirmation of the required quantities of devices and specific options for locations of the same.

E. The Work includes all fees and activities required to secure approvals for necessary State and Local permits.

F. The Work includes submitting detailed Working Plans and Product Data to the Engineer for review prior to submitting same to local officials for approval and permit.

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G. The Work includes submitting As-built Plans and closeout documentation to the Engineer for review prior to scheduling Owner demonstration training.

H. The Work includes training Owner's personnel on the operation of the system, required maintenance tasks and frequencies, and the locations of all spare tools and equipment, valves, pressure switches, risers, low point drains, nitrogen compressors, and equipment necessary to maintain and operate the sprinkler systems.

1.3 Performance Requirements

A. Dry-pipe, hydraulically calculated automatic fire sprinkler systems shall be installed in all areas of the building where the temperature is not maintained at 40°F or higher at all times.

B. Upright sprinklers or dry pendants shall be installed as noted on the plans. All sprinklers installed shall be quick-response corrosion resistant type unless otherwise noted or required by NFPA 13.

C. Pipe sizes for piping downstream and including riser control assemblies shall be determined by hydraulic calculations in accordance with NFPA 13. Verify that field modifications to the system, which require the addition of fittings and pipe, do not cause the hydraulic demand to exceed the available water supply including safety margin.

1. If, given the available water supply as indicated above, the automatic fire sprinkler system cannot be designed in compliance with this specification and the applicable codes and standards, provide a report to the Owner documenting the design options that have been investigated. Additionally, copies of the hydraulic calculations, which demonstrate the inability of the water distribution system to supply the necessary water for the sprinkler system demand, shall be submitted for each option.

D. Sprinkler system shall be designed according to the following:

1. A minimum 5 psi safety margin shall be provided between the residual water supply pressure and the required sprinkler system demand pressure at the calculated system design flow, including all hose allowances.

2. Sprinkler Occupancy Hazard Classifications shall be as follows:
   a. Light Hazard
      1) Lobbies
      2) Bathrooms
   b. Ordinary Hazard, Group 1
      1) Mechanical spaces
      2) Electrical rooms
      3) Storage rooms
   c. Ordinary Hazard, Group 2
      1) Vehicle Parking Areas.

3. Minimum Density for Automatic Sprinkler System Piping Design:
   a. Light Hazard Occupancy: 0.1 gpm/s.f. over 1,950- s.f. area
   b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm/s.f. over 1,950- s.f. area
   c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm/s.f. over 1,950- s.f. area.
   d. Quick response area reduction shall <u>not</u> be permitted per NFPA 13.

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4. Maximum Protection Area per Sprinkler:
    a. Ordinary Hazard Areas: 130 s.f. standard spray sprinklers
    b. Sprinklers shall be spaced per NFPA 13 requirements.
    c. All obstruction rules shall be strictly adhered to. Additional sprinklers shall be added, where required for compliance with NFPA 13.
5. Calculate pressure loss due to elevation and friction loss through all fittings, pipes, valves, and backflow prevention devices in accordance with NFPA 13.
6. Hose Allowance:
    a. A total inside and outside hose allowance of 250 gpm shall be required for ordinary hazard occupancies.

E. Components shall be capable of producing piping systems with 175-psig (1200-kPa) minimum working-pressure rating, unless otherwise indicated.

1.4 Order of Precedence

A. Should conflicts arise out of discrepancies between documents referenced in this specification, the most stringent requirement shall apply; however, should a level of stringency be indeterminable, the discrepancies shall be resolved as follows:

1. State and local codes shall take precedence over this specification.
2. The National Fire Protection Association Standards shall take precedence over this specification.
3. This specification shall take precedence over the drawings.

1.5 Submittals

A. Pre-Installation Documentation: Prepare and submit electronic submittal packages to the general contractor to be distributed to the Building Owner and JENSEN HUGHES for approval prior to submitting same to local officials for approval and permit. Resubmit portions or entirety of submittal to address Engineer comments prior to submitting package to local officials for approval and permit. The pre-installation submittal package shall include:

1. Product Data: For each product specified in Part 2. Submittal shall indicate listing and approvals, selected options, finishes, etc. and electrical characteristics.
    a. Contractor shall uniquely identify each item to be submitted, where multiple products or finishes are shown for a manufacturer's data sheet.
2. Working Plans: Minimum 1/8"=1'-0" scale inclusive of information required by NFPA 13 requirements.
    a. Where Working Plans deviate from the signed construction documents prepared by JENSEN HUGHES, the Contractor shall submit Working Plans sealed and signed by a registered Professional Engineer (P.E.) in Delaware.
    b. A single Professional Engineer (P.E.) registered in Delaware shall be the Engineer of Record for the project, therefore, where the Contractor modifies any portion of the signed construction documents; all components of the Working Plans shall be sealed and signed by a single registered P.E. in Delaware.

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3. Hydraulic Calculations: Prepared in accordance with NFPA 13 requirements. Minimum one (1) calculation for each hazard on each level. One (1) calculation required on highest level per hazard when pipe sizing and arrangement remains typical.

    a. Where the Hydraulic Calculations deviate from the signed construction documents prepared by the Engineer, the Contractor shall submit Hydraulic Calculations sealed and signed by a registered Professional Engineer (P.E.) in Delaware.

    b. A single Professional Engineer (P.E.) registered in Delaware shall be the Engineer of Record for the project, therefore, where the Contractor modifies any portion of the signed construction documents; all components of the Working Plans shall be sealed and signed by a single registered P.E. in Delaware.

B. Acceptance Documentation: Submit the following to the Owner, Engineer and authorities having jurisdiction once system installation is complete, including field quality control and commissioning activities, and is otherwise "ready" for authority approval.

1. Field Test Reports and Certificates: indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping". Make submittal after commissioning and prior to acceptance testing.

2. Statement of Completion: Upon completion of the installation of the automatic sprinkler system, a signed written statement, substantially in the form as follows:

    "The undersigned, having been engaged as the Sprinkler Contractor for the Legislative Hall Parking Garage Building in Dover, DE, confirms that the automatic fire sprinkler system equipment was installed in accordance with the diagrams, instructions, directions, and technical specifications provided to us by the Manufacturer and the Building Owner."

C. Acceptance Documentation: Prepare and submit electronic copies of closeout documentation packages to the Engineer for review prior to scheduling Owner demonstration and training. Resubmit portions or entirety of submittal to address Engineer comments prior to scheduling demonstration and training. The closeout submittal package shall include:

1. Maintenance Data: The maintenance manual shall describe in detail the purpose and function of all sprinkler system devices and valves. The manual shall also include all necessary inspection, testing and maintenance forms. The Sprinkler Contractor shall provide the Building Owner with one (1) copy of NFPA 25, Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems, in addition to the maintenance manual.

2. As-Built Drawings: Showing all field changes from original Working Plans. Submit full-size hard copy and electronic AutoCAD files on USB drive. Coordinate AutoCAD version with Owner at time of submittal.

3. As-Built Hydraulic Calculations: Showing all field changes from original Working Plans.

4. Valve Chart: Provide a drawing on 11-inch x 17-inch paper identifying the location of the control valves for the fire sprinkler system shown on the floor plan of the building. This valve chart shall be framed and permanently installed in the valve room.

5. Statement of Warranty.

1.6 Coordination

NOT FOR BIDDING

A. Coordinate the installation of the fire sprinkler system and testing of associated equipment with all related trades, contractors, equipment maintenance and testing representatives, the Engineer, the Owner and the authorities having jurisdiction.

B. The Fire Sprinkler Contractor shall furnish and install all sprinkler pressure switches, valve supervisory switches, and electric bells. The Fire Alarm Contractor shall be responsible for all wiring connections to all sprinkler pressure switches, valve supervisory switches and electric bells. The Fire Sprinkler Contractor shall be responsible for adjusting the sprinkler pressure switches and the valve supervisory switches to function as required by NFPA 13 and project specifications.

C. The Site Work contractor shall be responsible for furnishing and installing the new fire service main into the building as indicated on the drawings. The Fire Sprinkler Contractor shall furnish and install all sprinkler piping from where the new fire service main enters the building.

D. Coordinate sprinkler location and installation with other portions of the Work to ensure sprinkler locations are at the highest possible elevations located to minimize the risk of mechanical damage.

E. Coordinate sprinkler installation with other portions of the Work to comply with NFPA 13 requirements for obstruction to sprinkler discharge.

F. Coordinate and receive approval from Owner and/or Engineer for the routing of sprinkler piping before installation.

G. Coordinate sprinklers with unique ceiling features such as decorative metal panels, specialty ceilings, floating/cloud ceilings, structural members, etc.

1.7 Quality Assurance

A. Equipment and devices shall be labeled and approved for the intended use by UL.

B. Electrical components, devices, and accessories shall be listed, approved, and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

C. All materials and equipment shall be new and unused.

D. All equipment shall be first quality and capable of complying with all requirements of this specification and shall have been in continuous production and in service in commercial applications for at least one year. Obsolete equipment shall not be used.

E. Installer Qualifications: Licensed in the State of Delaware and experienced in the installation of automatic fire sprinkler systems in facilities similar to the Work described herein and has obtained design and inspection approvals for similar projects from authorities having jurisdiction.

F. Foreman: Provide proof of competence of both their company and the individual foreman that will be assigned to this project, in the area of installing automatic fire sprinkler systems for at least five (5) years and acceptable to Owner. Once assigned, the foreman shall not be changed without the approval of the Owner.

G. Service Organization: Capable of providing a service technician on-site within 4 hours of a request for on-site service.

H. The automatic sprinkler system shall comply with all applicable state and local codes, including:

NOT FOR BIDDING

1. Building Code of the City of Dover in the State of Delaware (DBC), which adopts and amends the International Building Code, 2009 Edition

2. Fire Prevention Code of the City of Dover in the State of Delaware (DFC), which adopts and amends the International Fire Code, 2009 Edition.

3. The Delaware State Fire Prevention Regulations, which adopt:

   a. The Fire Code (NFPA 1 – 2021 as amended)

   b. The Life Safety Code (NFPA 101 – 2021 as amended)

I. Products, installation, and testing shall be in accordance with the applicable provisions of the latest published edition of the following as referenced by the aforementioned codes and standards:

1. NFPA 13-2019, Standard for the Installation of Sprinkler Systems

2. NFPA 24-2019, Standard for the Installation of Private Fire Service Mains and Their Appurtenances

3. NFPA 25-2017, Standard for Inspection, Testing and Maintenance of Water-Based Fire Protection Systems

4. NFPA 70-2017, National Electrical Code

5. NFPA 72-2019, National Fire Alarm Code

1.8 Scheduling

A. The Contractor's Foreman shall act as primary point of contact and responsible-in-charge for coordinating the Pre-Acceptance Test with the other portions of the Work, Owner, and the Engineer.

B. The Contractor's Foreman shall act as primary point of contact and responsible-in-charge for coordinating the Final-Acceptance Test with the other portions of the Work, Owner, Engineer and the AHJs.

C. Upon award, the Contractor shall provide a schedule to the Owner and Engineer for the milestones and construction progress.

1.9 Extra Materials

A. Furnish extra materials described below that match the products installed and that are packaged with protective covering for storage and identified with labels describing the contents.

1. Sprinkler Cabinet: Finished, wall-mounting steel cabinet and hinged cover, with space for a minimum of six (6) spare sprinklers for each type, model, and temperature rating, plus a sprinkler wrench for each model.

1.10 Warranty

A. Guarantee equipment installed to be free from defects in workmanship and inherent mechanical defects for a period of two (2) years from the date of substantial completion of the project. See Part 1 "Submittals".

1.11 Qualification of Bidders

NOT FOR BIDDING

A. All contractors connected with this project shall provide proof of competence of both their company and the individual foreman that will be assigned to this project. The Contractor shall have been in the business of installing automatic sprinkler systems for at least five (5) years, acceptable to the Engineer and the Owner. Once assigned, the Contractor's foreman shall not be changed without the approval of the Engineer and the Owner.

B. Contractor shall be licensed in the State of Delaware and experienced in the installation of automatic sprinkler systems and has obtained design and inspection approvals for similar projects from authorities having jurisdiction.

C. The Contractor shall have on-staff a minimum NICET Level III certified technician who is experienced in providing automatic sprinkler system installation services.

D. Each proposed bid shall be professionally presented, be bound, and shall include a title page and index.

E. As a minimum, all bidding contractors shall include the following in the sprinkler system bid:

1. The names and qualifications of the Contractor's foreman, project manager and project engineer who shall be in responsible charge during the entire project installation. Contractor's qualifications shall include years in business, service policies, warranty definitions, and prior experience with similar installations.

2. A list of at least three (3) similar installations with addresses of properties, contact names and types of system equipment installed.

3. The price for the system as specified and the prices for required and recommended alternatives. The prices for fabrication and on-site installation of each system shall include all subcontractor and manufacturer's (as it applies) on-site representative labor costs. The Contractor shall list all deviations and/or exceptions to these specifications as proposed alternatives.

4. Nonconformance to the Qualification of Bidders requirements outlined in this specification shall be cause for immediate dismissal of the Bid Documents without comment.

5. The award of the contract shall be based on the submitted information and all considerations in the best interests of the Building Owner. Once the contract is awarded, no requested changes for equipment, suppliers or subcontractors shall be accepted unless justification is made in writing. Once assigned, the Contractor's foreman shall not be changed without the approval of the Engineer and the Building Owner. Upon written request from the Contractor, the Engineer and the Building Owner may authorize changes, but at their sole choice and discretion. The Contractor shall be at risk for any attempt to substitute the equipment suppliers or subcontractors accepted. All cost for removal, relocation, or replacement of a substituted item shall be at the risk of the Contractor.

2.0 PRODUCTS

2.1 Manufacturers

A. Subject to compliance with the requirements of this section, product selection shall be limited to those offered by manufacturers included in the "Available Manufacturer" lists in each Part 2 article. Substitution of the products listed requires approval by the Owner in writing prior to installation. The contractor shall submit a "Request for Alternative Manufacturer" form, completed in full, for approval by the Owner and engineer. (Applicable form will be provided).

NOT FOR BIDDING

B. Where lists are not indicated, products, subject to compliance with the requirements of this section, may be obtained from an approved domestic manufacturer.

C. All products are to be approved and labeled for use by UL and/or FM Global.

2.2 Pipe and Tube

A. Standard-Weight Steel Pipe: ASTM A135, and A795, Type F, Grade A; Schedule 40 galvanized steel.

1. Threaded ends for all piping 1-inch through 2-inch.

2. Cut-grooved ends or roll-grooved ends for all piping 2 ½-inches and larger

3. All piping, couplings, and fittings shall be painted. One (1) coat of primer and two (2) coats of epoxy paint. Paint shall be suitable for exterior environmental application.

2.3 Pipe and Tube Fittings

A. Dry System Fittings and couplings shall be galvanized.

B. All piping, couplings, and fittings shall be painted. One (1) coat of primer and two (2) coats of epoxy paint. Paint shall be suitable for exterior environmental application.

C. Cast-Iron Threaded Fittings: ASME B16.4; Class 125 or Class 250 pattern as required by application.

D. Malleable-Iron Threaded Fittings: ASME B16.3; ASME B16.4; Class 125 or Class 250 pattern as required by application.

E. Steel Threaded Couplings: ASTM A865; ASME B16.4; Class 125 or Class 250 pattern as required by application.

F. Steel Welding Fittings: ASTM A234/A 234M, ASME B16.9, or ASME B16.11; 300-psi pressure rating.

G. Cast-Iron Threaded Flanges: ASME B16.1; ASME B16.4; Class 125 plain face or Class 250 raised face pattern as required by application.

H. Steel Flanges and Flanged Fittings: ASME B16.5; ASME B16.4; Class 125 plain-face or Class 250 raised face pattern as required by application.

I. Flange Gaskets and Bolts

1. Plain-face Flanges: ASME B18.2.2 heavy-series hex-nuts and ASME B18.22.1 plain washers with ASME B16.21 1/8” full-face rubber gasket.

2. Raised-face Flanges: ASME B18.2.2 heavy-series hex-nuts and ASME B18.22.1 plain washers with ASME B16.20 1/8” spiral wound gasket.

J. Mechanical Grooved-End Fittings:

1. Assembly Pressure Rating: 300-psi.

2. Fittings and Couplings: UL 213; ASTM A536 ductile iron body.

NOT FOR BIDDING

3. Couplings: UL 213; ASTM A536 ductile iron rigid or flexible pattern as required by application.

4. Gaskets and Bolts: Pre-lubricated EPDM gaskets with ASTM A183 zinc-plated nuts and bolts.

5. Available Manufacturers
   a. Reliable Co.
   b. Tyco Co.
   c. Victaulic Co.
   d. Viking Co.
   e. Or approved equal.

K. Mechanical Tees: The use of mechanical tees shall not be permitted.

2.4 Valves

A. General: Minimum 175-psig (1200-kPa) non-shock working-pressure rating unless higher pressure rating is required by application or otherwise indicated. Valves for grooved-end pipe may be furnished with grooved ends instead of flanged ends.

B. Gate Valves; NPS 2-inch (DN50) and Smaller: UL 262; cast-bronze, threaded ends; solid wedge; OS&Y; and pre-grooved rising stem. NPS 2-1/2-inch (DN65) and Larger: UL 262, iron body, bronze mounted, tapered wedge, OS&Y, and pre-grooved rising stem. Include replaceable, bronze, wedge facing rings and flanged ends.

1. Available Manufacturers
   a. Reliable Co.
   b. Tyco Co.
   c. Victaulic Co.
   d. Viking Co.
   e. Or approved equal.

C. Swing Check Valves; NPS 2-inch (DN50) and Smaller: UL 312; cast-bronze, threaded ends. NPS 2-1/2-inch (DN65) and Larger: UL 312, cast-iron body and bolted cap, with bronze disc or cast-iron disc with bronze-disc ring and flanged ends.

1. Available Manufacturers
   a. Reliable Co.
   b. Tyco Co.
   c. Victaulic Co.
   d. Viking Co.

D. Dry-Pipe Valves: UL 312, cast iron body designed for horizontal or vertical installation, with grooved ends, bronze grooved seat with O-ring seals, and single-hinge pin and latch design. Include pressure gauges and 2-inch drain valve and trim.

1. Available Manufacturers

NOT FOR BIDDING

a. Tyco Co Model DPV-1.

b. Or approved equal.

E. Indicating Valves; NPS 2-inch (DN65) and Smaller: UL 1091; butterfly or ball-type, bronze body with threaded ends; and integral indicating device and pre-wired supervisory switch. NPS 2-1/2-inch (DN65) and Larger: UL 1091; butterfly-type, ductile-iron body with grooved ends; and integral indicating device and pre-wired supervisory switch.

1. Available Manufacturers

a. Reliable Co.

b. Tyco Co.

c. Victaulic Co.

d. Viking Co.

e. Or approved equal.

F. Double Check Valve Assembly: UL listed double check valve assembly designed to prevent the reverse flow of water from entering the potable water system. Approved by the local water purveyor.

1. Available Manufacturers

a. Watts.

b. Zurn.

c. Febco.

d. Or approved equal.

G. Wall Post Indicator Valve: UL listed, fire service control valve mounted on exterior wall. Valve shall provide means to operate a non-rising stem gate valve located inside building. Valve shall indicate open and shut positions.

1. Available Manufacturers

a. American Fire Supply.

b. Mueller.

c. United.

d. Or approved equal.

H. Ball Drip Valves: UL 1726, automatic drain valve, NPS 3/4 (DN20), ball check device with threaded ends. Automatic ball drip valve shall be installed on the pipe to the fire department connection to prevent water being trapped in the pipe which may become subject to freezing.

1. Available Manufacturers

a. Reliable Co.

b. Tyco Co.

c. Victaulic Co.

d. Viking Co.

e. Or approved equal.

NOT FOR BIDDING

1.1 Sprinklers

A. General: UL 199 and/or FM approved nominal 3/4-inch [K8.0] orifice standard-spray pattern sprinklers with “Ordinary” temperature classification rating, unless otherwise indicated or required by application.

B. Pressure Rating: 175-psi minimum unless otherwise indicated or required by application.

C. Operating Element: Quick Response (QR) or Standard Response (SR) as indicated or required by application. Refer to drawings for specific sprinkler types.

D. Sprinkler Types and Features; include the following:

1. Upright and/or dry pendent sprinklers in all areas.

E. Sprinkler Finishes: shall be coordinated with Architect and Owner, but shall include the following:

1. Corrosion-resistant.

F. Sprinkler Guards: Wire-cage type with zinc chromate finish, including fastening device for attaching to sprinkler. Sprinkler Guards shall be used on upright, sidewall and non-recessed pendent sprinklers in the storage and mechanical spaces. Sprinkler guards shall be listed for the sprinkler to which it is attached.

1. Sprinkler guards shall be installed on all sprinklers where they are susceptible to mechanical damage. This includes all sprinklers below obstructions or installed below stairs.

G. Available Manufacturers

1. Reliable Co.

2. Tyco Co.

3. Victaulic Co.

4. Viking Co.

5. Or approved equal.

H. Sprinkler Temperatures:

1. Sprinklers shall have a nominal temperature rating of 200 degrees F.

2. Sprinklers in mechanical rooms and boiler rooms shall have Intermediate (175 to 225 degrees F) and High (250-300 degrees F) temperature rated sprinklers where located adjacent to heat producing equipment per NFPA 13.

1.2 Fire Alarm Monitoring Devices

A. General: NEMA enclosure suitable for intended application; include tamper resistant cover with switch that transmits signal upon removal of cover; 250-psi pressure rating; two sets, single-pole double-throw form C contacts.

B. Pressure Switch: UL listed pressure switch with capability to monitor both high/low pressures.

NOT FOR BIDDING

C. Valve Supervisory Switches: UL 753 with normally closed contacts and compatible with valve stem to be monitored.

D. Available Manufacturers

1. Grinnell Corp.
2. Potter Electric Signal Co.
3. System Sensor Div.; Honeywell, Inc.
4. Or approved equal.

1.3 Pressure Gauges

A. Water Pressure Gauges: UL 393, 3-1/2- to 4-1/2-inch- diameter dial with dial range of 0 to 250 psig.

B. Available Manufacturers

1. Brecco Corp.
2. Dresser Instruments.
3. US Gauge.
4. Or approved equal.

1.4 Nitrogen Generator

A. UL listed nitrogen generator capable of providing 98% nitrogen purity.

B. Self-contained unit with steel enclosure and membrane type nitrogen generator.

C. Nitrogen generator shall have bypass alarm and leak monitoring.

D. Riser-mounted ECS SMART Vent (PSV-D/DE)

E. ECS Protector SMART Gas Analyzer (SGA-1)

F. Handheld Gas Analyzer (PHGA-1)

G. Available Manufacturers

1. Model ECS AG-6500
2. Or approved equal

1.5 Air-Pressure Maintenance Device

I. UL listed, automatic field adjustable, pressure reducing device that controls the pressure in a dry-pipe sprinkler system.

NOT FOR BIDDING

J. Available Manufacturers

1. Tyco Co Model AMD-1

2. Or approved equal

1.6 Electronic Dry Pipe Accelerator

A. UL 1486 quick-opening device intended to reduce the operating time for dry-pipe system water delivery. The accelerator shall be microprocessor-based, electronic, quick opening device.

B. Available Manufacturers

1. Tyco Co. VIZOR Electronic Dry Pipe Accelerator (EDPA)

2. Or approved equal

1.7 Pipe Sleeves

A. General: Provide pipe sleeves where piping passes entirely through walls, floors, and partitions. Secure sleeves in position during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, and roofs. Provide 1-inch minimum clearance between exterior of piping and interior of sleeve or core-drilled hole. Firmly pack space with mineral wool insulation. Seal space at both ends of the sleeve or core-drilled hole with plastic waterproof cement, which will dry to a firm but pliable mass, or provide a mechanically adjustable segmented elastomeric material. Penetrations of fire-rated barriers, wall and floor assemblies shall be sealed with a listed through penetration firestopping assembly.

1. Sleeves in Masonry and Concrete Walls, Floors, and Roofs: Provide hot-dip galvanized steel, ductile-iron, or cast-iron sleeves. Core-drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in the core-drilled hole are completely grouted smooth.

2. Sleeves in Other Than Masonry and Concrete Walls, Floors, and Roofs: Provide 26-gauge galvanized steel sheet.

1.8 Fire Department Connection (FDC)

A. Provide a check valve with automatic ball drip valve between the fire department connection and the connection to the fire protection water supply.

B. Provide a UL listed / FM Approved wall-mounted fire department connection with polished chrome finish.

C. FDC threads shall comply with Dover Fire Department requirements.

1.9 Inspector Test Connection

A. Provide inspectors test connection on the most remote branch line of the dry-pipe system.

3. Test connection drain shall be piped to the exterior of the building.

2.0 EXECUTION

NOT FOR BIDDING

2.1 Examination

A. Coordinate examinations with the Owner.

B. Coordinate locations of risers, mains, and branch line piping prior to preparing pre-installation submittal.

C. Examine walls and partitions for suitable thickness, fire- and smoke-rated construction, framing and other conditions where pipes, risers and cross-mains are to be installed prior to preparing pre-installation submittal.

2.2 Preparation

A. Prepare and submit an electronic "Pre-Installation Documentation" submittal package stamped by a registered Professional Engineer to JENSEN HUGHES for review prior to submitting same to local officials for approval and permit. Resubmit portions or entirety of submittal to address JENSEN HUGHES' comments prior to submitting package to local officials for approval and permit. See Part 1 "Submittals" for submittal content.

B. Obtain authority approval and permits with reviewed "Pre-Installation Documentation" submittal package.

2.3 Piping Applications

A. Use the following:

1. NPS 6-inch (DN150) to NPS 2-1/2-inch (DN65): Schedule 40 galvanized steel pipe with cut-grooved ends; steel, grooved-end fittings with rubber gaskets; and grooved joint couplings.

2. NPS 2-inch (DN50) and Smaller: Schedule 40 steel pipe with threaded or cut-grooved ends, cast- or malleable-iron threaded fittings, and threaded joints.

3. ASTM A53 and ASTM A135: Sprinkler System Piping.

B. Use threaded or grooved-end fittings to make changes in direction, branch takeoffs from mains and reduction in pipe sizes. Mechanical fittings are not permitted for branch line connections or sprinkler connections.

2.4 Piping Installation

A. Refer to manufacturer's specifications and NFPA 13 for basic piping installation.

B. Pitch dry-pipe sprinkler system in accordance with NFPA 13.

C. Install exposed piping in normally occupied areas as tight to ceiling as possible. Rise with elbows in series as necessary to adjust final height of piping. Cut hanger rods to length that allows nuts to be tightened flush with ceiling and leaves band hangers at the highest elevation possible.

D. Use threaded or grooved-end fittings to make changes in direction, branch takeoffs from mains and reduction in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2-inch (DN50) and smaller. Unions are not required on flanged devices or in piping installations using grooved joints.

NOT FOR BIDDING

F. Install flanges or flange adapters on valves, apparatus, and equipment having NPS 2-1/2-inch (DN65) and larger connections as required for proper connection.

G. Install sprinkler piping with drains for complete system drainage. All drain piping shall be routed to a location approved by the Owner.

H. Install alarm devices in piping systems as shown on the drawings.

I. Install inspector's test connections. The drain shall discharge to the exterior of the building.

J. Hangers and Supports: Install according to NFPA 13 for sprinkler piping.

K. Install piping with cut-grooved joints according to manufacturer's written instructions. Construct rigid piping joints through masonry penetrations. Provide flexible couplings within 1-foot of each side of the floor/ceiling assembly on vertical sprinkler supply risers.

L. Install pressure gauges on risers or feed main, at each sprinkler floor control valve assembly and on both sides of every check valve. Include pressure gauges with connection not less than NPS 1/4 (DN8) and with soft metal seated 3-way valve, plugged at one end and arranged for draining pipe between gauge and valve. Install gauges to permit removal and install where they will not be subject to freezing.

M. Flanges and unions with special transition fittings with pressure ratings the same as or higher than the systems pressure rating may be used in aboveground applications, unless otherwise indicated.

N. Pipe Painting

1. Piping that is exposed shall be painted. Painting shall be provided by a qualified contractor. Piping is to be primed with a metal primer and two coats of finish are to be applied. The contractor shall provide a color sample to demonstrate the finish color to the Owner for approval, prior to painting pipe. All piping and fittings shall have a finished painted color of red throughout where required.

2.5 Joint Construction

A. Refer to manufacturer's specifications for basic piping joint construction.

B. Steel-Piping, Grooved Joints: Use Schedule 40 steel pipe with cut-grooved ends; steel, grooved-end fittings; and groove couplings. Assemble joints with couplings, gaskets, lubricant, and bolts according to manufacturer's written instructions.

C. Dissimilar-Piping-Material Joints: Construct joints using adapters or couplings compatible with both piping materials. Use dielectric fittings if both piping materials are metal.

D. Refer to Manufacturer's specifications for grooved pipe fittings, pipe-flange gasket materials and welding filler metals.

E. Joint compound or tape shall be applied to male pipe threads only for all threaded joints.

F. Transition Couplings: AWWA C219, sleeve type, or other manufactured fitting the same size as, with pressure rating at least equal to, and with ends compatible with piping to be joined.

2.6 Valve Applications

A. Drawings indicate valve types to be used.

NOT FOR BIDDING

2.7 Valve Installation

A. Install valves in accessible locations with indicators clearly visible from floor level. Where valves are located above ceilings or accessible through access panels, provide and install signs to identify locations.

B. Maintain riser control assemblies at 3'-6" above the finished floor. Where this installation height is not feasible, the particular location is to be reviewed by JENSEN HUGHES and the Building Owner prior to installation.

2.8 Sprinkler Applications

A. Drawings indicate sprinkler types to be used.

B. Use QR sprinklers in Ordinary Hazard areas, unless otherwise noted.

2.9 Sprinkler Installation

A. Install sprinklers in accordance with NFPA 13 and as indicated on the approved working drawings.

B. Install upright and/or dry pendent sprinklers on the dry-pipe system.

C. Use sprinkler guards on all sprinklers in the mechanical or storage spaces unless recessed.

D. Do not install sprinklers, mains, or branch line pipes in locations where likely to be inadvertently damaged, such as in front of access hatches, doors, cabinets, etc.

2.10 Fire Alarm Monitoring Device Installation

A. Install pressure switches and valve supervisory switches to be connected to the Fire Alarm system.

B. Coordinate installation, wiring connections, and testing with the Fire Alarm System Contractor.

2.11 EXTERIOR WALL PENETRATIONS

A. Include escutcheons and watertight annular-space "soft" seal of appropriate size for the intended hole and pipe diameters, as recommended by the seal manufacturer. Seal material shall be of an approved type.

2.12 Labeling and Identification

A. Install signs, labeling, and pipe markers on all valves, equipment, drains, and piping in accordance with NFPA 13.

B. Signs and label styles and locations shall be coordinated with and approved by the Owner and the authorities having jurisdiction prior to installation.

C. Install hydraulic design information signs on the "main system riser".

D. Provide exterior signage for fire department connection and backflow test connection.

NOT FOR BIDDING

2.13 Field Quality Control

A. Perform hydrostatic test of entire sprinkler system and inspect sprinkler piping according to NFPA 13, "System Acceptance" Chapter. Coordinate hydrostatic test date and time of test with the Owner and the authorities having jurisdiction.

B. Perform dry-pipe system trip test in accordance with NFPA 13.

C. Replace piping system components that do not pass test procedures and retest to demonstrate compliance. Repeat procedure until satisfactory results are obtained.

D. Report test results promptly and in writing to the Owner, Engineer, and the authorities having jurisdiction. See Part 1 “Submittals”.

2.14 Cleaning and Protection

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers having paint other than factory applied finish.

C. Wipe all excess pipe joint compound from threaded pipe joints.

D. Wipe all excess oil from the exterior surface of sprinkler mains and branch line pipes.

E. Protect sprinklers from damage until substantial completion by other trades that may be working in building.

2.15 Commissioning

A. Verify that specialty valves, trim, fittings, controls, and accessories are installed and operate correctly.

B. Verify that specified tests of piping are complete.

C. Verify that damaged sprinklers and sprinklers with paint or coating not specified are replaced with new, correct type.

D. Verify that sprinklers are correct types, have correct finishes and temperature ratings, and have guards as required for each application.

E. Verify that potable-water supplies have correct types of backflow prevention devices and have been tested.

F. Provide a 5’inch Storz-type fire department connection with a 90 degree elbow. Verify that fire department connection and associated piping is adequately braced and restrained.

G. Verify that spare sprinkler cabinet is installed with correct number of wrenches and spare sprinklers.

H. Verify that labeling, identification, and signage is installed.

I. Perform dry-pipe system trip test in accordance with NFPA 13.

J. Verify nitrogen generator system provides 98% purity.

K. Energize circuits to electrical equipment and devices.

NOT FOR BIDDING

L. Coordinate with fire alarm contractor to perform acceptance test with new valve monitoring devices and sprinkler system alarm devices. Operate as required.

M. Report completion of commissioning promptly and in writing to the Owner, Engineer and the authorities having jurisdiction. See Part 1 "Submittals".

2.16 Acceptance Tests

A. Coordinate with fire alarm contactor for acceptance tests. Operate as required. Demonstrate system components to authority having jurisdiction as necessary.

B. Flush underground piping in accordance with NFPA 13.

2.17 Project Closeout Procedures

A. Submit Project Closeout Documentation; see Part 1 "Submittals".

B. Schedule Owner demonstration and training with the Owner. Provide at least ten (10) working days' notice.

C. Demonstrate equipment, specialties, and accessories with the Owner. Review operating and maintenance information with the Owner.

END OF SECTION

NOT FOR BIDDING

SECTION 22 05 13
COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General construction and requirements.

B. Applications.

C. Single phase electric motors.

D. Three phase electric motors.

1.02 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015 (Reaffirmed 2020).

B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; 2017.

C. NEMA MG 1 - Motors and Generators; 2017.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

D. Operation Data: Include instructions for safe operating procedures.

E. 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 for specified use, and their accessories, with minimum three years documented product development, testing, and manufacturing 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.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer warranty for pump motors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Baldor Electric Company/ABB Group: www.baldor.com/#sle.

B. Leeson Electric Corporation: www.leeson.com/#sle.

C. Regal-Beloit Corporation (Century): www.centuryelectricmotor.com/#sle.

D. Approved Equal.

E. Substitutions: See Section 01 60 00 - Product Requirements.

NOT FOR BIDDING

2.02 GENERAL CONSTRUCTION AND REQUIREMENTS

A. 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.

B. Explosion-Proof Motors: UL approved and labelled for hazard classification, with over temperature protection.

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.

2.03 APPLICATIONS

A. Motors located indoors: Open drip-proof

B. Motors located outdoors: Totally enclosed fan cooled

2.04 SINGLE PHASE POWER - SPLIT PHASE MOTORS

A. Starting Torque: Less than 150 percent of full load torque.

B. Starting Current: Up to seven times full load current.

C. Breakdown Torque: Approximately 200 percent of full load torque.

D. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.

E. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.05 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.

2.06 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.

NOT FOR BIDDING

2.07 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.

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. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter; refer to Section 26 29 13.

I. 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.

J. Sound Power Levels: To NEMA MG 1.

K. 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.

L. Weatherproof Epoxy Sealed Motors: Epoxy seal windings using vacuum and pressure with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease.

M. Nominal Efficiency: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

N. Nominal Power Factor: As indicated at full load and rated voltage when tested in accordance with IEEE 112.

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.

END OF SECTION

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SECTION 22 05 17
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 22 07 19 - Plumbing Piping Insulation.

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. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

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 work of the type specified this section.
   1. Minimum three years experience.

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.

1.06 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:
   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. Pipe Passing Through General Partitions:
   1. Galvanized steel pipe or black iron pipe with asphalt coating.
   2. Connect sleeve with floor plate except in mechanical rooms.

C. Clearances:
   1. Provide allowance for insulated piping.
   2. Wall and Floor Partitions: 1 inch greater than external pipe diameter.
   3. All Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 07 84 00 to prevent the spread of fire, smoke, and gases.

NOT FOR BIDDING

2.02 PIPE-SLEEVE SEALS

A. Manufacturers:
   1. Advance Products & Systems, LLC; Innerlynx: www.apsonline.com/#sle.
   2. American Polywater Corporation; PGKD Modular Seals: www.polywater-haufftechnik.com/#sle.
   3. Flexicraft Industries; PipeSeal: www.flexicraft.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Modular Mechanical Sleeve-Seal:
   1. Elastomer-based interlocking links 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. Glass-reinforced plastic pressure end plates.
   5. Required for all below-grade penetrations.

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.

3.02 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. 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.

F. 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, union, and couplings for servicing are consistently provided.

3.03 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. 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

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SECTION 22 05 33
HEAT TRACING FOR PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Self-regulating parallel resistance electric heating cable.

B. Cable outer jacket markings.

C. Connection kits.

D. Accessories.

E. Controls.

1.02 RELATED REQUIREMENTS

A. Section 22 05 53 - Identification for Plumbing Piping and Equipment

B. Section 22 07 19 - Plumbing Piping Insulation.

1.03 REFERENCE STANDARDS

A. IEEE 515.1 - IEEE Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Commercial Applications; 2022.

B. ITS (DIR) - Directory of Listed Products; current edition.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. UL (DIR) - Online Certifications Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with other trades to provide ground fault protection for electric heat tracing circuits as required by NFPA 70.

B. Coordinate the work with other trades to provide circuit breaker ratings suitable for installed circuit lengths.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for electric heat tracing.

C. Shop Drawings: Indicate electric heat tracing layout, electrical terminations, thermostats, controls, and branch circuit connections.

D. Project Record Documents: Record actual locations of electric heat tracing lines and thermostats.

E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions of equipment and controls, maintenance and repair data, and parts listings.

F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 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.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide two year manufacturer warranty for cables, connection kits, accessories, and controls.

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PART 2 PRODUCTS

2.01 SELF-REGULATING PARALLEL RESISTANCE ELECTRIC HEATING CABLE

A. Manufacturers:
   1. Chromalox, Inc: www.chromalox.com/#sle.
   2. Pentair: www.pentairthermal.com/#sle.
   3. Thermon Manufacturing Company: www.thermon.com/#sle.

B. Provide products listed, classified, and labeled by UL (DIR), ITS (DIR), or testing firm acceptable to authorities having jurisdiction (AHJ).

C. Factory Rating and Testing: Comply with IEEE 515.1.

D. Heating Element:
   1. Provide pair of parallel No.16 tinned or nickel coated stranded copper bus wires embedded in cross linked conductive polymer core with varying heat output in response to temperature along its length.
   2. Terminations: Waterproof, factory assembled, non-heating leads with connector at one end and water-tight seal at opposite end.
   3. Capable of crossing over itself without overheating.
   4. Electric resistance heat output shall be 5W/ft.

E. Insulated Jacket: Flame retardant polyolefin.

F. Cable Cover: Provide tinned copper and polyolefin outer jacket with UV inhibitor.

G. Maximum Power-On Operating Temperature: 150 degrees F.

H. Maximum Power-Off Exposure Temperature: 185 degrees F.

I. Electrical Characteristics:

2.02 CABLE OUTER JACKET MARKINGS

A. Name of manufacturer, trademark, or other recognized symbol of identification.

B. Catalog number, reference number, or model.

C. Month and year of manufacture, date coding, applicable serial number, or equivalent.

D. Agency listing or approval.

E. Applicable environmental or area use requirements, such as NEMA 4, Type 4, IP ratings, and hazardous (classified) location markings including temperature rating.

F. Any applicable warning/caution statements such as "WARNING: De-energize circuit before removing cover.

2.03 CONNECTION KITS

A. Provide power connection, splice/tee, and end seal kits compatible with the heating cable and without requiring cutting of the cable core to expose bus wires.

B. Provide with NEMA 4X rating for prevention of corrosion and water ingress.

2.04 ACCESSORIES

A. Provide Accessories As Indicated or As Required for Complete Installation, Including but Not Limited To:
   1. High temperature, glass filament tape for attachment of heating cable to metal piping.
   2. Aluminum self-adhesive tape for attachment of heating cable to plastic piping.
   3. Heat-conductive putty.
   4. Cable ties.
   5. Silicone end seals and splice kits.
   6. Installation clips.
   7. Warning labels for attachment to exterior of piping insulation. Refer to Section 22 05 53.

2.05 CONTROLS

A. Pipe Mounted Thermostats:

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1. Remote bulb unit with adjustable temperature range from 30 to 50 degrees F.
2. Snap-action, open-on-rise, single pole switch with minimum current rating adequate for the connected cable.
3. Remote bulb on capillary, resistance temperature device (RTD) or thermistor for direct sensing of pipe wall temperature.
4. Control Enclosure: Corrosion resistant and waterproof.

B. Provide minimum 30 ampere contactor to indicate operational status and on/off control.

C. Line sensing high-limit temperature control and high-limit alarm.

D. Programmable Controller:
1. Micro-processor based.
2. Capable of four separate schedules.
3. On/Off/Auto switch.
4. 365 day calendar with 20 programmable holidays.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping and equipment are ready to receive work.

B. Verify field measurements are as indicated on shop drawings.

C. Verify required power is available, in proper location, and ready for use.

3.02 PREPARATION

A. Clean exposed surfaces prior to installation.

B. Prepare surfaces using approved methods as recommended by manufacturer.

3.03 INSTALLATION

A. Install in accordance with manufacturer's written installation instructions.

B. Comply with installation requirements of IEEE 515.1 and NFPA 70, Article 427.

C. Apply heating cable linearly on pipe with fiberglass tape only after piping has successfully completed any required pressure testing.

D. Comply with applicable local building codes and requirements of authorities having jurisdiction.

E. Identification:
1. After thermal insulation installation, apply external pipeline decals to indicate presence of the thermal insulation cladding at intervals not to exceed 20 ft including cladding over each valve or other equipment that may require maintenance.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Perform start-up by factory technician or factory representative as per Owner's requirements.

C. Field Testing and Inspections:
1. Commission system in accordance with installation and operation manual.
2. Inspect for sources of water entry and proper sealing.
3. Inspect weather barrier to confirm that no sharp edges are contacting the trace heating.
4. Insulation Resistance: Greater than 20 megohms at a test voltage of 2500 VDC for polymer insulated trace heaters.
5. Test heating cable integrity with megohmmeter at the following intervals:
   a. Before installing the cable.
   b. After cable has been installed onto the piping.
   c. After installing the connection kits.
   d. After the installation of thermal insulation onto the piping.
   e. Prior to initial start-up (commissioning).
6. Measure voltage and current at each unit.
7. Controls:

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a. Verify control parameters are set to the application requirements.
b. Verify factory provided digital temperature controller is correctly configured with the building automation system.

3.05 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

NOT FOR BIDDING

SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.
B. Tags.
C. Pipe Markers.
D. Underground warning tape.
E. Ceiling Tacks.

1.02 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2015.
B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.
C. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 2007.

1.03 SUBMITTALS

A. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
C. Product Data: Provide manufacturers catalog literature for each product required.
D. Samples: Submit two labels; tags in size.
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 PLUMBING COMPONENT IDENTIFICATION GUIDELINE

A. Nameplates:
   1. Heat exchangers, water heaters, and other heat transfer products.
   2. Control panels, transducers, and other related control equipment products.
   3. Pumps, tanks, filters, water treatment devices, and other plumbing equipment products.
B. Tags:
   1. Piping: 3/4 inch diameter and smaller.
   2. Manual operated and automated control valves.
   3. Instrumentation, relays, gauges, and other related control equipment products.
   4. Ceiling tacks placed on lay-in ceiling surface to reference plumbing components.
C. Pipe Markers: 3/4 inch diameter and higher.

2.02 MANUFACTURERS

A. Brady Corporation: www.bradycorp.com.
B. Champion America, Inc: www.Champion-America.com.
C. Seton Identification Products: www.seton.com/aec.
D. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
   1. Letter Color: White.
   2. Letter Height: 1/2 inch.
   3. Background Color: Black.
   4. Nameplate Material:

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a. Flexible: Vinyl with adhesive backing per ASTM D709.
b. Metal: Brass with center-side holes for screw fastening.

2.04 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 or square.

B. Metal Tags: Brass, aluminum, or stainless steel with stamped letters; tag size minimum 1-1/2 inch diameter or square with smooth edges.

C. Valve Tag Chart: Typewritten 12-point letter size list in anodized aluminum frame.

D. Piping: 3/4 inch diameter and smaller. Include corrosion resistant chain. Identify service, flow direction, and pressure.

2.05 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 Flexible Marker: Bright-colored continuously printed ribbon tape, minimum 6 inches wide by 4 mil, 0.004 inch thick, manufactured for direct burial service.

D. Identification Scheme, ASME A13.1:
1. Primary: External Pipe Diameter, Uninsulated or Insulated.
a. 3/4 to 1-1/4 inches: Use 8 inch field-length with 1/2 inch text height.
b. 1-1/2 to 2 inches: Use 8 inch field-length with 3/4 inch text height.
c. 2-1/2 to 6 inches: Use 12 inch field-length with 1-1/4 inch text height.
d. 8 to 10 inches: Use 24 inch field-length with 2-1/2 inch text height.
e. Over 10 inches: Use 32 inch field-length with 3-1/2 inch text height.
2. Secondary: Color scheme per fluid service.
a. Water; Potable, Cooling, Boiler Feed, and Other: White text on green background.

2.06 UNDERGROUND WARNING TAPE

A. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, 0.005 inch, unless otherwise required for proper detection.

B. Legend: Type of service, continuously repeated over full length of tape.

C. Color:

2.07 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

B. Color code as follows:
1. Plumbing Components: Yellow.
2. Plumbing Valves: Green.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

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. 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.

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E. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

F. Apply ASME A13.1 Pipe Marking Rules:
   1. Place pipe marker adjacent to changes in direction.
   2. Place pipe marker adjacent each valve port and flange end.
   3. Place pipe marker at both sides of floor and wall penetrations.
   4. Place pipe marker every 25 to 50 feet interval of straight run.

G. Identify control panels and major control components outside panels with plastic nameplates.

H. Identify valves in main and branch piping with tags.

I. Identify piping, concealed or exposed, with plastic pipe markers or plastic tape pipe markers. 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.

J. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

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SECTION 22 07 19
PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cellular glass insulation.
B. Flexible elastomeric cellular insulation.
C. Piping insulation.
D. Glass fiber insulation.
E. Jackets and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.
B. Section 22 10 05 - Plumbing Piping: Placement of hangers and hanger inserts.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.
D. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.
E. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2013).
F. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2013).
G. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2017.
H. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2016.
I. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2017.
J. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2016a.
K. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2018.
L. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing; 2010 (Reapproved 2016).
M. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation; 2017.
N. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2013).
O. ASTM D1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber; 2014.
P. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2012.
Q. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.
R. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
S. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

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T. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

B. Samples: Submit two samples of any representative size illustrating each insulation type.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum 3 years of 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 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, NFPA 255, or UL 723.

2.02 GLASS FIBER

A. Manufacturers:
   1. Knauf Insulation: www.knaufusa.com.
   2. Johns Manville Corporation: www.jm.com.
   3. Owens Corning Corp: www.owenscorning.com.
   4. CertainTeed Corporation; : www.certainteed.com.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible, with wicking material to transport condensed water to the outside of the system for evaporation to the atmosphere.
   1. K Value: ASTM C177, 0.23 at 75 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Maximum Moisture Absorption: 0.2 percent by volume.

C. 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.

D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

E. Vapor Barrier Lap Adhesive:
   1. Compatible with insulation.

F. Insulating Cement/Mastic:
   1. ASTM C195; hydraulic setting on mineral wool.

G. Fibrous Glass Fabric:
   1. Cloth: Untreated; 9 oz/sq yd weight.
   2. Blanket: 1.0 lb/cu ft density.
   3. Weave: 5x5; 10x10; or 10x20.

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H. Indoor Vapor Barrier Finish:
   1. Cloth: Untreated; 9 oz/sq yd weight.
   2. Vinyl emulsion type acrylic, compatible with insulation, black or white color.

I. Outdoor Vapor Barrier Mastic:
   1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

J. Outdoor Breather Mastic:
   1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

K. Insulating Cement:
   1. ASTM C449/C449M.

2.03 CELLULAR GLASS

A. Manufacturers:
   1. Pittsburgh Corning Corporation: www.foamglasinsulation.com/#sle.
   2. Johns Manville Corporation: www.jm.com.
   3. Knauf Insulation: www.knaufusa.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: ASTM C552, Grade 1.
   1. 'K' value: 0.37 at 100 degrees F.
   2. Service Temperature: Up to 900 degrees F.
   3. Water Vapor Permeability: 0.005 perm inch.
   4. Water Absorption: 0.2 percent by volume, maximum.

2.04 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
   1. Aeroflex USA, Inc; AEROFLEX Self-Seal: www.aeroflexusa.com/#sle.
   2. Armacell International: www.armacell.com/#sle.
   3. K-Flex USA LLC; Insul-Tube: www.kflexusa.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C 534 Grade 3;grade 2; grade 1 use molded tubular material wherever possible.
   1. Minimum Service Temperature: -40 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

C. 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: 20 mil; 30 mil.
      e. Thickness: 10 mil.
      f. Connections: Brush on welding adhesive, tacks, pressure sensitive color matching vinyl tape.
   2. Covering Adhesive Mastic: Compatible with PVC jacket.

B. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
   1. Thickness: 0.016 inch, 0.020 inch sheet.
   2. Finish: Smooth, 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.

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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 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 Section 07 84 00.

J. 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 SCHEDULES

A. Interior, Above-Grade Insulation Application Schedule
   1. Service: Domestic hot, recirculated hot water.
      a. Operating Temperature: 60 to 140 deg F.
      b. Insulation Material: Flexible elastomeric or glass fiber.
      c. Insulation Thickness: Apply the following insulation thicknesses:
         1) Pipe, all sizes: 1.0 inch.
      d. Jacket:
         1) Exposed Spaces (not concealed above ceilings) = PVC
         2) Concealed Spaces = None
      e. Vapor Retarder Required: No.

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f. Finish: None.

2. Service: Domestic cold water.
   a. Operating Temperature: 35 to 60 deg F.
   b. Insulation Material: Flexible elastomeric or glass fiber.
   c. Insulation Thickness: Apply the following insulation thicknesses:
      1) Pipe, 1" or less: 0.5 inch.
      2) Pipe, 1¼" to 2" : 0.5 inch.
      3) Pipe, 2-1/2" to 4": 1.0 inch.
      4) Pipe, 5" and up : 1.0 inch.
   d. Jacket:
      1) Exposed Spaces (not concealed above ceilings) = PVC
      2) Concealed Spaces = None
   e. Vapor Retarder Required: Yes.
   f. Finish: None.
3. Service: Exposed sanitary drains and domestic water supplies and stops for fixtures for the disabled.
   a. Operating Temperature: 35 to 120 deg F.
   b. Insulation Material: Molded closed cell vinyl.
   c. Insulation Thickness: 3/16 inch.
   d. Vapor Retarder Required: No.
   e. Finish: None.

B. Exterior, Above-Grade Insulation Application Schedule (Including Insulation Installed in Unconditioned Parking Garage Areas)
1. Service: Domestic water (including sump discharge piping).
   a. Operating Temperature: 60 to 180 deg F.
   b. Insulation Material: Cellular glass, with jacket
   c. Insulation Thickness: Apply the following insulation thicknesses:
      1) Pipe, 1" or less: 2.0 inch.
      2) Pipe, 1-1/4" and larger: 2.0 inch.
   d. Jacket: Aluminum.
   e. Vapor Retarder Required: No.
   f. Finish: None.
2. Service: Storm water.
   a. Operating Temperature: 32 to 100 deg F.
   b. Insulation Material: Flexible elastomeric.
   c. Insulation Thickness: Apply the following insulation thicknesses:
      1) Pipe, 1-1/4" to 2": 0.5 inch.
      2) Pipe, 2-1/2" and up: 1.0 inch.
   d. Field-Applied Jacket: Aluminum.
   e. Vapor Retarder Required: Yes.
   f. Finish: None.

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SECTION 22 10 05

PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sanitary waste piping, buried within 5 feet of building.

B. Domestic water piping, buried within 5 feet of building.

C. Domestic water piping, above grade.

D. Storm drainage piping, buried beyond 5 feet of building.

E. Storm drainage piping, above grade.

F. Pipe, pipe fittings, valves, and connections for piping systems.
   1. Sanitary sewer.
   2. Sump discharge.
   3. Domestic water.
   4. Pipe flanges, unions, and couplings.
   5. Pipe hangers and supports.
   6. Valves.

1.02 RELATED REQUIREMENTS

A. Section 22 05 53 - Identification for Plumbing Piping and Equipment.

B. Section 22 07 19 - Plumbing Piping Insulation.

C. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. ANSI Z21.22 - American National Standard for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems; 2015.

B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2015.

C. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2016.

D. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2016.

E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.

F. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.

G. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV; 2016.

H. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; 2013.

I. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV; 2012.

J. ASME B31.1 - Power Piping; 2016.

K. ASME B31.2 - Fuel Gas Piping; The American Society of Mechanical Engineers; 1968.

L. ASME B31.9 - Building Services Piping; 2014.

M. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; 2017.

N. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing and Fusing Operators; 2017.

O. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999 (Reapproved 2014).

P. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.

Q. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2017.

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R. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2017.

S. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

T. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2015a.

U. ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes; 2015.

V. ASTM B68/B68M - Standard Specification for Seamless Copper Tube, Bright Annealed; 2011.

W. ASTM B68M - Standard Specification for Seamless Copper Tube, Bright Annealed (Metric); 2011.

X. ASTM B75/B75M - Standard Specification for Seamless Copper Tube; 2011.

Y. ASTM B75M - Standard Specification for Seamless Copper Tube (Metric); 1999 (Reapproved 2005).

Z. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2016.

AA. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2016.

AB. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2016.

AC. ASTM B302 - Standard Specification for Threadless Copper Pipe, Standard Sizes; 2012.

AD. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV); 2013.

AE. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2016.

AF. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2016.

AG. ASTM C4 - Standard Specification for Clay Drain Tile and Perforated Clay Drain Tile; 2004 (Reapproved 2014).

AH. ASTM C14 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe; 2015a.

AI. ASTM C14M - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, Culvert Pipe and (Metric); 2015a.

AJ. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe; 2016.

AK. ASTM C76M - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric); 2016.

AL. ASTM C425 - Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings; 2004 (Reapproved 2013).

AM. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets; 2012 (Reapproved 2017).

AN. ASTM C443M - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric); 2011 (Reapproved 2017).

AO. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2014.

AP. ASTM C700 - Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated; 2013.

AQ. ASTM C1053 - Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications; 2000 (Reapproved 2015).

AR. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2015, with Editorial Revision (2018).

AS. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings; 2004 (Reapproved 2016).

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AT. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter; 2012a.

AU. ASTM D2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series); 2015.

AV. ASTM D2447 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter; 2003.

AW. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2017.

AX. ASTM D2513 - Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings; 2018.

AY. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2012.

AZ. ASTM D2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe; 2015.

BA. ASTM D2661 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings; 2014.

BB. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2014.

BC. ASTM D2680 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping; 2001 (Reapproved 2014).

BD. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing; 2014.

BE. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2011.

BF. ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings; 2005.

BG. ASTM D2846/D2846M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems; 2017b, with Editorial Revision (2018).

BH. ASTM D2855 - Standard Practice for the Two-Step (Primer & Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets; 2015.

BI. ASTM D2996 - Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe; 2017.

BJ. ASTM D2997 - Standard Specification for Centrifugally Cast "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe; 2015.

BK. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2016.

BL. ASTM D3262 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe; 2016.

BM. ASTM D3517 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pressure Pipe; 2014.

BN. ASTM D3754 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer and Industrial Pressure Pipe; 2014.

BO. ASTM D3840 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Fittings for Nonpressure Applications; 2014.

BP. ASTM F437 - Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80; 2015.

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BQ. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40; 2017.

BR. ASTM F439 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80; 2013.

BS. ASTM F441/F441M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80; 2015.

BT. ASTM F442/F442M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR); 2013, with Editorial Revision.

BU. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe; 2014.

BV. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings; 2014.

BW. ASTM F628 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core; 2012, with Editorial Revision (2016).

BX. ASTM F679 - Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings; 2016.

BY. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992 (Reapproved 2008).

BZ. ASTM F1281 - Standard Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe; 2017.

CA. ASTM F1282 - Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe; 2017.

CB. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011 (Amended 2012).

CC. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2010.

CD. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2012.

CE. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2017.

CF. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2017.

CG. AWWA C651 - Disinfecting Water Mains; 2014.

CH. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution; 2016.

CI. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm), for Water Service; 2017.

CJ. AWWA C950 - Fiberglass Pressure Pipe; 2013.

CK. 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).

CL. 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).

CM. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements; 2015.

CN. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements; 2015.

CO. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements; 2015.

CP. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

CQ. MSS SP-67 - Butterfly Valves; 2017.

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CR. MSS SP-69 - Pipe Hangers and Supports - Selection and Application; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.

CS. MSS SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends; 2011.

CT. MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends; 2011, with Errata (2013).

CU. MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends; 2011.

CV. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; 2013.

CW. MSS SP-85 - Cast Iron Globe & Angle Valves, Flanged and Threaded Ends; 2011.

CX. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.

CY. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.

CZ. NFPA 54 - National Fuel Gas Code; National Fire Protection Association; 2012.

DA. NFPA 58 - Liquefied Petroleum Gas Code; National Fire Protection Association; 2014.

DB. NSF 61 - Drinking Water System Components - Health Effects; 2017.

DC. NSF 372 - Drinking Water System Components - Lead Content; 2016.

1.04 SUBMITTALS

A. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

B. Project Record Documents: Record actual locations of valves.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of experience.

C. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum 3 years of experience.

D. Perform Work in accordance with local standards.

E. Valves: Manufacturer's name and pressure rating marked on valve body.

F. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.06 REGULATORY REQUIREMENTS

A. Perform Work in accordance with local plumbing code.

B. Conform to applicable code for installation of backflow prevention devices.

C. Provide certificate of compliance from authority having jurisdiction indicating approval of installation of backflow prevention devices.

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 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

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1.09 EXTRA MATERIALS

A. Provide two repacking kits for each size valve.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 SANITARY WASTE PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 extra heavy weight.
   1. Fittings: Cast iron.
   2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless.
   1. Fittings: Cast iron.
   2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

C. Ductile Iron Pipe (Required Through Walls and Floor Slabs): ANSI/AWWA C151/A21.51 and ANSI/AWWA C150/A21.50, Class 53. Grade 60-42-10 with 40/90 metal strength and shall be tested to ASTM A339.
   1. Joints: Rubber-gasket joints shall meet requirements of ANSI/AWWA C111/A21.11.
   2. Coating and Lining: Outside coating shall be an asphaltic coating approximately one mil thick. Pipe shall be cement-mortar lined per ANSI/AWWA C104/A21.4.

2.03 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74, service weight.
   1. Fittings: Cast iron.
   2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

B. 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.

2.04 WATER PIPING AND SUMP DISCHARGE PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Ductile Iron Pipe (Required Through Walls and Floor Slabs): ANSI/AWWA C151/A21.51 and ANSI/AWWA C150/A21.50, Class 52.
   1. Joints: Rubber-gasket joints shall meet requirements of ANSI/AWWA C111/A21.11.
   2. Coating and Lining: Outside coating shall be an asphaltic coating approximately one mil thick. Pipe shall be cement-mortar lined per ANSI/AWWA C104/A21.4.

B. Copper Pipe: ASTM B88 (ASTM B88M), Type K (A), Drawn (H).
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: ASTM B32, alloy Sn95 solder.

C. Ductile Iron Pipe: AWWA C151/A21.51.
   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.

2.05 WATER PIPING AND SUMP DISCHARGE 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.
   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.
      a. Manufacturers:
         1) FNW; Copper Press: www.fnw.com/#sle.
         2) Grinnell Products, a Tyco Business: www.grinnell.com/#sle.

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3) Viega LLC: www.viega.com/#sle.
4) Substitutions: See Section 01 60 00 - Product Requirements.

2.06 STORM DRAINAGE PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Ductile Iron Pipe (Required through Walls and Floor Slabs): ANSI/AWWA C151/A21.51 and ANSI/AWWA C150/A21.50, Class 53.
   1. Joints: Rubber-gasket joints shall meet requirements of ANSI/AWWA C111/A21.11.
   2. Coating and Lining: Outside coating shall be an asphaltic coating approximately one mil thick. Pipe shall be cement-mortar lined per ANSI/AWWA C104/A21.4.

B. Cast Iron Pipe: ASTM A74 service weight.
   1. Fittings: Cast iron.
   2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

C. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.07 STORM DRAINAGE PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74 extra heavy weight.
   1. Fittings: Cast iron.
   2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless, service weight.
   1. Fittings: Cast iron.
   2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.08 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:
   1. Copper tube and pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Size Over 1 Inch:
   1. Copper tube and pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.09 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
   3. Trapeze Hangers: Welded steel channel frames attached to structure.
   4. Vertical Pipe Support: Steel riser clamp.

B. Plumbing Piping - Drain, Waste, and Vent:
   1. Conform to ASME B31.9.
   2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
   3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
   4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
   6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
   7. Vertical Support: Steel riser clamp.
   8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

C. Plumbing Piping - Water:

NOT FOR BIDDING

1. Conform to ASME B31.9.
2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 Inches to 4 Inches: Carbon steel, adjustable, clevis.
5. Hangers for Hot Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron pipe roll, double hanger.
6. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.
7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches and Over: Steel channels with welded supports or spacers and hanger rods, cast iron roll.
8. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
9. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
10. Wall Support for Hot Pipe Sizes 6 Inches and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron pipe roll.
11. Vertical Support: Steel riser clamp.
12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
13. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
14. Floor Support for Hot Pipe Sizes 6 Inches and Over: Adjustable cast iron pipe roll and stand, steel screws, and concrete pier or steel support.
15. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
1. Concrete Wedge Expansion Anchors: Comply with ICC-ES AC193.
2. Masonry Wedge Expansion Anchors: Comply with ICC-ES AC01.
3. Concrete Screw Type Anchors: Comply with ICC-ES AC193.
4. Masonry Screw Type Anchors: Comply with ICC-ES AC106.

2.10 BALL VALVES

A. Manufacturers:
1. Conbraco Industries: www.conbraco.com.
2. Nibco, Inc: www.nibco.com.
3. Milwaukee Valve Company: www.milwaukeevalve.com.
4. Viega LLC: www.viega.us/#sle.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, threaded or grooved ends with union.

2.11 PLUG VALVES

A. Manufacturers:
1. Conbraco Industries: www.conbraco.com.
2. Nibco, Inc: www.nibco.com.
3. Milwaukee Valve Company: www.milwaukeevalve.com.

B. Construction 2-1/2 Inches and Larger: 1, 175 psi CWP, cast iron body and plug, pressure lubricated, teflon or Buna N packing, flanged or grooved ends. Provide lever operator with set screw.

2.12 SWING CHECK VALVES

A. Manufacturers:
1. Hammond Valve: www.hammondvalve.com.
2. Nibco, Inc: www.nibco.com.

NOT FOR BIDDING

3. Milwaukee Valve Company: www.milwaukeevalve.com.

B. Up to 3 Inches:
1. 1, Class 125, bronze body and cap, bronze swing disc with rubber seat, solder ends.

C. Over 3 Inches:
1. 1, Class 125, iron body, bronze swing disc, renewable disc seal and seat, flanged or grooved ends.

2.13 SPRING LOADED CHECK VALVES

A. Manufacturers:
1. Hammond Valve: www.hammondvalve.com.
2. Crane Co.: www.cranevalve.com.
3. Milwaukee Valve Company: www.milwaukeevalve.com.

B. Class 125, iron body, bronze trim, stainless steel springs, bronze disc, Buna N seals, wafer style ends.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

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 non-conducting dielectric connections 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. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 07 19.

G. Install vent piping penetrating roofed areas to maintain integrity of roof assembly .

H. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

I. Provide support for utility meters in accordance with requirements of utility companies.

J. Install bell and spigot pipe with bell end upstream.

K. Install valves with stems upright or horizontal, not inverted.

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. 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.

NOT FOR BIDDING

3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.

Q. Pipe Hangers and Supports:
1. Install in accordance with ASME B31.9.
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 exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
10. Provide hangers adjacent to motor driven equipment with vibration isolation; refer to Section 22 05 48.
11. Support cast iron drainage piping at every joint.

3.04 APPLICATION

A. Use grooved mechanical couplings and fasteners only in accessible locations.

B. Install unions downstream of valves and at equipment or apparatus connections.

C. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

D. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

E. Provide spring loaded check valves on discharge of water pumps.

3.05 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope.

B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.06 FIELD TESTS AND INSPECTIONS

A. Verify and inspect systems according to requirements by the Authority Having Jurisdiction. In the absence of specific test and inspection procedures proceed as indicated below.

B. Domestic Water Systems:
1. Perform hydrostatic testing for leakage prior to system disinfection.
2. Test Preparation: Close each fixture valve or disconnect and cap each connected fixture.
3. General:
   a. Fill the system with water and raise static head to 10 psi above service pressure. Minimum static head of 50 to 150 psi. As an exception, certain codes allow a maximum static pressure of 80 psi.
4. Metal Piping Systems Subject to Freezing Conditions:
   a. Inject 40 psi of compressed air into piping to spot check for leaks with liquid soap. Document and repair leaks as necessary.
   b. Raise injected compressed air pressure to 1.5 times rated service pressure or minimum pressure of 100 psi for a duration of 2 hours and verify with a gauge that no perceptible pressure drop is measured.

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C. Test Results: Document and certify successful results, otherwise repair, document, and retest.

3.07 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed and clean.

B. Ensure Ph of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.

D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.08 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 double check backflow preventer and water meter with blocking valves, pressure gauges, by-pass valve, and sand strainer.
   1. Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Calk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.
   2. Provide 18 gage galvanized sheet metal sleeve around service main to 6 inch above floor and 6 feet minimum below grade. Size for minimum of 2 inches of loose batt insulation stuffing.

3.09 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe size: 1/2 inches to 1-1/4 inches:
         1) Maximum hanger spacing: 6.5 ft.
         2) Hanger rod diameter: 3/8 inches.
      b. Pipe size: 1-1/2 inches to 2 inches:
         1) Maximum hanger spacing: 10 ft.
         2) Hanger rod diameter: 3/8 inch.
      c. Pipe size: 2-1/2 inches to 3 inches:
         1) Maximum hanger spacing: 10 ft.
         2) Hanger rod diameter: 1/2 inch.
      d. Pipe size: 4 inches to 6 inches:
         1) Maximum hanger spacing: 10 ft.
         2) Hanger rod diameter: 5/8 inch.
      e. Pipe size: 8 inches to 12 inches:
         1) Maximum hanger spacing: 14 ft.
         2) Hanger rod diameter: 7/8 inch.
      f. Pipe size: 14 inches and Over:
         1) Maximum hanger spacing: 20 ft.
         2) Hanger rod diameter: 1 inch.
   2. Plastic Piping:
      a. Pipe Size 1" to 6":
         1) Maximum hanger spacing: 6 ft.

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2) Hanger rod diameter: 3/8 inch.

b. Pipe Size 8" and Over:
   1) Maximum hanger spacing: 6 ft.
   2) Hanger rod diameter: 7/8 inch.

END OF SECTION

NOT FOR BIDDING

SECTION 22 10 06
PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Drains.
B. Cleanouts.
C. Hydrants.
D. Double check valve assemblies.
E. Water hammer arrestors.
F. Floor drain trap seals.
G. Interceptors.

1.02 RELATED REQUIREMENTS

A. Section 22 10 05 - Plumbing Piping.
B. Section 22 40 00 - Plumbing Fixtures.

1.03 REFERENCE STANDARDS

A. ASME A112.6.3 - Floor and Trench Drains; 2016.
B. ASME A112.6.4 - Roof, Deck, and Balcony Drains; 2008 (Reaffirmed 2012).
C. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers; 2004, with Errata.
D. ASSE 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent; 2009.
E. ASSE 1013 - Performance Requirements for 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 (Reaffirmed 2016).
G. ASTM C478 - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections; 2015a.
H. ASTM C478M - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections (Metric); 2015a.
I. NSF 61 - Drinking Water System Components - Health Effects; 2017.
J. NSF 372 - Drinking Water System Components - Lead Content; 2016.
K. PDI-WH 201 - Water Hammer Arresters; 2010.

1.04 SUBMITTALS

A. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
B. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.
C. Certificates: Certify that grease or oil interceptors meet or exceed specified requirements.
D. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.
E. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, water hammer arrestors.
F. Operation Data: Indicate frequency of treatment required for interceptors.
G. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

NOT FOR BIDDING

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum [3] years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 DRAINS

A. Manufacturers:
   1. Josam Company: www.josam.com/#sle.
   2. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
   3. Zurn Industries, Inc: www.zurn.com/#sle.

B. Heavy-Duty Parking Deck Drains:
   1. 15-7/8" Square top parking deck drain, dura-coated cast iron body with bottom outlet, heavy-duty gasketed drain support flange, with heavy-duty slotted ductile iron grate.
      a. Provide with underdeck clamp of adjustable thickness, vandal-proof secured top and sediment bucket.

C. Floor Drains:
   1. Dura-coated cast iron body with bottom outlet, combination invertible membrane clamp and adjustable collar with seepage slot and polished nickel bronze, light-duty heel-proof strainer.
      a. Provide with sediment bucket, acid-resisting epoxy coated cast iron construction, and standard bronze top.

2.03 CLEANOUTS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.
   2. Josam Company: www.josam.com/#sle.
   3. Zurn Industries, Inc: www.zurn.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Cleanouts at Exterior Surfaced Areas (including parking garage areas):
   1. Square lacquered cast iron body with epoxy coated, gasketed non-skid cover suitable for vehicular traffic.

C. Cleanouts at Interior Finished Floor Areas:
   1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.

D. Cleanouts at Interior Finished Wall Areas:
   1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

E. Cleanouts at Interior Unfinished Accessible Areas: Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.04 HYDRANTS

A. Manufacturers:
   1. Arrowhead Brass Company: www.arrowheadbrass.com/#sle.

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2. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.
3. Zurn Industries, Inc: www.zurn.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Wall Hydrants: Parking Garage Areas
1. ASSE 1019; tamper-proof, freeze resistant, self-draining type with chrome plated wall plate hose thread spout, handwheel, and integral vacuum breaker.
a. Installation: Exposed, surface-mounted with traffic guard.
b. Finish: Polished bronze.
c. Operation: Operating key.

C. Wall Hydrants: Exterior
1. ASSE 1019; chrome plated lockable recessed box, hose thread spout, lockshield and removable key, and vacuum breaker.
a. Finish: Polished nickel bronze.

2.05 DOUBLE CHECK VALVE ASSEMBLIES

A. Manufacturers:
1. Conbraco Industries: www.conbraco.com/#sle.
2. Watts Regulator Company: www.wattsregulator.com/#sle.
3. Zurn Industries, Inc: www.zurn.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Double Check Valve Assemblies:
1. ASSE 1012; Bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.
2. Size: 3/4 to 2 inch, NPS assembly with threaded full port ball valves.
3. Maximum Working Parameters: 175 psi at 180 degrees F.
4. Accessories: Provide lead-free Y-strainer and test cock.

2.06 WATER HAMMER ARRESTORS

A. Manufacturers:
1. Jay R. Smith Manufacturing Company: www.jayrsmith.com/#sle.
2. Watts Regulator Company: www.wattsregulator.com/#sle.
3. Zurn Industries, Inc: www.zurn.com/#sle.
4. Souix Chief Company.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Water Hammer Arrestors:
1. Stainless steel construction, bellows or piston type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range -100 to 300 degrees F and maximum 250 psi working pressure.

2.07 INTERCEPTORS

A. Manufacturers:
1. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
2. Zurn Industries, Inc: www.zurn.com.
3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Oil Interceptors:
1. Construction:
a. Material: Fiberglass reinforced plastics consisting of polyester resin and E glass; minimum thickness 1/4" wall and 3/8" top and bottom bowls.
b. Rough-in: Fully recessed (shallow rough-in) with anchor flange.
c. Piping is schedule 40 PVC, with 8" inlet and 8" outlet.
d. Custom extension collars are to be furnished to mount covers at finished grade, to be cut on site for final adjustment.
e. Product to be furnished with 30-year warranty against leaks.

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f. Cover: Cast iron, AASHTO M306 Traffic load rated. 24-inch diameter covers with 0.25" gasket. Two closed pickholes. Non-bolted, 249-lbs, ASTM A48 CL35B.
g. Optional product accessories to be provided:
1) Alarm: An electornic monitoring system with remote-mounted control panel having audible / visual alarm and dry contract for BAS connection for remote high-level monitoring.
2) Coalescing filter for small diameter oil globules.
3) Suction pipe for indoor installations to facilitate oil removal.

2. Installation: Provide with vendor-supplied, concrete hold-down and compact select fill base.

2.08 FLOOR DRAIN TRAP SEALS

A. Description: Push-fit EPDM or silicone fitting with a one-way membrane.

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 floor cleanouts at elevation to accommodate finished floor.

E. Install approved portable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.

F. Pipe relief from backflow preventers and double check valve assemblies to nearest drain.

G. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatories, sinks, washing machines, toilets, urinal and any other quick closing valves .

H. Prefabricated oil separators are to be installed on a base of select fill with vendor-supplied, concrete hold-down(s).

END OF SECTION

NOT FOR BIDDING

SECTION 22 14 29
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. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide certified pump chart or curve with duty point marked over.

C. Shop Drawings: Include dimensions and performance data.

D. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

E. Executed warranty.

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.

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. See Section 01 78 00 - Closeout Submittals 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.

C. Submit warranty with related forms completed in Owner's name and registered with manufacturer.

PART 2 PRODUCTS

2.01 SUBMERSIBLE SUMP PUMPS

A. Manufacturers:
1. Grundfos Pumps Corporation: www.grundfos.com/#sle.
2. Goulds: www.gouldspumps.com.
3. Stancor: www.flowsolutions.com.
4. Zoeller Company: www.zoeller.com/#sle.

B. General: Rugged stainless steel and cast iron housing and base with oil-filled motor chamber, ball bearings, and mechanical seal.

C. Impeller: Thermoplastic; open nonclog, stainless steel shaft.

D. 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.

E. 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.

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F. Solids Handling Capacity: Pass lint and other small solids up to 1/2 inch in size.

G. Discharge Pipe Size: 2 inch, NPT, female.

H. Maximum Water-Based Effluent Temperature: 120 degrees F.

I. Accessories: Provide full flow swing-type discharge check valve.

J. Elevator Pit Sumps:
   1. Basis of Design is the Model SE-50 submersible effluent pump by Stancor or approved equal -- with 115V, 1/2 HP, 3600 RPM motor and 2" discharge connection with 2" check valve.
   2. Stancor Oil-Minder or approved equal control system (115V, single phase) without oil sensing alarm, but with alarm for high amperage conditions. Provide silencing button for audible alarm built into panel. Panel shall have two contacts for remote alarm location (one each for oil and high water or amperage alert). Junction box will be provided with multi-pin connector and cord in lengths as required in 25 ft inrements. Control panel is to be located as directed by the Owner.
   3. Junction box will be provided with multi-pin connector and cord in lengths as required in 25 ft increments up to 250 ft.
   4. All buried pump pressure discharge piping shall be protected with tapecoat CT corrosion protection protection tape.
   5. Pump cable, probe cable, high liquid alarm cable, and pump "on" float cable to be furnished in 16 ft lengths.
   6. High liquid alarm flat with clamp device to mount to pump discharge piping.
   7. Pump on/oil alert float.
   8. Power cord and molded ground plug to be furnished in 6 ft length.
   9. "Push to test" switch for diagnostic check of all pump control and power functions.

K. Stormwater Sumps:
   1. Fiberglass Sump Basin
      a. Basis of Design is Model DUP 4872LS3 duplex fiberglass sump basin by Goulds Pumps or approved equal.
      b. Heavy-duty construction, 48" diameter x 72" deep with pipe grommets, discharge hubs, stainless steel float switch bracket, junction boxes, cord grips and cord seals.
      c. Ventilated duplex steel pump cover with black epoxy coating applied ot each cover with field-installed inlet(s) to match incoming pipe size(s) and field-installed outlet(s) to match outgoing pipe size(s); two pump access doors, one inspection plate, and float switch cord grips.
      d. Portable hoist, 2-3/8" diameter, 304 stainless steel construction with 30' of 1/4" stainless steel cable, galvanized one-ton hook, marine grade brake winch, and adjustable reach in 1" increments.
      e. Provide with vendor-supplied, concrete hold-down and compact select fill base.
   2. Duplex Pumps
      a. Basis of Design is two (2) Model 3DWS3F4A2D1A pumps by Goulds Pumps or approved equal.
      b. One pump is to be enabled and the second is to be in standby, alternated periodically by the vendor-furnished control panel.
      c. Pump characteristics are 115 GPM @ 25 ft nominal head. Pump motor shall be 1.5 HP, 1800 RPM and pump shall have a 6.5-in impeller.
      d. Cast iron, two-vane, semi-open, non-clogging impeller with pump-out vanes for mechanical seal protection and balanced for smooth operation.
      e. Heavy-duty, gray cast iron, volute type casting with a horizontal discharge.
      f. Dual mechanical seals with stainless steel parts and BUNA-N elastomers: the outer seal has silicon carbide vs silicon carbide ssealing faces, the inner seal has carbon vs ceramic sealing faces.
      g. Upper and lower shaft seals, which are positioned independently and separated by an oil-filled chamber.

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h. Stainless steel fasteners and shaft with a keyed design.
i. Capable of running dry temporarily without damage to seals or motor.
j. Designed for continuous operation.
k. Three year standard warranty.

3. Control Panel
   a. Basis of Design is Model BGDUP - 3-PH - DISCSEALF or approved equal.
   b. Duplex panel for two (2) three-phase pumps.
   c. NEMA-1 oversized enclosure with one main disconnect and through-the-door interlock to prevent the door from being opened when disconnect is on.
   d. Manual, lockable disconnect feature on the motor overload protector.
   e. Oversized magnetic contactor.
   f. Ambinet compensated, bi-metallic motor overload circuit protector. Instantaneous magnetic trip for short circuit protection. Single-phase protection for three-phase motor. Field adjustable within the amp range.
   g. Control transformer with fused primary and fused secondary on all three-phases.
   h. Through-door hand-off-auto switch, control on/off switch, and green pump run lights.
   i. Numbered and wired control terminal board.
   j. Alarm audible horn and auxiliary dry-contacts for connection to remote monitoring and/or BAS.
   k. Field adjustalbe for 208/230/460/575 V @ 60 Hz with 120V control circuit transformer and adjustable motor overload protectors.
   l. Provide the following additional product options:
      1) Guaranteed pump submergence circuit
      2) 115V condensation heater
      3) Three-phase lightning arrestor
      4) Elapsed time meter - duplex
      5) Seal fail circuit - duplex
      6) Cycle counter - duplex
      7) High temp. indicator
      8) Four (4) intrinsically safe relays in duplex panel
      9) Duplex dry contact for seal failure interface to building management system.
      10) Duplex dry contact for pump running interface to building management system.
      11) Dry contact for high level alarm interface to buliding management system.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install products with related fittings and accessories according to manufacturer instructions.

B. Observe and provide incidentals required to complete installation in compliance with ICC (IPC).

3.02 PROTECTION

A. Protect installed products from damage from subsequent construction operations.

END OF SECTION

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SECTION 22 40 00
PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water closets.

B. Lavatories.

C. Mop sinks.

1.02 RELATED REQUIREMENTS

A. Section 07 90 05 - Joint Sealers: Seal fixtures to walls and floors.

B. Section 22 10 05 - Plumbing Piping.

C. Section 22 10 06 - Plumbing Piping Specialties.

1.03 REFERENCE STANDARDS

A. ANSI Z124.1 - American National Standard for Plastic Bathtub Units; 1995.

B. ANSI Z124.2 - American National Standard for Plastic Shower Units; 1995.

C. IAPMO Z124 - Plastic Plumbing Fixtures; 2017.

D. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment; 2014.

E. ARI 1010 - Self-Contained, Mechanically-Refrigerated Drinking-Water Coolers; Air-Conditioning and Refrigeration Institute; 2002.

F. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2017).

G. ASME A112.18.1 - Plumbing Supply Fittings; 2012.

H. ASME A112.19.1M - Enameled Cast Iron Plumbing Fixtures; The American Society of Mechanical Engineers; 2008 (R2011).

I. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2013.

J. ASME A112.19.3 - Stainless Steel Plumbing Fixtures; 2017.

K. ASME A112.19.4M - Porcelain Enameled Formed Steel Plumbing Fixtures; 1994 (R2009).

L. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks; 2017.

M. ASME A112.19.14 - Six Liter Water Closets Equipped with Dual Flushing Device; 2013.

N. NSF 61 - Drinking Water System Components - Health Effects; 2017.

O. NSF 372 - Drinking Water System Components - Lead Content; 2016.

1.04 SUBMITTALS

A. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

B. Samples: Submit two sets of color chips for each standard color.

C. Manufacturer's Instructions: Indicate installation methods and procedures.

D. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

E. Waterless Urinals: Submit recommended frequency of maintenance and parts replacement, methods of cleaning, sources of replacement supplies and parts.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

NOT FOR BIDDING

1.05 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., or testing firm acceptable to the authority having jurisdiction as suitable for the purpose specified and indicated.

1.06 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.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

1.08 EXTRA MATERIALS

A. Supply two sets of faucet washers, flush valve service kits, and lavatory supply fittings.

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. Maximum Fixture or Faucet Supply Pressure: 60 psi unless stated otherwise.

2.02 REGULATORY REQUIREMENTS

A. Comply with applicable codes for installation of plumbing systems.

2.03 FLUSH VALVE WATER CLOSETS

A. Water Closets: Vitreous china, ASME A112.19.2, floor mounted, siphon jet flush action, china bolt caps. See schedules.
   1. Bowl: ASME A112.19.2; 16.5 inches high with elongated rim.
   2. Flush Volume: 1.1 GPM or 1.6 GPM, dual flush.
   3. Flush Valve: Exposed (top spud).
   4. Flush Operation: Manual, oscillating handle
   5. Handle Height: 44 inches or less.
   6. Manufacturers:
      a. American Standard Inc: www.americanstandard.com.
      b. Kohler: www.kohler.com.
      c. Toto USA: www.totousa.com.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

B. Flush Valves: ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.
   1. Valve Supply Size: 1 inch.
   2. Manual Operated:
      a. Type: ASME A112.18.1 or ASME A112.19.5; diaphragm type complete with vacuum breaker stops, and accessories.
      b. Supplied Volume Capacity: 1.1 or 1.6 gal per flush, dual flush.
   3. Manufacturers:
      a. Toto USA: www.totousa.com
      b. Sloan Valve Company: www.sloanvalve.com.
      c. Moen: www.moen.com.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

C. Seats:
   1. Manufacturers:
      a. Kohler
      b. Bemis Manufacturing Company: www.bemismfg.com/#sle.

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c. Church Seat Company: www.churchseats.com/#sle.
d. Olsonite: www.olsonite.com/#sle.
e. Substitutions: See Section 01 60 00 - Product Requirements.

2. Solid white plastic, open front, extended back, self-sustaining hinge, brass bolts, with cover.

2.04 LAVATORIES

A. Lavatory Manufacturers:
1. American Standard, Inc: www.americanstandard-us.com/#sle.
2. Kohler Company: www.kohler.com/#sle.
3. Toto USA: www.totousa.com.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Vitreous China Wall Hung Basin: ASME A112.19.2; vitreous china wall hung lavatory with 4 inch high back, rectangular basin with splash lip, front overflow, and soap depression. See schedules.
1. Drilling Centers: 4 inch.

C. Supply Faucet: ASME A112.18.1; chrome plated combination supply fitting with pop-up waste, water economy aerator with maximum flow of 0.5 gallon per minute (low-flow), single lever handle.

D. Accessories:
1. Chrome plated 17 gage brass P-trap with clean-out plug and arm with escutcheon.
2. Offset waste with perforated open strainer.
3. Screwdriver stops.
4. Rigid supplies.
5. Carrier:
a. Manufacturers:
1) See schedules.
2) Substitutions: See Section 01 60 00 - Product Requirements.
b. ASME A112.6.1M; with lugs for wall attachment, threaded studs for fixture hanger, or concealed arm supports bearing plate and studs.

2.05 MOP SINKS

A. Manufacturers:
1. Acorn Engineering Company: www.acorneng.com/#sle.
2. American Standard: www.americanstandard.com.
3. Metcraft Industries, Inc: metcraftindustries.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Material: Enameled cast iron.

C. Type: Rectilinear.

D. Grid Strainer: Stainless steel; integral; removable.

E. Faucet: Chrome plated cast brass sink faucet with 6" vacuum breaker spout, lever handles, pail hook, 3/4" hose end and 8" brace, adjustable flow.

F. Dimensions: As indicated on drawings.

G. Accessories:
1. 5 feet of 1/2 inch diameter plain end reinforced plastic hose.
2. Hose clamp hanger.
3. Mop hanger.

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.

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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 rigid or flexible supplies to fixtures with screwdriver stops, reducers, and escutcheons.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall supports or wall carriers and bolts.

E. Seal fixtures to wall and floor surfaces with sealant as specified in Section 07 90 05, color to match fixture.

F. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

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.

END OF SECTION

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SECTION 23 05 53
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.
B. Tags.
C. Stencils.
D. Pipe Markers.

1.02 RELATED REQUIREMENTS

A. Section 09 90 00 - Painting and Coating: Identification painting.

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2015.

1.04 SUBMITTALS

A. See Section 01 33 00 - Administrative Requirements, for submittal procedures.
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. Samples: Submit two labels, tags and pipe markers.
F. Manufacturer's Installation Instructions: Indicate special procedures, and installation.
G. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Air Handling Units: Nameplates.
B. Automatic Controls: Nameplates.
C. Control Panels: Nameplates.
D. Ductwork: Stencilled painting.
E. Instrumentation: Nameplates.
F. Major Control Components: Nameplates.
G. Piping: Pipe markers.
H. Pumps: Nameplates.
I. Relays: Nameplates.
J. Thermostats: Nameplates.
K. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.02 MANUFACTURERS

A. Brady Corporation: www.bradycorp.com.
B. Champion America, Inc: www.Champion-America.com.
C. Seton Identification Products: www.seton.com/aec.
D. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.
    1. Letter Color: White.

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2. Letter Height: 1/4 inch.
3. Background Color: Black.

2.04 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved white letters on green 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.

2.05 STENCILS

A. Stencils: With clean cut symbols and letters of following size:
1. Ductwork and Equipment: 2-1/2 inch high letters.

B. Stencil Paint: As specified in Section 09 90 00, semi-gloss enamel, colors conforming to ASME A13.1.

2.06 PIPE MARKERS

A. Color: Conform to 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. Refrigerant and condensate piping: Green with white letters.

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. HVAC 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 Section 09 90 00 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. Install tags with corrosion resistant chain.

C. Apply stencil painting in accordance with Section 09 90 00.

D. Install plastic pipe markers in accordance with manufacturer's instructions.

E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

G. 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.

H. Identify control panels and major control components outside panels with plastic nameplates.

I. Identify thermostats relating to terminal boxes or valves with nameplates.

J. Identify valves in main and branch piping with tags.

K. Identify air terminal units and radiator valves with numbered tags.

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L. Tag automatic controls, instruments, and relays. Key to control schematic.

M. Identify piping, concealed or exposed, with plastic pipe markers. 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 ductwork with plastic nameplates or stencilled painting. Identify 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.

3.03 UNIT TAG SCHEDULE

A. Equipment Type: Heat Pump (HP)
   1. Identification: Tag (HP-X) where X = VRF Heat Pump number. Include manufacturer, model number, serial number, voltage, and operating weight.
   2. Background:
      a. Size: As needed to contain information
      b. Color: Black
   3. Lettering:
      a. Size: 1/4 inch high
      b. Color: White
   4. Placement: Visible location

B. Equipment Type: Fan Coil (FC)
   1. Identification: Tag (FC-X) where X = Fan Coil number. Include manufacturer, model number, serial number, voltage, and operating weight.
   2. Background:
      a. Size: As needed to contain information
      b. Color: Black
   3. Lettering:
      a. Size: 1/4 inch high
      b. Color: White
   4. Placement: Visible location

C. Equipment Type: Exhaust Fan (EF)
   1. Identification: Tag (EF-X) where X = Exhaust Fan number. Include manufacturer, model number, serial number, design airflow, design pressure loss, and voltage.
   2. Background:
      a. Size: As needed to contain information
      b. Color: Black
   3. Lettering:
      a. Size: 1/4 inch high
      b. Color: White
   4. Placement: Visible location

D. Equipment Type: Electric Unit Heater (UH)
   1. Identification: Tag (UH-X) where X = Electric Unit Heater number. Include manufacturer, model number, serial number, voltage, and heater nominal wattage.
   2. Background:
      a. Size: As needed to contain information
      b. Color: Black
   3. Lettering:
      a. Size: 1/4 inch high
      b. Color: White

NOT FOR BIDDING

4. Placement: Visible location

END OF SECTION

NOT FOR BIDDING

SECTION 23 05 93

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 refrigerating as applicable systems.

C. Measurement of final operating condition of HVAC systems.

1.02 REFERENCE STANDARDS

A. AABC MN-1 - AABC National Standards for Total System Balance; Associated Air Balance Council; 2002.

B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008.

C. NEBB (TAB) - Procedural Standards for Testing Adjusting and Balancing of Environmental Systems; 2015, with Errata (2017).

D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2002.

1.03 SUBMITTALS

A. See Section 01 33 00 - Administrative Requirements, for submittal procedures.

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 Commissioning Authority.
   2. Submit six weeks prior to starting the testing, adjusting, and balancing work.
   3. Include certification that the plan developer has reviewed the contract documents, the equipment and systems, and the control system with the Architect and other installers to sufficiently understand the design intent for each system.
   4. 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:

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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. Proposed selection points for sound measurements and sound measurement methods.
p. Methods for making coil or other system plant capacity measurements, if specified.
q. Time schedule for TAB work to be done in phases (by floor, etc.).
r. Description of TAB work for areas to be built out later, if any.
s. Time schedule for deferred or seasonal TAB work, if specified.
t. False loading of systems to complete TAB work, if specified.
u. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
v. Interstitial cavity differential pressure measurements and calculations, if specified.
w. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
x. Procedures for formal progress reports, including scope and frequency.
y. Procedures for formal deficiency reports, including scope, frequency and distribution.

D. Field Logs: Submit at least twice a week to Studio JAED; Commissioning Authority and HVAC Controls Contractor.

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 Commissioning Authority; Studio JAED and HVAC Controls Contractor 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 and for inclusion in operating and maintenance manuals.
4. Provide reports in hard 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.

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f. Project Engineer.
g. Project altitude.
h. Report date.

H. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:
1. AABC MN-1, AABC National Standards for Total System Balance.
2. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
3. SMACNA (TAB).
4. Maintain at least one copy of the standard to be used at project site at all times.

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. Having minimum of three years documented experience.
3. Certified by one of the following:
a. AABC, Associated Air Balance Council: www.aabchq.com; upon completion submit AABC National Performance Guaranty.
b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.

E. TAB Supervisor Qualifications: Professional Engineer licensed in the State in which the Project is located.

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.

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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 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 10 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 10 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, 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 Owner.

H. Check and adjust systems approximately six months after final acceptance and submit report.

3.06 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.

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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. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

M. Check multi-zone units for motorized damper leakage. Adjust air quantities with mixing dampers set first for cooling, then heating, then modulating.

N. For variable air volume system powered units set volume controller to air flow setting indicated. Confirm connections properly made and confirm proper operation for automatic variable air volume temperature control.

3.07 SCOPE

A. Test, adjust, and balance the following:
1. Fan Coils.
2. Exhaust Fans.
3. Plumbing Pumps.
4. Air Cooled Refrigerant Condensers and Heat Pumps.
5. Air Coils.
6. Air Filters.
7. Air Inlets and Outlets.

3.08 MINIMUM DATA TO BE REPORTED

A. Electric Motors:
1. Manufacturer
2. Model/Frame
3. HP/BHP
4. Phase, voltage, amperage; nameplate, actual, no load
5. RPM
6. Service factor
7. Starter size, rating, heater elements
8. 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

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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. Cooling Coils:
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. Saturated suction temperature, design and actual.
11. Air pressure drop, design and actual

F. Heating Coils:
1. Identification/number
2. Location
3. Service
4. Manufacturer
5. Air flow, design and actual
6. Entering air temperature, design and actual
7. Leaving air temperature, design and actual
8. Air pressure drop, design and actual

G. 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

H. Return Air/Outside Air:

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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

I. 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.

J. 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

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SECTION 23 07 13
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Insulation jackets.

1.02 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 C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2017.

D. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.

E. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.

F. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2016.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.

H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

I. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.

J. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

K. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).

L. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

B. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.04 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. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of experienceand approved by manufacturer.

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.

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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 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, NFPA 255, or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturer:
   1. Knauf Insulation: www.knaufusa.com.
   2. Johns Manville Corporation: www.jm.com/#sle.
   3. Owens Corning Corporation: www.ocbuildingspec.com.
   4. CertainTeed Corporation: www.certainteed.com/#sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: ASTM C553; flexible, noncombustible blanket.
   1. 'K' value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
   2. Maximum Service Temperature: 450 degrees F.
   3. Maximum Water Vapor Sorption: 5.0 percent by weight.

C. Vapor Barrier Jacket:
   1. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
   2. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Outdoor Vapor Barrier Mastic:
   1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

F. Tie Wire: Annealed steel, 16 gage, 0.0508 inch diameter.

2.03 GLASS FIBER, RIGID

A. Manufacturer:
   1. Knauf Insulation: www.knaufusa.com.
   2. Johns Manville Corporation: www.jm.com/#sle.
   3. Owens Corning Corp: www.owenscorning.com.
   4. CertainTeed Corporation: www.certainteed.com/#sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: ASTM C612; rigid, noncombustible blanket.
   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 Sorption: 5.0 percent.
   4. Maximum Density: 8.0 lb/cu ft.

C. Vapor Barrier Jacket:
   1. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
   2. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:
   1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

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E. Indoor Vapor Barrier Finish:
   1. Cloth: Untreated; 9 oz/sq yd weight, glass fabric.
   2. Vinyl emulsion type acrylic, compatible with insulation, black color.

2.04 JACKETS

A. Aluminum Jacket: ASTM B209 (ASTM B209M).
   1. Thickness: 0.016 inch sheet.
   2. Finish: Smooth.
   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 ducts have been tested before 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 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. Insulated ducts conveying air above ambient temperature:
   1. Provide with or without standard vapor barrier jacket.
   2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

E. Ducts not Concealed Above Ceilings or Behind Walls: Finish with aluminum jacket.

F. External Duct Insulation Application:
   1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
   2. Secure insulation without vapor barrier with staples, tape, or wires.
   3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
   4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
   5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.
   6. Provide tapered cap on all ducts and fittings to shed water.

3.03 SCHEDULES

A. DUCT AND PLENUM APPLICATION SCHEDULE
   1. Service: Round, supply-air ducts, concealed.
      a. Material: Mineral-fiber blanket.
      b. Thickness: 3 inches, R-8 minimum.
      c. Jacket: Foil and paper.
      d. Vapor Retarder Required: Yes.
   2. Service: Round, return-air ducts, concealed above ceilings.
      a. Material: Mineral-fiber blanket.
      b. Thickness: 3 inches, R-8 minimum.
      c. Jacket: Foil and paper.

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d. Vapor Retarder Required: Yes.

3. Service: Round, outside-air ducts, concealed above ceilings.
   a. Material: Mineral-fiber blanket
   b. Thickness: 3 inches, R-8 minimum.
   c. Jacket: Foil and paper.
   d. Vapor Retarder Required: Yes.
4. Service: Rectangular, supply-air ducts, concealed above ceilings.
   a. Material: Mineral-fiber blanket
   b. Thickness: 3 inches, R-8 minimum.
   c. Jacket: Foil and paper.
   d. Vapor Retarder Required: Yes.
5. Service: Rectangular, return-air ducts, concealed above ceilings.
   a. Material: Mineral-fiber blanket
   b. Thickness: 3 inches, R-8 minimum.
   c. Jacket: Foil and paper.
   d. Vapor Retarder Required: Yes.
6. Service: Rectangular, outside-air ducts, concealed above ceilings.
   a. Material: Mineral-fiber blanket
   b. Thickness: 3 inches, R-8 minimum.
   c. Jacket: Foil and paper.
   d. Vapor Retarder Required: Yes.
7. Service: Round, supply-air ducts, not concealed above ceilings.
   a. Material: Molded rigid glass fiber.
   b. Thickness: 3 inches, R-8 minimum.
   c. Jacket: Aluminum.
   d. Vapor Retarder Required: Yes.
8. Service: Round, return-air ducts, not concealed above ceilings.
   a. Material: Molded rigid glass fiber.
   b. Thickness: 3 inches, R-8 minimum.
   c. Jacket: Aluminum.
   d. Vapor Retarder Required: No.
   e. NOTE: Provide double-walled spiral ductwork in areas exposed to view in finished areas and where noted.
9. Service: Round, outside-air ducts, not concealed above ceilings.
   a. Material: Molded rigid glass fiber.
   b. Thickness: 3 inches, R-8 minimum.
   c. Jacket: Aluminum.
   d. Vapor Retarder Required: Yes.
10. Service: Rectangular, supply-air ducts, not concealed above ceilings.
    a. Material: Glass fiber board.
    b. Thickness: 3 inches, R-8 minimum.
    c. Jacket: Aluminum.
    d. Vapor Retarder Required: Yes.
11. Service: Rectangular, return-air ducts, not concealed above ceilings.
    a. Material: Glass fiber board.
    b. Thickness: 3 inches, R-8 minimum.
    c. Jacket: Aluminum.
    d. Vapor Retarder Required: No.
12. Service: Rectangular, outside-air ducts, not concealed above ceilings.
    a. Material: Glass fiber board.
    b. Thickness: 3 inches, R-8 minimum.
    c. Jacket: Aluminum.
    d. Vapor Retarder Required: Yes.

END OF SECTION

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SECTION 23 07 19
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Jackets and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping.

B. Section 23 23 00 - Refrigerant Piping: Placement of inserts.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

D. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.

E. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2013).

F. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2013).

G. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2017.

H. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation; 2013.

I. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2016.

J. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2017.

K. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2016a.

L. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2018.

M. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing; 2010 (Reapproved 2016).

N. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation; 2017.

O. ASTM C610 - Standard Specification for Molded Expanded Perlite Block and Pipe Thermal Insulation; 2016.

P. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2013).

Q. ASTM D1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber; 2014.

R. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2012.

S. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2018.

T. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

U. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association; 2006.

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V. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

B. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

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.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of 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 REQUIREMENTS FOR ALL PRODUCTS OF THIS SECTION

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, NFPA 255, or UL 723.

2.02 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
   1. Aeroflex USA, Inc; AEROFLEX Self-Seal: www.aeroflexusa.com/#sle.
   2. Armacell LLC: www.armacell.us.
   3. K-Flex USA LLC; K-Flex Titan: www.kflexusa.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 3; use molded tubular material wherever possible.
   1. Minimum Service Temperature: -40 degrees F.
   2. Maximum Service Temperature: 220 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.03 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.
   2. Covering Adhesive Mastic:
      a. Compatible with insulation.

B. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
   1. Thickness: 0.016 inch sheet.
   2. Finish: Smooth.

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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 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. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

H. 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.

I. 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.

J. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 84 00.

K. Interior Pipe not Concealed Above Ceilings or Behind Walls: Provide PVC jacket unless noted otherwise.

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 SCHEDULE

A. INTERIOR PIPING APPLICATION SCHEDULE
   1. Service: Condensate drain piping, equipment drains and overflows
      a. Operating Temperature: 35 to 75 deg F.
      b. Insulation Material: Flexible elastomeric.

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c. Insulation Thickness: 0.5 inch.
d. Jacket: PVC where not concealed above ceilings.
e. Vapor Retarder Required: Yes.
f. Finish: None.

2. Service: Refrigerant liquid, low pressure gas, and high pressure gas piping
   a. Operating Temperature: 35 to 140 deg F.
   b. Insulation Material: Flexible elastomeric.
   c. Insulation Thickness: Apply the following insulation thicknesses:
      1) Pipe, 1” or less: 1.0 inch.
      2) Pipe, 1-1/4” and up: 1.5 inch.
   d. Jacket: PVC where not concealed above ceilings.
   e. Vapor Retarder Required: Yes.

B. EXTERIOR PIPING INSULATION APPLICATION SCHEDULE (INCLUDING WHERE INSTALLED IN PARKING GARAGE AREAS)
   1. Service: Refrigerant suction and liquid piping.
      a. Operating Temperature: 35 to 140 deg F.
      b. Insulation Material: Flexible elastomeric.
      c. Insulation Thickness: Apply the following insulation thicknesses:
         1) Pipe, 1” or less: 1.0 inch.
         2) Pipe, 1-1/4” to 2”: 1.5 inch.
         3) Pipe, 2-1/2” and up: 1.5 inch.
      d. Jacket: Aluminum.
      e. Vapor Retarder Required: Yes.
      f. Finish: None.
   2. Service: Condensate drain piping.
      a. Operating Temperature: 35 to 140 deg F.
      b. Insulation Material: Flexible elastomeric.
      c. Insulation Thickness: Apply the following insulation thicknesses:
         1) Pipe, Up to 2": 1.0 inch.
      d. Jacket: Aluminum.
      e. Vapor Retarder Required: Yes.
      f. Finish: None.

END OF SECTION

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SECTION 23 09 50

BUILDING AUTOMATION SYSTEM (BAS) GENERAL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. General Requirements
B. Description of Work
C. Quality Assurance
D. System Architecture
E. Distributed Processing Units/Quantity and Location
F. Demolition and Reuse of Existing Materials and Equipment
G. Sequence of Work

1.02 RELATED DOCUMENTS

A. Section 23 09 51 - Building Automation System (BAS) Basic Materials, Interface Devices, and Sensors
B. Section 23 09 53 - BAS Field Panels
C. Section 23 09 54 - BAS Communication Devices
D. Section 23 09 55 - BAS Software and Programming
E. Section 23 09 58 - Sequences of Operation

1.03 DESCRIPTION OF WORK

A. **HVAC Controls are to be an extension of the existing Automated Logic Building Automation System (BAS) by Radius Systems serving Legislative Hall.**
   1. The control system shall integrate fully and seamlessly with the existing State of Delaware web server. The contractor shall include all hardware, engineering, and technician time to integrate data from the new system into the existing web server, including color graphics (floor plans, equipment, etc.), alarms, reports, schedules, trend logging.
   2. Included in this seamless integration must be all physical/hardware gateways, drivers, engineering time, technician time, installation costs, or anything else required to make visible all data points (inputs, outputs, and all virtual points) in the new system readable/writable to the existing web server. If this is an extension of an existing system or a new system that is not already integrated via BACnet IP to the web server, vendor must include integration of all pre-existing points as well.
   3. HVAC controls are to be operable in standalone mode prior to connection to Legislative Hall via underground tunnel which is to be constructed in future phase of work. Upon completion of tunnel, BAS contractor shall connect HVAC controls to existing supervisory controller(s) serving Legislative Hall.

B. The building automation system (BAS) defined in this specification shall interface with the State of Delaware network, and shall utilize the BACnet communication requirements as defined by ASHRAE/ANSI 135 (current version and addendum) for all communication.

C. The BAS shall utilize electronic sensing, microprocessor-based digital control, and electronic actuation of dampers and valves to perform control sequences and functions specified. The BAS for this project will generally consist of monitoring and control of systems listed below. Reference also control drawings, sequences of operation, and points lists.

D. The systems to be controlled under work of this section basically comprise the newly installed units, with capabitliy to expand the system for future equipment.

1.04 APPLICATION OF OPEN PROTOCOLS

A. Subject to the detailed requirements provided throughout the specifications, the BAS and digital control and communications components installed, as work of this contract shall be an integrated distributed processing system utilizing BACnet. System components shall

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communicate using true BacNET in accordance with ASHRAE Standard 135 and current addenda and annexes, including all workstations, all building controllers, and all application specific controllers. Gateways to other communication protocols are not acceptable

1.05 QUALITY ASSURANCE

A. Product Line Demonstrated History: The product line being proposed for the project must have an installed history of demonstrated satisfactory operation for a length of 2 years since date of final completion in at least 10 installations of comparative size and complexity. Submittals shall document this requirement with references. The following requirement relates to the actual installing contractor.

B. Installer's Qualifications: Firms specializing and experienced in control system installations for not less than 5 years. Firms with experience in BAS installation projects with point counts equal to this project and systems of the same character as this project. If installer is a Value Added Reseller (VAR) of a manufacturer's product, installer must demonstrate at least three years prior experience with that manufacturer's products. Experience starts with awarded Final Completion of previous projects. Submittals must document this experience with references.

C. Installer's Experience with Proposed Product Line: Firms shall have specialized in and be experienced with the installation of the proposed product line for not less than one year from date of final completion on at least 3 projects of similar size and complexity. Submittals shall document this experience with references.

D. Installer's Field Coordinator and Sequence Programmer Qualifications: Individual(s) shall specialize in and be experienced with control system installation for not less than 5 years. Proposed field coordinator shall have experience with the installation of the proposed product line for not less than 2 projects of similar size and complexity. Installer shall submit the names of the proposed individual and at least one alternate for each duty. Submittals shall document this experience with references. The proposed individuals must show proof of the following training:
   1. Product Line Training: Individuals overseeing the installation and configuration of the proposed product line must provide evidence of the most advanced training offered by the Manufacturer on that product line for installation and configuration
   2. Programming Training: Individuals involved with programming the site-specific sequences shall provide evidence of the most advanced programming training offered by the vendor of the programming application offered by the Manufacturer.

E. Installer's Service Qualifications: The installer must be experienced in control system operation, maintenance and service. Installer must document a minimum 5 year history of servicing installations of similar size and complexity. Installer must also document at least a one year history of servicing the proposed product line.

F. Installer's Response Time and Proximity
   1. Installer must maintain a fully capable service facility within a 45 mile radius of the project site. Service facility shall manage the emergency service dispatches and maintain the inventory of spare parts.
   2. Emergency response times are listed below in this section. Installer must demonstrate the ability to meet the response times.

1.06 CODES AND STANDARDS

A. American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
   1. ASHRAE 135: BACnet - A Data Communication Protocol for Building Automation and Control Networks. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. current edition including all related addenda shall apply.

B. Electronics Industries Alliance
   1. EIA-709.1-A-99: Control Network Protocol Specification
   2. EIA-709.3-99: Free-Topology Twisted-Pair Channel Specification
   3. EIA-232: Interface between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange.

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4. EIA-458: Standard Optical Fiber Material Classes and Preferred Sizes
5. EIA-485: Standard for Electrical Characteristics of Generator and Receivers for use in Balanced Digital Multipoint Systems.
6. EIA-472: General and Sectional Specifications for Fiber Optic Cable
7. EIA-475: Generic and Sectional Specifications for Fiber Optic Connectors and all Sectional Specifications
8. EIA-573: Generic and Sectional Specifications for Field Portable Polishing Device for Preparation Optical Fiber and all Sectional Specifications
9. EIA-590: Standard for Physical Location and Protection of Below-Ground Fiber Optic Cable Plant and all Sectional Specifications

C. Underwriters Laboratories
1. UL 916: Energy Management Systems. The following rating is required only for devices used for smoke control purposes. If these are not intended, delete.
2. UUKL 864: UL Supervised Smoke Control

D. NEMA Compliance
1. NEMA 250: Enclosure for Electrical Equipment
2. NEMA ICS 1: General Standards for Industrial Controls.

E. NFPA Compliance
1. NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" where applicable to controls and control sequences.
2. NFPA 70 National Electrical Code (NEC)

F. Institute of Electrical and Electronics Engineers (IEEE)
1. IEEE 142: Recommended Practice for Grounding of Industrial and Commercial Power Systems
2. IEEE 802.3: CSMA/CD (Ethernet - Based) LAN
3. IEEE 802.4: Token Bus Working Group (ARCNET - Based) LAN

1.07 DEFINITIONS

A. Advanced Application Controller (AAC): A device with limited resources relative to the Building Controller (BC). It may support a level of programming and may also be intended for application specific applications.

B. Application Protocol Data Unit (APDU): A unit of data specified in an application protocol and consisting of application protocol control information and possible application user data (ISO 9545).

C. Application Specific Controller (ASC): A device with limited resources relative to the Advanced Application Controller (AAC). It may support a level of programming and may also be intended for application-specific applications..

D. BACnet/BACnet Standard: BACnet communication requirements as defined by ASHRAE/ANSI 135 (Current edition and addendum).

E. BACnet Interoperability Building Blocks (BIBB): A BIBB defines a small portion of BACnet functionality that is needed to perform a particular task. BIBBS are combined to build the BACnet functional requirements for a device in a specification.

F. Binding: In the general sense, binding refers to the associations or mappings of the sources network variable and their intended opr required destinations.

G. Building Automation System (BAS): The entire integrated management and control system

H. Building Controller (BC): A fully programmable device capable of carrying out a number of tasks including control and monitoring via direct digital control (DDC) of specific systems, acting as a communications router between the controlled devices / equipment and the CSS, and temporary data storage for trend information, time schedules, and alarm data.

I. Change of Value (COV): An event that occurs when a measured or calculated analog value changes by a predefined amount (ASHRAE/ANSI 135 (current version and addendum)).

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J. Client: A device that is the requestor of services from a server. A client device makes requests of and receives responses from a server device.

K. Continuous Monitoring: A sampling and recording of a variable based on time or change of state (e.g. trending an analog value, monitoring a binary change of state).

L. Controller or Control Unit (CU): Intelligent stand-alone control device. Controller is a generic reference and shall include BCs, AACs, and ASCs as appropriate.

M. Control Systems Server (CSS): A server class computer(s) that maintains the systems configuration and programming database. This server is located at the Owner's data center in a virtual environment and serves as an access point to BAS.

N. Controlling LAN: High speed, peer-to-peer controller LAN connecting BCs, AACs and ASCs. Refer to System Architecture below.

O. Direct Digital Control (DDC): Microprocessor-based control including Analog/Digital conversion and program logic

P. Functional Profile: A collection of variables required to define a the key parameters for a standard application. As this applies to the HVAC industry, this would include applications like VAV terminal, fan coil units, and the like.

Q. Gateway (GTWY): A device, which contains two or more dissimilar networks/protocols, permitting information exchange between them.

R. Hand Held Device (HHD): Manufacturer's microprocessor based device for direct connection to a Controller.

S. LAN Interface Device (LANID): Device or function used to facilitate communication and sharing of data throughout the BAS

T. Local Area Network (LAN): General term for a network segment within the architecture. Various types and functions of LANs are defined herein.

U. Local Supervisory LAN: Also known as the Owner's Network: Ethernet-based network connecting Primary Controlling LANs with each other and OWSs and CSSs. See System Architecture below.

V. Master-Slave/Token Passing (MS/TP): Data link protocol as defined by the BACnet standard.

W. Open Database Connectivity (ODBC): An open standard application-programming interface (API) for accessing a database developed. ODBC compliant systems make it possible to access any data from any application, regardless of which database management system (DBMS) is handling the data.

X. Operator Interface (OI): A device used by the operator to manage the BAS including OWSs, POTs, and HHDs.

Y. Operator Workstation (OWS): The user's interface with the BAS system. As the BAS network devices are stand-alone, dedicated OWS is not required for communications to occur. The OWS can be any computer on the Owner's Network that has a compatible Web browser.

Z. Point-to-Point (PTP): Serial communication as defined in the BACnet standard.

AA. Portable Operators Terminal (POT): Mobile computer used both for direct connection to a controller as well as network connection.

AB. Protocol Implementation Conformance Statement (PICS): A written document, created by the manufacturer of a device, which identifies the particular options specified by BACnet that are implemented in the device (ASHRAE/ANSI 135 (current version and addendum).

AC. Router: A device that connects two or more networks at the network layer.

AD. Secondary Controlling LAN: LAN connecting AACs and ASCs, generally lower speed and less reliable than the Controlling LAN. Refer to System Architecture below.

AE. Server: A device that is a provider of services to a client. A client device makes requests of and receives responses from a server device.

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AF. Standardized Query Language (SQL): A database computer language designed for managing data in relational database management system (RDBMS). Its scope includes data insert, query, update and delete, schema creation and modification, and data access control.

AG. Smart Device: A control I/O device such as a sensor or actuator that can directly communicate with a controller through the network. This differs from an ASC in that it typically deals only with one variable.

AH. Extensible Markup Language (XML): A specification developed by the World Wide Web Consortium. XML is a pared-down version of SGML, designed especially for Web documents. It is a set of rules for encoding documents in machine-readable form that allows designers to create their own customized tags, enabling the definition, transmission, validation, and interpretation of data between applications and between organizations.

1.08 FUNCTIONAL INTENT

A. Throughout Sections 23 09 50 through 23 09 55, the Sequences of Operation, and Section 23 09 59 detailed requirements are specified, some of which indicate a means, method or configuration acceptable to meet that requirement. Contractor may submit products that utilize alternate means, methods, and configurations that meet the functional intent. However these will only be allowed with prior approval.

1.09 SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. Electronic Submittals: While all requirements for hard copy submittal apply, control submittals and O&M information shall also be provided in electronic format as follows.
   1. Drawings and Diagrams: Shop drawings shall be provided on electronic media as an AutoCAD (current version) and/or Adobe Portable Document Format file. All 'X reference' and font files must be provided with AutoCAD files.
   2. Other Submittals: All other submittals shall be provided in Adobe Portable Document Format (PDF).

C. Qualifications: Manufacturer, Installer, and Key personnel qualifications as indicated for the appropriate item above.

D. Product Data: Submit manufacturer's technical product data for each control device, panel, and accessory furnished, indicating dimensions, capacities, performance and electrical characteristics, and material finishes. Also include installation and start-up instructions.

E. Shop Drawings: Submit shop drawings for each control system, including a complete drawing for each air handling unit, system, pump, device, etc. with all point descriptors, addresses and point names indicated. Each shop drawing shall contain the following information:
   1. System Architecture and System Layout:
      a. One-line diagram indicating schematic locations of all control units, workstations, LAN interface devices, gateways, etc. Indicate network number, device ID,, instance number, MAC address, drawing reference number, and controller type for each control unit. Indicate media, protocol, baud rate, and type of each LAN. Indicate media, protocol, baud rate, and type of each LAN. All optical isolators, repeaters, end-of-line resistors, junctions, ground locations etc. shall be located on the diagram.
      b. Provide electronic floor plans locating all control units, workstations, LAN interface devices, gateways, etc. Include all network communication wiring routing, power wiring, power originating sources, and low voltage power wiring. Indicate network number, device ID, instance number, MAC address, drawing reference number, and controller type for each control unit. Indicate media, protocol, baud rate, and type of each LAN. All optical isolators, repeaters, end-of-line resistors, junctions, ground locations etc. shall be located on the floor plans. Wiring routing as-built conditions shall be maintained accurately throughout the construction period and the drawing shall be updated to accurately reflect accurate, actual installed conditions.

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2. Schematic flow diagram of each air and water system showing fans, coils, dampers, valves, pumps, heat exchange equipment and control devices. Include verbal description of sequence of operation.
3. All physical points on the schematic flow diagram shall be indicated with names, descriptors, and point addresses identified as listed in the point summary table.
4. With each schematic, provide a point summary table listing building number and abbreviation, system type, equipment type, full point name, point description, Ethernet backbone network number, network number, device ID, object ID (object type, instance number). See Section 23 09 55 - Part III for additional requirements.
5. Label each control device with setting or adjustable range of control.
6. Label each input and output with the appropriate range.
7. Provide a Bill of Materials with each schematic. Indicate device identification to match schematic and actual field labeling, quantity, actual product ordering number, manufacturer, description, size, voltage range, pressure range, temperature range, etc. as applicable.
8. With each schematic, provide valve and actuator information including size, Cv, design flow, design pressure drop, manufacturer, model number, close off rating, etc. Indicate normal positions of spring return valves and dampers.
9. Indicate all required electrical wiring. Electrical wiring diagrams shall include both ladder logic type diagram for motor starter, control, and safety circuits and detailed digital interface panel point termination diagrams with all wire numbers and terminal block numbers identified. Provide panel termination drawings on separate drawings. Ladder diagrams shall appear on system schematic. Clearly differentiate between portions of wiring, which are existing, factory-installed and portions to be field-installed.
10. Details of control panels, including controls, instruments, and labeling shown in plan or elevation indicating the installed locations.
11. Sheets shall be consecutively numbered.
12. Each sheet shall have a title indicating the type of information included and the HVAC system controlled.
13. Table of Contents listing sheet titles and sheet numbers.
14. Legend and list of abbreviations.
15. Memory allocation projections.
16. Submit along with shop drawings but under separate cover calculated and guaranteed system response times of the most heavily loaded LAN in the system.

F. Open Protocol Information
   1. BACnet Systems:
      a. BACnet object description, object ID, and device ID, for each I/O point.
      b. Documentation for any non-standard BACnet objects, properties, or enumerations used detailing their structure, data types, and any associated lists of enumerated values.
      c. Submit PICS indicating the BACnet functionality and configuration of each controller.

G. Framed Control Drawings: Laminated control drawings including system control schematics, sequences of operation and panel termination drawings, shall be provided in panels for major pieces of equipment. Terminal unit drawings shall be located in the central plant equipment panel or mechanical room panel.

H. Control Logic Documentation
   1. Submit control logic program listings (for graphical programming) and logic flow charts (for line type programs) to document the control software of all control units.
   2. Control logic shall be annotated to describe how it accomplishes the sequence of operation. Annotations shall be sufficient to allow an operator to relate each program component (block or line) to corresponding portions of the specified Sequence of Operation.
   3. Include written description of each control sequence.

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4. Include control response, settings, setpoints, throttling ranges, gains, reset schedules, adjustable parameters and limits.
5. Sheets shall be consecutively numbered.
6. Each sheet shall have a title indicating the controller designations and the HVAC system controlled.
7. Include Table of Contents listing sheet titles and sheet numbers
8. Submit one complete set of programming and operating manuals for all digital controllers concurrently with control logic documentation. This set will count toward the required number of Operation and Maintenance materials specified below and in Section 01 30 00.

I. Operation and Maintenance Materials:
1. Submit documents under provisions of Section 01 03 00. One copy of the materials shall be delivered directly to the Owner's facilities operation staff, in addition to the copies required by other Sections.
2. Submit maintenance instructions and spare parts lists for each type of control device, control unit, and accessory.
3. Submit BAS User's Guides (Operating Manuals) for each controller type.
4. Submit BAS advanced Programming Manuals for each controller type.
5. Include all submittals (product data, shop drawings, control logic documentation, hardware manuals, software manuals, installation guides or manuals, maintenance instructions and spare parts lists) in maintenance manual; in accordance with requirements of Division 1.

J. Controls contractor shall provide the Owner with all product line technical manuals and technical bulletins, to include new and upgraded products, by the same distribution channel as to dealers or branches. This service will be provided for 5 years as part of the contract price, and will be offered to the Owner thereafter for the same price as to a dealer or branch.

K. Manufacturers Certificates: For all listed and/or labeled products, provide certificate of conformance.

L. Product Warranty Certificates: submit manufacturers product warranty certificates covering the hardware provided.

1.10 PROJECT RECORD DOCUMENTS

A. Submit documents under provisions of Section 01 30 00.

B. Record copies of product data and control shop drawings updated to reflect the final installed condition.

C. Record copies of approved control logic programming and database on paper and on CD's. Accurately record actual setpoints and settings of controls, final sequence of operation, including changes to programs made after submission and approval of shop drawings and including changes to programs made during specified testing.

D. Record copies of approved project specific graphic software on CDs.

E. Record copies shall include individual floor plans with controller locations with all interconnecting wiring routing including space sensors, LAN wiring, power wiring, low voltage power wiring. Indicate device instance, MAC address and drawing reference number.

F. Provide record riser diagram showing the location of all controllers.

G. Maintain project record documents throughout the warranty period and submit final documents at the end of the warranty period

1.11 SYSTEM ARCHITECTURE

A. The system provided shall incorporate hardware resources sufficient to meet the functional requirements of these Specifications. The Contractor shall include all items not specifically itemized in these Specifications that are necessary to implement, maintain, and operate the system in compliance with the functional intent of these Specifications.

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B. **All data points are to be mapped to the State of DE OMB/DFM web portal for web-based access.** The system shall be configured as a distributed processing network(s) capable of expansion as specified below.

C. The system architecture shall consist of the Ethernet-based Owner's Network, and Controlling LANs that support BCs, AACs, ASCs, Smart Devices (SD), and Remote Communication Devices (RCDs) as applicable. The following indicates a functional description of the BAS structure.
   1. Owner Network: Internet-based network connecting multiple facilities with a central data and application server, accessible via standard web-browser. This is an existing infrastructure and contractor is not required to configure any components of this network. Refer to Section 23 09 54 for requirements. This contractor shall integrate the controlling devices and the CCS together.
   2. Local Supervisory LAN: The Local Supervisory LAN shall be an Ethernet-based, 100 Mbps LAN connecting Primary Control LANs and OWSs. The LAN serves as the inter-BC gateway and OWS-to-BC gateway and communications path. Contractor shall provide this as a dedicated LAN for the control system. LAN shall be IEEE 802.3 Ethernet over Fiber or Category 5 cable with switches and routers that support 100 Mbps throughput. Power-line carrier communication shall not be acceptable for communications. The physical media will be that installed for the IT infrastructure of the facility and as such network drops will be provided under that scope of work to facilitate work of this scope. This network will be 100 Mbps and therefore all network interface cards shall support that speed. The higher level layers of this network shall be BACnet as described below:
      a. BACnet Supervisory LAN: Shall be BACnet/IP as defined in the BACnet standard, and shall share a common network number for the Ethernet backbone, as defined in the BACnet standard. Point/Object naming conventions are specified in 23 09 55 - Part III.
   3. Controlling LAN: High-speed, peer-to-peer communicating LAN used to connect AACs, ASCs and Building Controllers (BCs) and communicate exclusively control information. Acceptable technologies include:
      a. Ethernet (IEEE802.3)
      b. ARCNET (IEEE802.4)
      c. Communication to/from building controller (BC) and the control system server (CSS) shall utilize standard TCP/IP, BACnet/IP ports (80and/or 47808)
   4. Secondary Controlling LAN: Network used to connect AACs, ASCs or SDs. These can be Master Slave/ Token Passing or polling, in addition to those allowed for Primary Controller LANs. Network speed vs. the number of controllers on the LAN shall be dictated by the response time and trending requirements.

D. Dynamic Data Access: Any data throughout any level of the network shall be available to and accessible by all other devices, Controllers and OWS, whether directly connected or connected remotely.

E. Remote Data Access: The system shall support the following methods of remote access to the building data.
   1. Browser-based access: A remote user using a standard browser shall be able to access all control system facilities and graphics with proper authentication. The Owner shall maintain continuous network connection. The following paradigms are acceptable for browser-based access:
      a. Native Internet-based user interface (HTML, Java, XML, etc.) via a standard freely distributed web browser that does not require a Windows client software installation.

F. The communication speed between the controllers, LAN interface devices, and operator interface devices shall be sufficient to ensure fast system response time under any loading condition. Contractor shall submit guaranteed response times with shop drawings including calculations to support the guarantee. In no case shall delay times between an event, request, or command initiation and its completion be greater than those listed herein. Contractor shall recommend reconfiguring the LAN as necessary to accomplish these performance requirements.:

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1. 5 seconds between a Level 1 (critical) alarm occurrence and enunciation at operator workstation.
2. 10 seconds between a Level 2 alarm occurrence and enunciation at operator workstation.
3. 20 seconds between and a Level 3-5 alarm occurrence and enunciation at operator workstation.
4. 10 seconds between an operator command via the operator interface to change a setpoint and the subsequent change in the controller.
5. 5 seconds between an operator command via the operator interface to start/stop a device and the subsequent command to be received at the controller.
6. 10 seconds between a change of value or state of an input and it being updated on the operator interface.
7. 10 seconds between an operator selection of a graphic and it completely painting the screen and updating at least 10 points.

G. Control Systems Server (CSS): A server class computer(s) that maintains the systems configuration and programming database. This server is located at the State of Delaware's data center in a virtual environment and serves as an access point to BAS. It shall hold the backup files of the information downloaded into the individual controllers and as such support uploading and downloading that information directly to/from the controllers. It shall also act as a control information server to non-control system based programs. It shall allow secure multiple-access to the control information.

H. The BCs, AACs, ASCs, [and SDs] shall monitor, control, and provide the field interface for all points specified. Each BC, AAC, or ASC shall be capable of performing all specified energy management functions, and all DDC functions, independent of other BCs, AACs, or ASCs and operator interface devices as more fully specified in Section 23 09 53 - BAS Field Panels.

I. Systems Configuration Database: The system architecture shall support maintaining the systems configuration database on the CSS. User tools provided to the Owner shall allow configuring, updating, maintaining, etc. current configurations and settings whether they are initiated at the server or the end device.
   1. Database Schema shall be published and provided to the Owner to facilitate easy access to the data.
   2. Database shall be ODBC compliant.

J. Interruptions or fault at any point on any Primary Controller LAN shall not interrupt communications between other nodes on the network. If a LAN is severed, two separate networks shall be formed and communications within each network shall continue uninterrupted.

K. All line drivers, signal boosters, and signal conditioners etc. shall be provided as necessary for proper data communication.

L. Anytime any controller's database or program is changed in the field, the controller shall be capable of automatically uploading the new data to the CSS.

1.12 WARRANTY MAINTENANCE

A. Contractor shall warrant all products and labor for a period of (2) two years after Substantial Completion.

B. The Owner reserves the right to make changes to the BAS during the warranty period. Such changes do not constitute a waiver of warranty. The Contractor shall warrant parts and installation work regardless of any such changes made by the Owner, unless the Contractor provides clear and convincing evidence that a specific problem is the result of such changes to the BAS.

C. At no cost to the Owner, during the warranty period, the Contractor shall provide maintenance services for software and hardware components as specified below:
   1. Maintenance services shall be provided for all devices and hardware specified in sections 23 09 51 through 23 09 59. Service all equipment per the manufacturer's recommendations. All devices shall be calibrated within the last month of the warranty period.

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2. Emergency Service: Any malfunction, failure, or defect in any hardware component or failure of any control programming that would result in property damage or loss of comfort control shall be corrected and repaired following notification by the Owner to the Contractor.
    a. Response by telephone to any request for service shall be provided within two (2) hours of the Owner's initial telephone request for service.
    b. In the event that the malfunction, failure, or defect is not corrected through the telephonic communication, at least one (1) hardware and software technician, trained in the system to be serviced, shall be dispatched to the Owner's site within eight (8) hours of the Owner's initial telephone request for such services, as specified.
3. Normal Service: Any malfunction, failure, or defect in any hardware component or failure of any control programming that would not result in property damage or loss of comfort control shall be corrected and repaired following telephonic notification by the Owner to the Contractor.
    a. Response by telephone to any request for service shall be provided within eight (8) working hours (contractor specified 40 hr per week normal working period) of the Owner's initial telephone request for service.
    b. In the event that the malfunction, failure, or defect is not corrected through the telephonic communication, at least one (1) hardware and software technician, trained in the system to be serviced, shall be dispatched to the Owner's site within three (3) working days of the Owner's initial telephone request for such services, as specified.
4. Telephonic Request for Service: Contractor shall specify a maximum of three telephone numbers for The Owner to call in the event of a need for service. At least one of the lines shall be attended at any given time at all times. Alternatively, pagers can be used for technicians trained in system to be serviced. One of the three paged technicians shall respond to every call within 15 minutes.
5. Technical Support: Contractor shall provide technical support by telephone throughout the warranty period.
6. Preventive maintenance shall be provided throughout the warranty period in accordance with the hardware component manufacturer's requirements.

1.13 DELIVERY, STORAGE, AND HANDLING

A. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons during shipping, storage and handling as required to prevent equipment damage, and to eliminate dirt and moisture from equipment. Store equipment and materials inside and protect from weather.

1.14 LISTING AND LABELING

A. The BAS and components shall be listed by Underwriters Laboratories (UL 916) as an Energy Management System.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Automated Logic by Radius Systems (Basis of Design)

B. Johnson Controls (JCI) by Modern Controls

C. BuildingLogix / Lynxspring / KMC Controls by Seiberlich Trane

2.02 MATERIALS AND EQUIPMENT

A. Materials shall be new, the best of their respective kinds without imperfections or blemishes and shall not be damaged in any way. Used equipment shall not used in any way for the permanent installation except where drawings or specs specifically allow existing materials to remain in place.

2.03 UNIFORMITY

A. To the extent practical, all equipment of the same type serving the same function shall be identical and from the same manufacturer.

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PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which control systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF CONTROL SYSTEMS

A. General: Install systems and materials in accordance with manufacturer's instructions, roughing-in drawings and details shown on drawings.

B. Network Connectivity: The BAS contractor shall provide two network connections with Cat-6 cables from the Building Controller to the Owner's IT network.
   1. The BAS contractor shall terminate one end of the two Cat-6 cables at or around the Owner's patch panel and make connections to the Owner's switch with green patch cables, following the instruction of the Owner's IT personnel.
   2. The BAS contractor shall terminate the other end of the two Cat-6 cables near or within the building controller cabinet with dual RJ-45 terminal box and make connection of one cable to the building controller. Note: the second connection is for on-site operator interface through a mobile computer. Exposed cable shall be protected by conduit or wire mold.
   3. The BAS contractor shall label the two network connections BAC-1 and BAC-2 on both ends.

C. Refer to additional requirements in other sections of this specification.

3.03 SURGE PROTECTION

A. The Contractor shall furnish and install any power supply surge protection, filters, etc. as necessary for proper operation and protection of all BCs, AAC/ASCS operator interfaces, printers, routers, gateways and other hardware and interface devices. All equipment shall be capable of handling voltage variations 10% above or below measured nominal value, with no effect on hardware, software, communications, and data storage.

3.04 CONTROL POWER SOURCE AND SUPPLY

A. **Section 23 09 50 Contractor shall extend all power source wiring required for operation of all equipment and devices provided under Sections 23 09 50 through 23 09 55 and Sequences of Operation. See electrical drawings for line voltage panel schedules and locations.** The following item will have to be customized for each system and project. The consideration is where to power controllers from. For distributed controllers that are associated with one unit, it is convenient to power them along with the system so the controller can take action based on the presence of power. However on large centralized panels, it may be best to put these on the most reliable source of power that serves the equipment being controlled and then provide for individual monitoring of the various system's power sources by the controller. The object here is to make a robust system that does not interpret power failures as device failure and therefore in some instances have to take down the unit for manual acknowledged reset. This can compromise reliability.

B. General requirements for obtaining power include the following:
   1. Obtain power from a source that feeds the equipment being controlled such that both the control component and the equipment are powered from the same panel. Where equipment is powered from a 460V source, obtain power from the electrically most proximate 120v source fed from a common origin.
   2. Where control equipment is located inside a new equipment enclosure, coordinate with the equipment manufacturer and feed the control with the same source as the equipment. If the equipment's control transformer is large enough and of the correct voltage to supply the controls it may be used. If the equipment's control transformer is not large enough or of the correct voltage to supply the controls provide separate transformer
   3. Where a controller controls multiple systems on varying levels of power reliability (normal, emergency, and/or interruptible), the controller shall be powered by the highest level of reliability served. Furthermore, the controller in that condition shall monitor each power type served to determine so logic can assess whether a failure is due to a power loss and

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respond appropriately. A three-phase monitor into a digital input shall suffice as power monitoring.

4. Standalone Functionality: Refer to Section 23 09 53 BAS Field Panels.

3.05 SEQUENCE OF OPERATION

A. Refer to Section 23 09 58 - Sequences of Operation

END OF SECTION

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SECTION 23 09 51

BAS BASIC MATERIALS, INTERFACE DEVICES, AND SENSORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Wiring
B. Control Dampers and Actuators
C. Control Panels
D. Sensors
E. Electric Control Components
F. Transducers
G. Current Switches
H. Nameplates
I. Testing Equipment

1.02 RELATED DOCUMENTS

A. Section 23 09 50 - Building Automation System (BAS) General
B. Section 23 09 53 - BAS Field Panels
C. Section 23 09 54 - BAS Communications Devices
D. Section 23 09 55 - BAS Software
E. Section 23 09 58 - Sequences of Operation
F. Section 23 09 59 - BAS Commissioning

1.03 DESCRIPTION OF WORK

A. Refer to Section 23 09 50 Building Automation System (BAS) for general requirements.
B. Refer to other Division 23 sections for installation of instrument wells, valve bodies, and dampers in mechanical systems; not work of this section.
C. Provide the following electrical work of this section, complying with requirements of Division 26 sections:
    1. Control wiring between field-installed controls, indicating devices, and unit control panels.
    2. Interlock wiring between electrically interlocked devices, sensors, and between a hand or auto position of motor starters as indicated for all mechanical and controls.
    3. Wiring associated with indicating and alarm panels (remote alarm panels) and connections to their associated field devices.
    4. All other necessary wiring for fully complete and functional control system as specified.

1.04 WORK BY OTHERS

A. Control Dampers furnished under this section shall be installed under the applicable air distribution or air handling equipment section under the direction of Section 23 09 51 Basic Materials, Interfaces and Sensors Contractor who will be fully responsible for the proper operation of the damper
B. Water Pressure Taps, Thermal Wells, Flow Switches, Flow Meters, etc. that will have wet surfaces, shall be installed under the applicable piping Section under the direction of Section 23 09 51 Contractor who will be fully responsible for the proper installation and application.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. General: Provide electronic control products in sizes and capacities indicated, consisting of valves, dampers, thermostats, clocks, controllers, sensors, and other components as required for complete installation and reviewed and approved by the Owner. Except as otherwise indicated, provide manufacturer's standard materials and components as published in their

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product information; designed and constructed as recommended by manufacturer, and as required for application indicated.

B. Communication Wiring: All wiring shall be in accordance with National Electrical Codes and Division 26 of this specification.
   1. Contractor shall supply all communication wiring between Building Controllers, Routers, Gateways, AAC's, ASC's and local and remote peripherals (e.g., operator workstations, printers, and modems).
   2. Local Supervisory LAN: For any portions of this network required under this section of the specification, contractor shall use Fiber or Category 6 of standard TIA/EIA (100/1000BaseT). Network shall be run with no splices and separate from any wiring over thirty (30) volts.
   3. Primary and Secondary Controller LANs: Communication wiring shall be individually 100% shielded pairs per manufacturers recommendations for distances installed, with overall PVC cover, Class 2, plenum-rated run with no splices and separate from any wiring over thirty (30) volts. Shield shall be terminated and wiring shall be grounded as recommended by BC manufacturer.

C. Signal Wiring: Contractor shall run all signal wiring in accordance with National Electric Codes and Division 26 of this Specification.
   1. Signal wiring to all field devices, including, but not limited to, all sensors, transducers, transmitters, switches, etc. shall be twisted, 100% shielded pair, minimum 18-gauge wire, with PVC cover. Signal wiring shall be run with no splices and separate from any wiring above thirty (30) volts.
   2. Signal wiring shield shall be grounded at controller end only unless otherwise recommended by the controller manufacturer.

D. Low Voltage Analog Output Wiring: Contractor shall run all low voltage control wiring in accordance with National Electric Codes and Division 26 of this Specification.
   1. Low voltage control wiring shall be minimum 16-gauge, twisted pair, 100% shielded, with PVC cover, Class 2 plenum-rated. Low voltage control wiring shall be run with no splices separate from any wiring above thirty (30) volts.

E. Control Panels: Provide control panels with suitable brackets for wall mounting for each control system. Locate panel adjacent to systems served.
   1. Fabricate panels of 16-gage furniture-grade steel, or 6063-T5 extruded aluminum alloy, totally enclosed on four sides, with hinged door and keyed lock, with manufacturer's standard shop- painted finish and color.
   2. Provide UL-listed cabinets for use with line voltage devices.
   3. Control panel shall be completely factory wired and piped, and all electrical connections made to a terminal strip. Control panel shall have standard manufacturer's color.
   4. All gauges and control components shall be identified by means of nameplates.
   5. All control tubing and wiring shall be run neatly and orderly in open slot wiring duct with cover.
   6. Complete wiring and tubing termination drawings shall be mounted in or adjacent to panel.

2.02 CONTROL DAMPERS

A. General: Provide factory fabricated automatic control dampers of sizes, velocity and pressure classes as required for smooth, stable, and controllable air flow. Provide parallel or opposed blade dampers as recommended by manufacturers sizing techniques. For dampers located near fan outlets, provide dampers rated for fan outlet velocity and close-off pressure, and recommended by damper manufacturer for fan discharge damper service. Control dampers used for smoke dampers shall comply with UL 555S. Control Dampers used for fire dampers shall comply with UL 555.

B. For general isolation and modulating control service in rectangular ducts at velocities not greater than 1500 fpm (7.62 m/s), differential pressure not greater than 2.5” w.c. (622 Pa):
   1. Performance: Test in accordance with AMCA 500.

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2. Frames: Galvanized steel, 16-gauge minimum thickness, welded or riveted with corner reinforcement.
3. Blades: Stainless steel in lab exhausts and galvanized steel elsewhere, maximum blade size 8 inches (200 mm) wide by 48 inches (1219 mm) long, attached to minimum 1/2 inch (12.7 mm) shafts with set screws, 16 gauge minimum thickness.
4. Blade Seals: Synthetic elastomer, mechanically attached, field replaceable.
5. Jamb Seals: Stainless steel.
6. Shaft Bearings: Oil impregnated sintered bronze, graphite impregnated nylon sleeve or other molded synthetic sleeve, with thrust washers at bearings.
7. Linkage: Concealed in frame.
8. Linkage Bearings: Oil impregnated sintered bronze or graphite impregnated nylon.
9. Leakage: Less than one percent based on approach velocity of 1500 ft./min. (7.62 m/s) and 1 inches wg. (249Pa).
10. Maximum Pressure Differential: 2.5 inches wg. (622 Pa)
11. Temperature Limits: -40 to 200 °F (-40 to 93 °C).
12. Where opening size is larger than 48 inches (1219 mm) wide, or 72 inches (1829 mm) high, provide dampers in multiple sections, with intermediate frames and jackshafts appropriate for installation.

2.03 ACTUATORS

A. General: Size actuators and linkages to operate their appropriate dampers or valves with sufficient reserve torque or force to provide smooth modulating action or 2-position action as specified. Select spring-return actuators with manual override to provide positive shut-off of devices as they are applied.

B. Damper Actuators
   1. Ambient Operating Temperature Limits: -10 to 150°F (-12.2 to 66 °C)
   2. Two Position Electric Actuators: Line voltage with spring return
   3. Electronic Actuators: Provide actuators with spring return for two-position (24v), 0-5 Vdc, 0-10 Vdc, 2-10Vdc, 4-20 mA, or PWM input (subject to restrictions) as required. Actuators shall travel full stroke in less than [90] seconds. Actuators shall be designed for a minimum of 60,000 full cycles at full torque and be UL 873 listed. Provide stroke indicator. Actuators shall have positive positioning circuit. Where two actuators are required in parallel or in sequence provide an auxiliary actuator driver. Actuators shall have current limiting motor protection. Actuators shall have manual override where indicated. Modulating actuators for valves shall have minimum rangeability of 40 to 1.
      a. Close-Off Pressure: Provide the minimum torque required, and spring return for fail positioning (unless otherwise specifically indicated) sized for required close-off pressure. Required close-off pressure for two-way water valve applications shall be the shutoff head of associated pump. Required close-off rating of steam valve applications shall be design inlet steam pressure plus 50 percent for low pressure steam, and 10 percent for high pressure steam. Required close-off rating of air damper applications shall be shutoff pressure of associated fan, plus 10 percent.
      b. Acceptable Manufacturers: Subject to compliance with requirements approved manufacturers are as follows:
         1) Belimo
         2) Johnson Controls
         3) Delta
         4) Invensys
         5) Substitutions: See Section 01 60 00 - Product Requirements

2.04 GENERAL FIELD DEVICES

A. Provide field devices for input and output of digital (binary) and analog signals into controllers (BCs, AACs, ASCs). Provide signal conditioning for all field devices as recommended by field device manufacturers, and as required for proper operation in the system.

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B. It shall be the Contractor's responsibility to assure that all field devices are compatible with controller hardware and software.

C. Field devices specified herein are generally 'two-wire' type transmitters, with power for the device to be supplied from the respective controller. If the controller provided is not equipped to provide this power, or is not designed to work with 'two-wire' type transmitters, or if field device is to serve as input to more than one controller, or where the length of wire to the controller will unacceptably affect the accuracy, the Contractor shall provide 'four-wire' type equal transmitter and necessary regulated DC power supply or 120 VAC power supply, as required.

D. For field devices specified hereinafter that require signal conditioners, signal boosters, signal repeaters, or other devices for proper interface to controllers, Contractor shall furnish and install proper device, including 120V power as required. Such devices shall have accuracy equal to, or better than, the accuracy listed for respective field devices.

E. Accuracy: As stated in this Section, accuracy shall include combined effects of nonlinearity, nonrepeatability and hysteresis.

2.05 TEMPERATURE SENSORS (TS)

A. Sensor range: When matched with A/D converter of BC, AAC/ASC, or SD, sensor range shall provide a resolution of no worse than 0.3°F (0.16 °C) (unless noted otherwise). Where thermistors are used, the stability shall be better than 0.25°F over 5 years.

B. Matched Sensors: The following applications shall require matched sensors:
   1. Building Loop Connections: Provide matched loop and building supply sensors where control sequence requires controlling to a temperature rise (differential).
   2. Hydronic Temperature Difference Calculations: Provide matched supply and return temperature sensors where the pair is used for calculating temperature difference for use in load calculations or sequencing such as across chillers and plants.
   3. Air Handling Unit Sequencing: Provide matched pair for the cooling and heating coil leaving sensors where the sequence includes calculating an offset from the supply air setpoint to maintain a leaving heating coil temperature.

C. Room Temperature Sensor: Shall be an element contained within a ventilated cover, suitable for wall mounting. Provide insulated base. Following sensing elements are acceptable:
   1. Sensing element shall be platinum RTD, thermistor, or integrated circuit, +/- 0.4°F accuracy at calibration point.
   2. Provide an occupancy override button on the room sensor. This shall be a momentary contact closure.
   3. Provide current temperature indication via an LCD or LED readout, with +/- sliding user temperature adjustment in occupied office spaces only.
   4. Provide flat-plate covers in stairwells, lobbies, utility spaces and elevator pits.

D. Outside air sensors shall consist of a sensor, sun shield, utility box, and watertight gasket to prevent water seepage. Temperature range shall be as require for resolution indicated in Paragraph A
   1. Sensing element shall be platinum RTD, thermistor, or integrated circuit, +/- 0.4°F accuracy at calibration point.

2.06 TEMPERATURE TRANSMITTERS

A. Where required by Controller, or where wiring runs are over 50 feet, sensors as specified above may be matched with transmitters outputting 4-20 mA linearly across the specified temperature range. Transmitters shall have zero and span adjustments, an accuracy of 0.1°F when applied to the sensor range.

2.07 TRANSDUCERS

A. Standard Capacity Electronic-to-Pneumatic (E-P) Transducers: E-P transducers shall be Voltage-to-Pneumatic (V-P) type, Current-to-Pneumatic (I-P) type, [and Pulse Width Modulated-to-Pneumatic (PWM-P) type]:
   1. Electrical Power Supply: 24 Vac or 24 Vdc.

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2. Pneumatic Air Supply: 30 psig (2.07 bar) maximum.
3. Air Capacity: 1100 scim @ 20 psig (300 cm3/sec @ 1.4 bar).
4. Air Consumption: Zero at steady state.
5. Output Span: 0-20 psig (0-1.4 bar).
6. Input: 4-20 mA, 0-5 Vdc, 1-5 Vdc, 0-10 Vdc, 2-10 Vdc, 0-15 Vdc, or 3-15 Vdc input. [Pulse width modulated or tri-state input shall be allowed].
7. Pulse Width Modulated and Tri-state Input Time Base: Dip switch selectable
8. Enclosure: Polymer designed for surface or panel mount.
9. Air Connections: ¼" (6.35 mm) barbed.
10. Failure Mode on Power Loss: Non-failsafe transducers shall have no output air loss. Failsafe transducers shall exhaust output upon power loss.
11. Acceptable Manufacturers: RE Technologies Model UCP-522. Substitutions shall be allowed per Division 1.

B. Binary to Analog Transducers ([Pulse Width Modulating] or Tri-State-to-Voltage or -Current):
1. Adjustable zero and span.
2. Failure Mode on Power Loss: Shall be provided with memory feature to allow the transducer to return to last value on power failure.
3. Accuracy: ± 1% of span
4. Output Span: 4-20 mA, 0-5 Vdc, 1-5 Vdc, 0-10Vdc, 2-10Vdc, 0-15Vdc, 3-15Vdc
5. Input: 4-20 mA, pulse width modulated or tri-state input.
6. Pulse Width Modulated] and Tri-state Input Time Base: Dip switch selectable.
7. Enclosure: Polymer designed for surface or panel mount.
8. Failure Mode on Power Loss: Non-failsafe transducers shall have no output air loss. Failsafe transducers shall exhaust output upon power loss.
9. Acceptable Manufacturers: RE Technologies Model PWA Series. Substitutions shall be allowed per Division 1.

C. Electronic-to Electronic (Voltage or Current to Current or Voltage):
1. Adjustable zero and span.
2. Failure Mode on Power Loss: Memory feature to allow the transducer to return to last value on power failure.
3. Accuracy: ± 1% of span.
4. Output Span: 4-20 mA, 0-5 Vdc, 1-5 Vdc, 0-10 Vdc, 2-10 Vdc, 0-15 Vdc, 3-15 Vdc.
5. Input: 0-20 Vdc, 0-20 ma, 0-10 kOhm.
6. Pulse Width Modulated] and Tri-state Input Time Base: Dip switch selectable
7. Enclosure: Polymer enclosure designed for surface or panel mount.
8. Acceptable Manufacturers: RE Technologies Model PWA Series. Substitutions shall be allowed per Division 1.

2.08 CURRENT SWITCHES (CS)

A. Clamp-On or Solid-Core Design Current Operated Switch (for Constant Speed Motor Status Indication)
1. Range: 1.5 to 150 amps.
2. Trip Point: Adjustable.
3. Switch: Solid state, normally open, 1 to 135 Vac or Vdc, 0.3 Amps. Zero off state leakage.
4. Lower Frequency Limit: 6 Hz.
5. Trip Indication: LED
6. Approvals: UL, CSA
7. Max. Cable Size: 350 MCM
8. Acceptable Manufacturers: Veris Industries H-708/908; Inc., RE Technologies SCS1150A-LED. Substitutions shall be allowed per Division 1.

B. Clamp-on or Solid-Core Wire Through Current Switch (CS/CR) (for Constant Speed Motors): Same as CS with 24v command relay rated at 5A @ 240 Vac resistive, 3A @ 240 Vac inductive, load control contact power shall be induced from monitored conductor (minimum conductor current required to energize relay 5A, max. rating of 135A). Acceptable Manufacturers shall be

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Veris Industries, Inc., Model # H938/735; or RE Technologies RCS 1150. Substitutions shall be allowed per Division 1.

1. Where used for single-phase devices, provide the CS/CR in a self-contained unit in a housing similar with override switch to Kele RIBX. Substitutions shall be allowed per Division 1.

C. Clamp-On Design Current Operated Switch for Variable Speed Motor Status Indication
   1. Range: 1.5 to 135 Amps.
   2. Trip Point: Self-calibrating based on VA memory associated with frequency to detect loss of belt with subsequent increase of control output to 60 Hz.
   3. Switch: Solid state, normally open, 1 to 135 Vac or Vdc, 0.3 Amps. Zero off state leakage.
   4. Frequency Range: 5-75 Hz
   5. Trip Indication: LED
   6. Approvals: UL, CSA
   7. Max. Cable Size: 350 MCM
   8. Acceptable Manufacturers: Veris Industries, Inc. H-904. Substitutions shall be allowed per Division 1.

D. Clamp-On Wire Through Current Switch (CS/CR) (for Variable Speed Motors): Same as CS with 24v command relay rated at 5A @ 240 Vac resistive, 3A @ 240 Vac inductive, load control contact power shall be induced from monitored conductor (minimum conductor current required to energize relay 5A, max. rating of 135A). Acceptable manufacturer shall be Veris Industries, Inc., Model # H934. Substitutions shall be allowed per Division 1.

E. Variable Speed Status: Where current switches are used to sense the status for variable speed devices, the CT shall include on-board VA/Hz memory to allow distinction between a belt break and subsequent ramp up to 60 Hz, versus operation at low speed. The belt break scenario shall be indicated as a loss of status and the operation at low speed shall indicate normal status.

2.09 CURRENT TRANSFORMERS (CT)

A. Clamp-On Design Current Transformer (for Motor Current Sensing)
   1. Range: 1-10 amps minimum, 20-200 amps maximum
   2. Trip Point: Adjustable
   3. Output: 0-5 VDC.
   4. Accuracy: ±0.2% from 20 to 100 Hz.
   5. Acceptable Manufacturers: KELE SA100. Substitutions shall be allowed per Division 1.

2.10 ELECTRIC METER

A. Sub-meter shall be designed for Multifunction Electrical Measurement on 3 phase power systems.
   1. Sub-meter shall support 3 element wye, 2.5 element wye, 2 element delta, 4 wire delta systems.
   2. The sub-meter shall accept universal voltage input suitable for 120, 220, and 277 power systems.
   3. Surge withstand shall conform to IEEE C37.90.1
   4. The sub-meter shall be user programmable for voltage range to any PT ratio.
   5. The sub-meter shall accept a voltage input range of up to 416 Volts Line to Neutral, and a range of up to 721 Volts Line to Line.
   6. Sub-meter shall accept a current reading of up to 11 amps continuous.

B. The sub-meter shall have an accuracy of +/- 0.1% or better for volts and amps, and 0.2% for power and energy functions. The sub-meter shall meet the accuracy requirements of IEC687 (class 0.2%) and ANSI C12.20 (Class 0.2%).
   1. The sub-meter shall provide true RMS measurements of voltage, phase to neutral and phase to phase, current, per phase and neutral.
   2. The sub-meter shall provide sampling at 400+ samples per cycle on all channel measured readings simultaneously.
   3. The sub-meter shall utilize 24 bit Analog to Digital conversion.

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C. The sub-meter shall include a three lines, bright red,.56” LED display.
   1. The sub-meter shall fit in both DIN 92mm and ANSI C39.1 Round cut-outs.
   2. The sub-meter must display a % of Load Bar on the front panel to provide an analog feel. The % Load bar shall have no less than 10 segments.
   3. The sub-meter must have a programmable display, which allows for the following programming functions including automatic scroll, screen selection programming, and energy scaling.

D. Sub-meter shall include virtual measurement upgrade packs, which shall allow user to upgrade in field without removing installed sub-meter.
   1. Two upgrade packs shall be:
      a. Volts, Amps, kW, kVAR, PF, kVA, Freq., kWh, kVAh, kVARh.
      b. Volts, Amps, kW, kVAR, PF, kVA, Freq., kWh, kVAh, kVARh, %THD Monitoring and Limit Exceeded Alarms.
         1) These virtual upgrade packs must be able to be updated without physically removing the installed sub-meter.
         2) Sub-meter shall be a traceable revenue sub-meter, which shall contain a utility grade test pulse, allowing power providers to verify and confirm that the sub-meter is performing to its rated accuracy.

E. The sub-meter shall include two independent communication ports with advanced features.
   1. Port 1 shall provide an optical IrDA port (through the faceplate) which shall allow the unit to be set up and programmed using a PDA or remote laptop without need for a communication cable.
   2. Port 2 shall be selectable for RS485 communication, for 10 base-T Ethernet or for 802.11 Wireless Ethernet.
   3. When in serial mode, the meter shall speak Modbus ASCII, Modbus RTU, or DNP 3.0 protocol up to 57.6K baud.
   4. When in Ethernet mode, the meter shall provide an 802.11 WIFI or an RJ45 Ethernet connection which shall allow the unit to be assigned an IP address and communicate Modbus protocol over Ethernet TCP/IP.
   5. The sub-meter shall have Pocket PC based software available for remote programming and integration.

F. The sub-meter shall provide user configured fixed window or rolling window demand. This shall allow user to set up the particular utility demand profile.
   1. Readings for kW, kVAR, kVA and PF shall be calculated using utility demand features.
   2. All other parameters shall offer max and min capability over the user selectable averaging period.
   3. Voltage shall provide an instantaneous max and min reading, displaying the highest surge and lowest sag seen by the sub-meter.
   4. The meter shall additionally measure accumulated energy in both generating and consuming quadrants with a programmable scaling that allow up to 8 digits of energy resolution.
   5. The meter shall also accumulate positive and negative VAR-hours and VA-hours. All readings shall be stamped with a positive and negative average demand.

G. The sub-meter shall support power supply and support direct wiring from 100 to 400 Volts AC or 100 to 370 Volts DC.
   1. Sub-meter power supply shall accept burden of 10VA max.
   2. The sub-meter shall have a standard 4-year warranty.

H. Sub-meter shall be able to be stored in (-40 to +85) degrees C.
   1. Operating temperature shall be (-30 to +70) degrees C.
   2. NEMA 12 faceplate rating shall be available for the Sub-meter.

I. The following devices are required for each meter assembly:
   1. Meter: Shark 100-S-60-10-V3-WIFI (or pre-approved equal)
   2. Split CT's (3 per Meter): EI-5SP-1200-00 (or pre-approved equal)

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a. Field verified amp rating on service prior to ordering CT.
b. CT Short Block: SB-6TC (or pre-approved equal)

2.11 MAGNETIC FLOW METERS FOR WATER SERVICE

A. General Requirements:
1. Sensor shall be a magnetic flow meter, which utilizes Faraday's Law to measure volumetric fluid flow through a pipe.
2. The flow meter shall consist of 2 elements, the sensor and the electronics. The sensor shall generate a measuring signal proportional to the flow velocity in the pipe. The electronics shall convert this EMF into a standard current output.
3. Electronic replacement shall not affect meter accuracy (electronic units are not matched with specific sensors).
a. Provide a four-wire, externally powered, magnetic type flow transmitter with adjustable span and zero, integrally mounted to flow tube.
b. Output: 4-20 mA
c. Flow Tube: Stainless steel
d. Electrical Enclosure: NEMA 4, 7.
e. Approvals: UL or CSA.
f. Stability: 0.1% of rate over six months.
g. Process Connection: Carbon steel, ANSI 150 LB, size as required.

B. Meter Accuracy:
1. Under the reference conditions of a 68 °F media temperature, a 68 °F ambient temperature, a +/- 1% nominal power supply voltage, 10 diameters up stream and 5 down of straight piping and a fully developed flow profile; the meter must meet the following requirements:
2. +/- 0.8% of reading accuracy in the flow range of 1.65 - 33 ft/sec +/- (0.66/Velocity actual ft/s +0.4)% of reading accuracy in the flow range of 0-1.65 ft/sec.
3. Meter repeatability shall be +/- 0.1% of rate at velocities > 1.65 ft/sec.

C. Calibration: The sensor must be calibrated on an internationally accredited (i.e. NAMAS) flow rig with accuracy better than 0.1%. Calibration shall be traceable to National Institute of Standard and Technology.

D. Construction:
1. The meter piping material shall be AISI 304 stainless steel.
2. The meter flange and enclosure material shall be carbon steel.
3. The external surface of the sensor is to be treated with at least.006 in. (150 µm) of Corrosion resistant two-component paint.
4. The inner meter piping shall be protected with a neoprene liner or similar liner.
5. The electrode material shall be AISI 316 Ti or better.
6. The sensor be ANSI class 150#.

E. Electronics:
1. The sensor shall contain a SENSOR-PROM, storing calibration and factory default settings, i.e. the identification of the sensor and size.
2. An ISO 9001 approved company shall manufacture the sensor and electronics.
3. As standard, the electronics must be installable directly on the sensor or installable (remote) up to 1500 ft from the sensor as a maximum.
4. With local electronics installation, the electronics shall be able to withstand 3 feet water submersion for up to 30 minutes.
5. The electronics shall be compatible with the following power specifications:
a. 15/230 Vac +10% to 15% 50-60 Hz.
b. The power consumption must be 10 Watts or less independent of meter size.
c. The meter electronics shall be able to produce simultaneous scaleable current and frequency/pulse output. The frequency output shall be linearly proportional to flow rate and scaleable from 0-10 kHz. The pulse output shall be scaleable from 50 to 5000 milliseconds duration, suitable for an electromechanical totalizer in engineering units.

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d. The electronics must have an internal totalizer for summation of flow.
e. The output of the electronics must be individually, galvanically isolated with an isolation voltage of more than 500 V.

F. Output:
1. The current signal must be either 0-20 mA or 4-20 mA proportional to the flow velocity.
2. The output current signal must accommodate 20% over range without loss in linearity.
3. The electronics shall have an alphanumeric LCD display showing actual flow and totalized flow in engineering units.
4. The display and keyboard must be rotatable so that the display can be viewed regardless of sensor orientation.

G. Error Detection:
1. The electronics must be able to detect the flowing error conditions:
a. Signal connection between electronics and sensor interrupted.
b. Loss of current to the coil circuit.
c. Load on the current output.
d. Defective electronics.
e. Defective sensor.
f. Empty pipe.
g. The electronics must have an Error Log where all error conditions occurring within a period of 180 days are stored.

H. Electronic Replacement Programming:
1. The electronics must be immediately replaceable without the need of cable disconnection or renewed configuration programming.
2. When the supply voltage is applied, the electronics must self configure and display flow without keyboard contact (no programming required).
3. The electronics must be provided with an automatic zero flow setting.
4. The electronics shall be programmable with respect to:
a. User display options and menu
b. Setting data
c. Configuration of outputs
d. Zero 'cut-off' from 0% to 9.9% of maximum flow.
e. For ease of programming, the electronics shall be programmable away from the meter using the meter Sensor-Prom and a 9 V battery.
f. The electronics shall be suitable for operation in an ambient temperature range of -4 °F to 120 °F.

2.12 ELECTRIC CONTROL COMPONENTS

A. Limit Switches (LS): Limit switches shall be UL listed, SPDT or DPDT type, with adjustable trim arm. Limit switches shall be as manufactured by Square D, Allen Bradley. Substitutions shall be allowed per Division 1.

B. Electric Solenoid-Operated Pneumatic Valves (EP): EP valves shall be rated for a minimum of 1.5 times their maximum operating static and differential pressure.. Valves shall be ported 2-way, 3-way, or 4-way and shall be normally closed or open as required by the application. EPs shall be sized for minimum pressure drop, and shall be UL and CSA listed. Furnish and install gauges on all inputs of EPs. Furnish an adjustable air pressure regulator on input side of solenoid valves serving actuators operating at greater than 30 psig.
1. Coil Enclosure: Indoors shall be NEMA-1, Outdoors and NEMA-3, 4, 7, 9.
2. Fluid Temperature Rating: Valves for compressed air and cold water service shall have 150 °F (66 °C) minimum rating. Valves for hot water or steam service shall have fluid temperature rating higher than the maximum expected fluid temperature.
3. Acceptable Manufacturers: EP valves shall be as manufactured by ASCO or Parker. Substitutions shall be allowed per Division 1.
4. Coil Rating: EP valves shall have appropriate voltage coil rated for the application (i.e., 24 VAC, 120 VAC, 24 VDC, etc.).

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C. Low Temperature Detector ('Freezestat') (FZ): Low temperature detector shall consist of a 'cold spot' element which responds only to the lowest temperature along any one foot of entire element, minimum bulb size of 1/8" x 20' (3.2mm x 6.1m), junction box for wiring connections and gasket to prevent air leakage or vibration noise, DPST (4 wire, 2 circuit) with manual reset. Temperature range 15 to 55°F (-9.4 to 12.8°C), factory set at 38°F.

D. High Temperature Detectors ('Firestat') (FS): High temperature detector shall consist of 3-pole contacts, a single point sensor, junction box for wiring connections and gasket to prevent air leakage of vibration noise, triple-pole, with manual reset. Temperature range 25 to 215°F (-4 to 102°C).

E. Surface-Mounted Thermostat: Surface-mounted thermostat shall consist of SPDT contacts, operating temperature range of 50 to 150° F (10 to 65°C), and a minimum 10°F fixed setpoint differential.

F. Low Voltage Wall Thermostat: Wall-mounted thermostat shall consist of SPDT sealed mercury contacts, operating temperature range of 50 to 90°F (10 to 32°C), switch rating of 24 Vac (30 Vac max.), and both manual and automatic fan operation in both the heat and cool modes.

G. Control Relays: All control relays shall be UL listed, with contacts rated for the application, and mounted in minimum NEMA-1 enclosure for indoor locations, NEMA-4 for outdoor locations.
   1. Control relays for use on electrical systems of 120 volts or less shall have, as a minimum, the following:
      a. AC coil pull-in voltage range of +10%, -15% or nominal voltage.
      b. Coil sealed volt-amperes (VA) not greater than four (4) VA.
      c. Silver cadmium Form C (SPDT) contacts in a dustproof enclosure, with 8 or 11 pin type plug.
      d. Pilot light indication of power-to-coil and coil retainer clips.
      e. Coil rated for 50 and 60 Hz service.
      f. Acceptable Manufacturers: Relays shall be Potter Brumfield, Model KRPA. Substitutions shall be allowed per Division 1.
      g. Relays used for across-the-line control (start/stop) of 120V motors, 1/4 HP, and 1/3 HP, shall be rated to break minimum 10 Amps inductive load. Relays shall be IDEC. Substitutions shall be allowed per Division 1.
      h. Relays used for stop/start control shall have low voltage coils (30 VAC or less), and shall be provided with transient and surge suppression devices at the controller interface.

H. General Purpose Power Contactors: NEMA ICS 2, AC general-purpose magnetic contactor. ANSI/NEMA ICS 6, NEMA type 1enclosure. Manufacturer shall be Square 'D', Cutler-Hammer or Westinghouse.

I. Control Transformers: Furnish and install control transformers as required. Control transformers shall be machine tool type, and shall be US and CSA listed. Primary and secondary sides shall be fused in accordance with the NEC. Transformer shall be proper size for application, and mounted in minimum NEMA-1 enclosure.
   1. Transformers shall be manufactured by Westinghouse, Square 'D', or Jefferson. Substitutions shall be allowed per Division 1.

J. Time Delay Relays (TDR): TDRs shall be capable of on or off delayed functions, with adjustable timing periods, and cycle timing light. Contacts shall be rated for the application with a minimum of two (2) sets of Form C contacts, enclosed in a dustproof enclosure.
   1. TDRs shall have silver cadmium contacts with a minimum life span rating of one million operations. TDRs shall have solid state, plug-in type coils with transient suppression devices.
   2. TDRs shall be UL and CSA listed, Crouzet type. Substitutions shall be allowed per Division 1.

K. Electric Push Button Switch: Switch shall be momentary contact, oil tight, push button, with number of N.O. and/or N.C. contacts as required. Contacts shall be snap-action type, and rated

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for minimum 120 Vac operation. Switch shall be 800T type, as manufactured by Allen Bradley. Substitutions shall be allowed per Division 1.

L. Pilot Light: Panel-mounted pilot light shall be NEMA ICS 2 oil tight, transformer type, with screw terminals, push-to-test unit, LED type, rated for 120 VAC. Unit shall be 800T type, as manufactured by Allen-Bradley. Substitutions shall be allowed per Division 1.

M. Alarm Horn: Panel-mounted audible alarm horn shall be continuous tone, 120 Vac Sonalert solid-state electronic signal, as manufactured by Mallory. Substitutions shall be allowed per Division 1.

N. Electric Selector Switch (SS): Switch shall be maintained contact, NEMA ICS 2, oil-tight selector switch with contact arrangement, as required. Contacts shall be rated for minimum 120 Vac operation. Switch shall be 800T type, as manufactured by Allen-Bradley. Substitutions shall be allowed per Division 1.

2.13 NAMEPLATES

A. Provide engraved phenolic or micarta nameplates for all equipment, components, and field devices furnished. Nameplates shall be 1/8 thick, black, with white center core, and shall be minimum 1" x 3", with minimum 1/4" high block lettering. Nameplates for devices smaller than 1" x 3" shall be attached to adjacent surface.

B. Each nameplate shall identify the function for each device.

2.14 TESTING EQUIPMENT

A. Contractor shall test and calibrate all signaling circuits of all field devices to ascertain that required digital and accurate analog signals are transmitted, received, and displayed at system operator terminals, and make all repairs and recalibrations required to complete test. Contractor shall be responsible for test equipment required to perform these tests and calibrations. Test equipment used for testing and calibration of field devices shall be at least twice as accurate as respective field device (e.g., if field device is +/-0.5% accurate, test equipment shall be +/-0.25% accurate over same range).

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which control systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF CONTROL SYSTEMS

A. General: Install systems and materials in accordance with manufacturer's instructions, roughing-in drawings and details shown on drawings. Install electrical components and use electrical products complying with requirements of National Electric Code and all local codes.

B. Control Wiring: The term "control wiring" is defined to include providing of wire, conduit and miscellaneous materials as required for mounting and connection of electric control devices.

1. Wiring System: Install complete wiring system for electric control systems. Conceal wiring except in mechanical rooms and areas where other conduit and piping are exposed. Installation of wiring shall generally follow building lines. Install in accordance with National Electrical Code and Division 16 of this Specification. Fasten flexible conductors bridging cabinets and doors, neatly along hinge side, and protect against abrasion. Tie and support conductors neatly.
2. Control Wiring Conductors: Install control wiring conductors, without splices between terminal points, color-coded. Install in neat workmanlike manner, securely fastened. Install in accordance with National Electrical Code and Division 16 of this Specification.
3. Communication wiring, signal wiring and low voltage control wiring shall be installed separate from any wiring over thirty (30) volts. Signal wiring shield shall be grounded at controller end only, unless otherwise recommended by the controller manufacturer.
4. All WAN and LAN Communication wiring shield shall be terminated as recommended by controller manufacturer. All WAN and LAN Communication wiring shall be labeled with a

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network number, device ID at each termination and shall correspond with the WAN and LAN system architecture and floor plan submittals.

5. Install all control wiring external to panels in electric metallic tubing or raceway. However, communication wiring, signal wiring and low voltage control wiring may be run without conduit in concealed, accessible locations if noise immunity is ensured. Contractor will be fully responsible for noise immunity and rewire in conduit if electrical or RF noise affects performance. Accessible locations are defined as areas inside mechanical equipment enclosures, such as heating and cooling units, instrument panels etc.; in accessible pipe chases with easy access, or suspended ceilings with easy access. Installation of wiring shall generally follow building lines. Run in a neat and orderly fashion, bundled where applicable, and completely suspended (strapped to rigid elements or routed through wiring rings) away from areas of normal access. Tie and support conductors neatly with suitable nylon ties. Conductors shall not be supported by the ceiling system or ceiling support system. Conductors shall be pulled tight and be installed as high as practically possible in ceiling cavities. Wiring shall not be laid on the ceiling or duct. Conductors shall not be installed between the top cord of a joist or beam and the bottom of roof decking. Contractor shall be fully responsible for noise immunity and rewire in conduit if electrical or RF noise affects performance.
6. Number-code or color-code conductors appropriately for future identification and servicing of control system. Code shall be as indicated on approved installation drawings.

C. Averaging Temperature Sensors: Cover no more than two square feet per linear foot of sensor length except where indicated. Generally where flow is sufficiently homogeneous/adequately mixed at sensing location, consult AE for requirements.

D. Airflow Measuring Stations: Install per manufacturer's recommendations in an unobstructed straight length of duct (except those installations specifically designed for installation in fan inlet). For installations in fan inlets, provide on both inlets of double inlet fans and provide inlet cone adapter as recommended by AFM station manufacturer.

E. Relative Humidity Sensors: Provide element guard as recommended by manufacturer for high velocity installations. For high limit sensors, position remote enough to allow full moisture absorption into the air stream before reaching the sensor.

F. Current Switches for Motor Status Monitoring: Adjust so that setpoint is below minimum operating current and above motor no load current.

G. Cutting and Patching Insulation: Repair insulation to maintain integrity of insulation and vapor barrier jacket. Use hydraulic insulating cement to fill voids and finish with material matching or compatible with adjacent jacket material.

END OF SECTION

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SECTION 23 09 53

BAS FIELD PANELS

PART 1 - GENERAL

1.01 SECTION INCLUDES:

A. Building Controller (BC)

B. Advance Application Specific Controller (AAC)

C. Application Specific Controller (ASC)

1.02 RELATED DOCUMENTS:

A. Section 23 09 50 - Building Automation System (BAS) General - Refer to this section for definitions of terminology

B. Section 23 09 51 - BAS Basic Materials, Interface Devices, and Sensors

C. Section 23 09 54 - BAS Communications Devices

D. Section 23 09 55 - BAS Software

E. Section 23 09 58 - Sequence of Operation

F. Section 23 09 59 - BAS Commissioning

1.03 DESCRIPTION OF WORK:

A. Furnish and install DDC Control units and/or Smart Devices required to support specified building automation system functions.

B. Refer to Section 23 09 50 for general requirements.

PART 2 - PRODUCTS

2.01 STAND-ALONE FUNCTIONALITY

A. General: These requirements clarify the requirement for stand-alone functionality relative to packaging I/O devices with a controller. Stand-alone functionality is specified with the controller and for each Application Category specified in Part 3. This item refers to acceptable paradigms for associating the points with the processor.

B. Functional Boundary: Provide controllers so that all points associated with and common to one unit or other complete system/equipment shall reside within a single control unit. The boundaries of a standalone system shall be as dictated in the contract documents. Generally systems specified for the Application Category will dictate the boundary of the standalone control functionality. See related restrictions below. When referring to the controller as pertains to the standalone functionality, reference is specifically made to the processor. One processor shall execute all the related I/O control logic via one operating system that uses a common programming and configuration tool.

C. The following configurations are considered acceptable with reference to a controller's standalone functionality:

1. Points packaged as integral to the controller such that the point configuration is listed as an essential piece of information for ordering the controller (having a unique ordering number).
2. Controllers with processors and modular back planes that allow plug in point modules as an integral part of the controller.
3. I/O point expander boards, plugged directly into the main controller board to expand the point capacity of the controller.
4. I/O point expansion devices connected to the main controller board via wiring and as such may be remote from the controller and that communicate via a sub LAN protocol. These arrangements to be considered standalone shall have a sub LAN that is dedicated to that controller and include no other controller devices (AACs or ASCs). All wiring to interconnect the I/O expander board shall be:
   a. Contained in the control panel enclosure;

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b. Or run in conduit. Wiring shall only be accessible at the terminations.

D. The following configurations are considered unacceptable with reference to a controller's standalone functionality:
   1. Multiple controllers enclosed in the same control panel to accomplish the point requirement.

2.02 BUILDING CONTROLLER (BC)

A. General Requirements:
   1. The BC(s) shall provide fully distributed control independent of the operational status of the OWSs and CSS. All necessary calculations required to achieve control shall be executed within the BC independent of any other device. All control strategies performed by the BC(s) shall be both operator definable and modifiable through the Operator Interfaces.
   2. BCs shall perform overall system coordination, accept control programs, perform automated HVAC functions, control peripheral devices and perform all necessary mathematical and logical functions. BCs shall share information with the entire network of BCs and AACs/ASCs for full global control. Each controller shall be accessed through the CSS in normal operations. In the event that the CSS is not available, the controller shall permit multi-user operation from multiple OWS and mobile computers connected either locally or over the network. Each unit shall have its own internal RAM, non-volatile memory, microprocessor, battery backup, regulated power supply, power conditioning equipment, ports for connection of operating interface devices, and control enclosure. BCs shall be programmable from the CSS, OWS, mobile computer, or hand held device. BC shall contain sufficient memory for all specified global control strategies, user defined reports and trending, communication programs, and central alarming.
   3. BCs shall be connected to a controller network that qualifies as a controlling LAN.
   4. All BCs shall be provided with a UPS to protect against memory loss and allow for continuous communication with the CSS in the event of a loss of power.
      a. The UPS shall be a 500 VA UPS equal to APC Back-UPS CS, 300 Watts / 500 VA, Input 120V / Output 120V, Interface Port DB-9 RS-232, USB
   5. In addition BCs may provide intelligent, standalone control of BAS functions. Each BC may be capable of standalone direct digital operation utilizing its own processor, non-volatile memory, input/output, wiring terminal strips, A/D converters, real-time clock/calendar and voltage transient and lightning protection devices. Refer to standalone functionality specified above.
   6. The BC may provide for point mix flexibility and expandability. This requirement may be met via either a family of expander boards, modular input/output configuration, or a combination thereof. Refer to stand alone functionality specified above.
   7. All BC point data, algorithms and application software shall be modifiable from the CSS and OWS.
   8. Each BC shall execute application programs, calculations, and commands via a microprocessor resident in the BC. The database and all application programs for each BC shall be stored in non-volatile or battery backed volatile memory within the BC and will be able to upload/download to/from the CSS.
   9. BC shall provide buffer for holding alarms, messages, trends etc.
   10. Each BC shall include self-test diagnostics, which allow the BC to automatically alarm any malfunctions, or alarm conditions that exceed desired parameters as determined by programming input.
   11. Each BC shall contain software to perform full DDC/PID control loops.
   12. For systems requiring end-of-line resistors those resistors shall be located in the BC.
   13. Input-Output Processing
      a. Digital Outputs (DO): Outputs shall be rated for a minimum 24 Vac or Vdc, 1 amp maximum current. Each shall be configurable as normally open or normally closed. Each output shall have an LED to indicate the operating mode of the output and a manual hand off or auto switch to allow for override. Each DO shall be discrete outputs from the BC's board (multiplexing to a separate manufacturer's board is unacceptable). Provide suppression to limit transients to acceptable levels.

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b. Analog Inputs (AI): AI shall be 0-5 Vdc, 0-10 Vdc, 0-20 Vdc, and 0-20 mA. Provide signal conditioning, and zero and span calibration for each input. Each input shall be a discrete input to the BC's board (multiplexing to a separate manufacturers board is unacceptable unless specifically indicated otherwise). A/D converters shall have a minimum resolution of 12 bits.
c. Digital Inputs (DI): Monitor dry contact closures. Accept pulsed inputs of at least one per second. Source voltage for sensing shall be supplied by the BC and shall be isolated from the main board. Software multiplexing of an AI and resistors may only be done in non-critical applications and only with prior approval of Architect/Engineer.
d. Universal Inputs (UI-AI or DI): To serve as either AI or DI as specified above.
e. Electronic Analog Outputs (AO): Voltage mode: 0-5 Vdc and 0-10 Vdc; Current mode: 4-20 mA. Provide zero and span calibration and circuit protection. Pulse Width Modulated (PWM) analog via a DO [and transducer] is acceptable only with Owner approval (Generally these will not be allowed on loops with a short time constant such as discharge temperature loops, economizer loops, pressure control loops and the like. They are generally acceptable for standard room temperature control loops.). Where these are allowed, transducer/actuator shall be programmable for normally open, normally closed, or hold last position and shall allow adjustable timing. Each DO shall be discrete outputs from the BC's board (multiplexing to a separate manufacturers board is unacceptable). D/A converters shall have a minimum resolution of 10 bits.
f. Pulsed Inputs: Capable of counting up to 8 pulses per second with buffer to accumulate pulse count. Pulses shall be counted at all times.

14. A communication port for operator interface through a mobile computer shall be provided in each BC. It shall be possible to perform all program and database back-up, system monitoring, control functions, and BC diagnostics through this port. Standalone BC panels shall allow temporary use of portable devices without interrupting its normal operation.
15. Each BC shall be equipped with loop tuning algorithm for precise proportional, integral, derivative (PID) control. Loop tuning tools provided with the CSS software is acceptable. In any case, tools to support loop tuning must be provided such that P, I, and D gains are automatically calculated.
16. All analog output points shall have a selectable failure setpoint. The BC shall be capable of maintaining this failure setpoint in the event of a system malfunction, which causes loss of BC control, or loss of output signal, as long as power is available at the BC. The failure setpoint shall be selectable on a per point basis.
17. Slope intercepts and gain adjustments shall be available on a per-point basis.
18. BC Power Loss:
    a. Upon a loss of power to any BC, the other units on the controlling LAN shall not in any way be affected.
    b. Upon a loss of power to any BC, the battery backup shall ensure that the energy management control software, the Direct Digital Control software, the database parameters, and all other programs and data stored in the RAM are retained for a minimum of fifty (50) hours. An alarm diagnostic message shall indicate that the BC is under battery power.
    c. Upon restoration of power within the specified battery backup period, the BC shall resume full operation without operator intervention. The BC shall automatically reset its clock such that proper operation of any time dependent function is possible without manual reset of the clock. All monitored functions shall be updated.
    d. Should the duration of a loss of power exceed the specified battery back-up period or BC panel memory be lost for any reason, the panel shall automatically report the condition (upon resumption of power) and be capable of receiving a download via the network from the CSS or a mobile computer. In addition, the Owner shall be able to upload the most current versions of all energy management control programs, Direct Digital Control programs, database parameters, and all other data and programs in the memory of each BC to the CSS or a mobile computer via the network or the local USB or RS-232C port.

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19. BC Failure:
    a. Building Controller LAN Data Transmission Failure: BC shall continue to operate in stand-alone mode. BC shall store loss of communication alarm along with the time of the event. All control functions shall continue with the global values programmable to either the last value or a specified value. Peer BCs shall recognize the loss and report alarm.
    b. BC Hardware Failure: BC shall cease operation and terminate communication with other devices. All outputs shall go to their specified fail position.
20. Each BC shall be equipped with firmware resident self-diagnostics for sensors and be capable of assessing an open or shorted sensor circuit and taking an appropriate control action (close valve, damper, etc.).
21. BCs may include network communications interface functions for controlling secondary controlling LANs Refer to Section 23 09 54 - BAS System Communications Devices for requirements if this function is packaged with the BC.
22. A minimum of four levels of privileges shall be provided at each BC.
23. All local user accounts shall be password protected. Strong password shall be used and complies with the Owner's security standard.
24. BCs shall be mounted on equipment, in packaged equipment enclosures, or locking wall mounted in a NEMA 1 enclosure, as specified elsewhere.

B. BACnet Building Controller Requirements:
1. The BC(s) shall support all BIBBs defined in the BACnet-IP (B-BC) device profile as defined in the BACnet standard.
2. BCs shall communicate over the BACnet-IP LAN.
3. Each BC shall be connected to the BACnet-IP LAN communicating to/from other BCs.

2.03 ADVANCED APPLICATION SPECIFIC CONTROLLER (AAC) AND APPLICATION SPECIFIC CONTROLLER (ASC)

A. General Requirements:
1. AACs and ASCs shall provide intelligent, standalone control of HVAC equipment. Each unit shall have its own internal RAM, non-volatile memory and will continue to operate all local control functions in the event of a loss of communications on the ASC LAN or sub-LAN. Refer to standalone requirements by application specified in Part 3 of this section. In addition, it shall be able to share information with every other BC and AAC /ASC on the entire network.
2. Each AAC and ASC shall include self-test diagnostics that allow the AAC /ASC to automatically relay to the BC, or LAN Interface Device, any malfunctions or abnormal conditions within the AAC /ASC or alarm conditions of inputs that exceed desired parameters as determined by programming input.
3. AACs and ASCs shall include sufficient memory to perform the specific control functions required for its application and to communicate with other devices.
4. Each AAC and ASC must be capable of stand-alone direct digital operation utilizing its own processor, non-volatile memory, input/output, minimum 8 bit A to D conversion, voltage transient and lightning protection devices. All volatile memory shall have a battery backup of at least fifty- (50) hrs with a battery life of (5) five years.
5. All point data; algorithms and application software within an AAC /ASC shall be modifiable from the OWS.
6. AAC and ASC Input-Output Processing
    a. Digital Outputs (DO): Outputs shall be rated for a minimum 24 VAC or VDC, 1 amp maximum current. Each shall be configurable as normally open or normally closed. Each output shall have an LED to indicate the operating mode of the output and a manual hand off or auto switch to allow for override (Only AAC requires HOA). Each DO shall be discrete outputs from the AAC/ASC's board (multiplexing to a separate manufacturer's board is unacceptable). Provide suppression to limit transients to acceptable levels.

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b. Analog Inputs (AI): AI shall be O-5 Vdc, 0-10Vdc, 0-20Vdc, and 0-20 mA. Provide signal conditioning, and zero and span calibration for each input. Each input shall be a discrete input to the BC's board (multiplexing to a separate manufacturers board is unacceptable unless specifically indicated otherwise). A/D converters shall have a minimum resolution of 8-10 bits depending on application.
c. Digital Inputs (DI): Monitor dry contact closures. Accept pulsed inputs of at least one per second. Source voltage for sensing shall be supplied by the BC and shall be isolated from the main board. Software multiplexing of an AI and resistors may only be done in non-critical applications and only with prior approval of Architect/Engineer
d. Universal Inputs (UI-AI or DI): To serve as either AI or DI as specified above.
e. Electronic Analog Outputs (AO) as required by application: voltage mode, 0-5VDC and 0-10VDC; current mode (4-20 mA). Provide zero and span calibration and circuit protection. Pulse Width Modulated (PWM) analog via a DO [and transducer] is acceptable only with Owner approval (Generally, PWM will not be allowed on loops with a short time constant such as discharge temperature loops, economizer loops, pressure control loops and the like. They are generally acceptable for standard room temperature control loops.). Where PWM is allowed, transducer/actuator shall be programmable for normally open, normally closed, or hold last position and shall allow adjustable timing. Each DO shall be discrete outputs from the BC's board (multiplexing to a separate manufacturers board is unacceptable). D/A converters shall have a minimum resolution of 8 bits.

B. BACnet AAC(s) and ASC(s) Requirements:
1. The AAC(s) and ASC(s) shall support all BIBBs defined in the BACnet Building Controller (B-AAC and B-ASC) device profile as defined in the BACnet standard.
2. AAC(s) and ASC(s) shall communicate over the BACnet Building Controller LAN or the ASC LAN or sub-LAN.
3. Each BC shall be connected to the BACnet Building Controller LAN communicating to/from other BCs.

C. Terminal Box Controllers:
1. Terminal box controllers controlling damper positions to maintain a quantity of supply or exhaust air serving a space shall have an automatically initiated function that resets the volume regulator damper to the fully closed position on a scheduled basis. The controllers shall initially be set up to perform this function once every 24 hours. The purpose of this required function is to reset and synchronize the actual damper position with the calculated damper position and to assure the damper will completely close when commanded. The software shall select scheduled boxes randomly and shall not allow more than 5% of the total quantity of controllers in a building to perform this function at the same time. This reset shall be performed while the AHU is operating. The BAS shall send an alarm for any terminal box that has been reset and does not indicate 0 cfm flow with the damper commanded closed.

PART 3 - EXECUTION

3.01 INSPECTION:

A. Examine areas and conditions under which control systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF CONTROL SYSTEMS:

A. General: Install systems and materials in accordance with manufacturer's instructions, specifications roughing-in drawings and details shown on drawings. Contractor shall install all controllers in accordance with manufacturer's installation procedures and practices.

3.03 HARDWARE APPLICATION REQUIREMENTS

A. General: The functional intent of this specification is to allow cost effective application of manufacturers standard products while maintain the integrity and reliability of the control functions. A BC as specified above is generally fully featured and customizable whereas the AAC/ASC refers to a more cost-effective unit designed for lower-end applications. Specific

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requirements indicated below are required for the respective application. Manufacturer may apply the most cost-effective unit that meets the requirement of that application.

B. Standalone Capability: Each Control Unit shall be capable of performing the required sequence of operation for the associated equipment. All physical point data and calculated values required to accomplish the sequence of operation shall originate within the associated CU with only the exceptions enumerated below. Refer to Item 2.01 above for physical limitations of standalone functionality. Listed below are functional point data and calculated values that shall be allowed to be obtained from or stored by other CUs or SDs via LAN.

C. Where associated control functions involve functions from different categories identified below, the requirements for the most restrictive category shall be met.

D. Application Category 0 (Distributed monitoring)
   1. Applications in this category include the following:
      a. Monitoring of variables that are not used in a control loop, sequence logic, or safety.
   2. Points on BCs, AACs, and ASCs may be used in these applications as well as SDs and/or general-purpose I/O modules.
   3. Where these points are trended, contractor shall verify and document that the network bandwidth is acceptable for such trends and is still capable of acceptable and timely control function.

E. Application Category 1 (Application Specific Controller):
   1. Applications in this category include the following:
      a. Fan Coil Units
      b. Airflow Control Boxes (VAV and Constant Volume Terminal Units)
      c. Misc. Heaters
      d. Unitary equipment <15 tons (Package Terminal AC Units, Package Terminal Heat Pumps, Split-System AC Units, Split-System Heat Pumps, Water-Source Heat Pumps)
      e. Induction Units
      f. Variable Speed Drive (VSD) controllers not requiring safety shutdowns of the controlled device.
   2. ASCs may be used in these applications.
   3. Standalone Capability: Provide capability to execute control functions for the application for a given setpoint or mode, which shall generally be occupied mode control. Only the following data (as applicable) may be acquired from other controllers via LANs. In the event of a loss of communications with any other controller, or any fault in any system hardware that interrupts the acquisition of any of these values, the ASC shall use the last value obtained before the fault occurred. If such fault has not been corrected after the specified default delay time, specified default value(s) shall then be substituted until such fault has been corrected.
      a. Physical/Virtual PointDefault Value
      b. Scheduling PeriodNormal
      c. Morning Warm-UpOff (cold discharge air)
      d. Load ShedOff (no shedding)
      e. Summer/WinterWinter
      f. [Trend DataN/A]
      g. [Smoke Pressurization ModeNormal Mode]
   4. Mounting:
      a. ASCs that control equipment located above accessible ceilings shall be mounted on the equipment in an accessible enclosure that does not hinder maintenance of mechanical equipment and shall be rated for plenum use.
      b. ASCs that control equipment mounted in a mechanical room may either be mounted in, on the equipment, or on the wall of the mechanical room at an adjacent, accessible location.
      c. ASCs that control equipment located in occupied spaces or outside shall either be mounted within the equipment enclosure (responsibility for physical fit remains with

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the contractor) or in a nearby mechanical/utility room in which case it shall be enclosed in a NEMA 1, locking enclosure.

d. Section 23 09 53 contractor may furnish ASCs to the terminal unit manufacturer for factory mounting.

5. Programmability: Operator shall be able to modify all setpoints (temperature and airflow), scheduling parameters associated with the unit, tuning and set up parameters, interstage timing parameters, and mode settings. Application-specific block control algorithms may be used to meet the sequence of operations. The ability to customize the control algorithm is not required unless specifically indicated otherwise.
6. LAN Restrictions: Limit the number of nodes on the network to the maximum recommended by the manufacturer.

F. Application Category 2 (General Purpose Terminal Controller)
1. Applications in this category include the following:
   a. Unitary Equipment >= 15 tons (Air Conditioners, Heat Pumps, Packaged Heating/Cooling Units, and the like)
   b. Small, Constant Volume Single Zone Air Handling Units
   c. Constant Volume Pump Start/Stop
   d. Misc. Equipment (Exhaust Fan) Start/Stop
   e. Misc. Monitoring (not directly associated with a control sequence and where trending is not critical)
   f. Steam Converter Control
2. BCs may be used in these applications.
3. ASC's may be used in these applications provided the ASC meets all requirements specified below. This category requires a general-purpose ASC to which application-specific control algorithms can be attached.
4. Standalone Capability: Only the following data (as applicable) may be acquired from other ASCs via LANs. In the event of a loss of communications with any other ASCs, or any fault in any system hardware that interrupts the acquisition of any of these values, the AAC/ASC shall use the last value obtained before the fault occurred. If such fault has not been corrected after the specified default delay time, specified default value(s) shall then be substituted until such fault has been corrected.
   a. Physical/Virtual PointDefault Delay TimeDefault Value
   b. Outside Air Temperature3 minutes80°F
   c. Outside Air Humidity3 minutes60%RH
   d. Outside Air Enthalpy3 minutes30 Btu/lb
   e. Trend DataN/A
   f. Cooling/Heating Requests3 minutesNone
   g. Smoke Pressurization Mode3 minutesNormal Mode
   h. Smoke Exhaust Command3 minutesNormal Mode
5. Mounting:
   a. ASCs that control equipment located above accessible ceilings shall be mounted on the equipment so as not to hinder mechanical maintenance and shall be rated for plenum use.
   b. ASCs that control equipment located in occupied spaces or outside shall either be mounted within the equipment enclosure (responsibility for physical fit remains with the contractor) or in a nearby mechanical/utility room in which case it shall be enclosed in a NEMA 1, locking enclosure.
6. Programmability: Operator shall be able to modify all setpoints (temperature and airflow), scheduling parameters associated with the unit, tuning and set up parameters, interstage timing parameters, and mode settings. Operator shall be able to address and configure spare inputs for monitoring. [Operator shall be able to address and configure spare outputs for simple single loop control actions or event initiated actions.] Application-specific block control algorithms shall used to meet the sequence of operations. The ability to customize the control algorithm is not required unless specifically indicated otherwise.

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7. LAN Restrictions: Limit the number of nodes servicing any one of these applications on the AAC/ASC LAN to 32.

G. Application Category 3 (Advanced Application Controller)
   1. Applications in this category include the following:
      a. Large Constant Volume Air Handlers
      b. VAV Air Handlers generally >5,000 and <10,000cfm
      c. Dual Duct Air Handlers generally >5000 and < 10,000 cfm
      d. Multizone Air Handlers
      e. Self-Contained VAV Units
   2. BCs may be used in these applications.
   3. AAC's may be used in these applications provided:
      a. The AAC's meets all requirements specified below.
      b. All control functions and physical I/O associated with a given unit resides in one AAC.
      c. Input A/D is 10-bit. Exception: 8-bit input A/D can be used when matched with high accuracy sensors, the range of which meets the resolution requirements specified for the applicable sensor in Section 23 09 51.
      d. Pulsed inputs required for the application can be monitored and accumulated effectively.
   4. Standalone Capability: Only the following data (as applicable) may be acquired from other AACs via LANs. In the event of a loss of communications with any other AACs, or any fault in any system hardware that interrupts the acquisition of any of these values, the AAC shall use the last value obtained before the fault occurred. If such fault has not been corrected after the specified default delay time, specified default value(s) shall then be substituted until such fault has been corrected.
      a. Physical/virtual point - default delay - time default value
      b. Outside Air Temperature - 3 minutes - 80°F
      c. Outside Air Humidity - 3 minutes - 60%RH
      d. Outside Air Enthalpy - 3 minutes - 30 Btu/lb
      e. Enable Local Operation - Last Value
      f. Cooling/Heating Requests - 3 minutes - None
      g. Smoke Pressurization Mode - 3 minutes - Normal Mode
      h. Smoke Exhaust Command - 3 minutes - Normal Mode
   5. Mounting:
      a. AACs that control equipment located above accessible ceilings shall be mounted on the equipment so as not to hinder mechanical maintenance and shall be rated for plenum use.
      b. AACs that control equipment located in occupied spaces or outside shall either be mounted within the equipment enclosure (responsibility for physical fit remains with the contractor) or in a near by mechanical/utility room in which case it shall be enclosed in a NEMA 1, locking enclosure.
   6. Programmability: Operator shall be able to modify all setpoints (temperature and airflow), scheduling parameters associated with the unit, tuning and set up parameters, interstage timing parameters, and mode settings. Operator shall be able to address and configure spare inputs for monitoring. Operator shall be able to program custom DDC control algorithms and specify trending parameters, which will be retained in memory in the event of a loss of communications. Application-specific block control algorithms may be used provided they meet the sequence of operations. The control algorithms shall be completely customizable.
   7. LAN Restrictions: Each LAN which participates in the transfer of data between the CU and the local operator workstation shall be subject to the following criteria:
      a. Limit the number of nodes servicing any one of these applications on the AAC/ASC LAN to 16.
      b. The Building Controller LAN shall be subject only to manufacturer's published LAN limitations.

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H. Application Category 4
   1. Applications in this category include the following:
      a. Central Cooling Plant
      b. Central Heating Plant
      c. Cooling Towers
      d. Sequenced or Variable Speed Pump Control
      e. Local Chiller Control (unit specific)
      f. Local Free Cooling Heat Exchanger Control
      g. Air Handlers over 10,000 cfm or serving critical areas
   2. BCs shall be used in these applications.

3.04 CONTROL UNIT REQUIREMENTS

A. Refer to Section 23 09 50 for requirements pertaining to control unit quantity and location.

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SECTION 23 09 54

BAS COMMUNICATION DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Network Integration Devices

1.02 RELATED DOCUMENTS:

A. Section 23 09 50 - Building Automation System (BAS) General
B. Section 23 09 51 - BAS Basic Materials, Interface Devices, and Sensors
C. Section 23 09 53 - BAS Field Panels
D. Section 23 09 55 - BAS Software
E. Section 23 09 58 - Sequences of Operation
F. Section 23 09 59 - BAS Commissioning

1.03 DESCRIPTION OF WORK

A. Contractor shall provide all interface devices and software to provide an integrated system connecting BCs, AACs, ASCs and Gateways to the Owner's network.

PART 2 - PRODUCTS

2.01 NETWORK CONNECTION

A. Owner's WAN: Refer Section 23 09 50 Part 1.11.C.1 - Building Automation System (BAS) General for description of System Architecture.

B. The following BIBBs must be supported on the Local Supervisory LAN using Ethernet either directly or through a gateway:
   1. BACnet Data Sharing Objects (DS-):
      a. Read Property (RP-A) Initiate
      b. Read Property (RP-B) Execute
      c. Read Property Multiple (RPM-A) Initiate
      d. Read Property Multiple (RPM-B) Execute
      e. Write Property (WP-A) Initiate
      f. Write Property (WP-B) Execute
      g. Write Property Multiple (WPM-A) Initiate
      h. Write Property Multiple (WPM-B) Execute
      i. COV Unsubscribed (COVU-A) Initiate
      j. COV Unsubscribed (COVU-B) Execute
   2. BACnet Alarm and Event Object (AE-)
      a. Confirmed Event Notification (N-B) Initiate
      b. Unconfirmed Event Notification (N-B) Initiate
      c. Refer to Section 23 09 55 Part III for the BACnet Object naming convention.

2.02 BACNET GATEWAYS

A. Gateways shall be provided to link non-BACnet control products to the BACnet inter-network. All of the functionality described in this section is to be provided by using the BACnet capabilities. Each Gateway shall have the ability to expand the number of BACnet objects of each type supported by 20% to accommodate future system changes.

B. Each Gateway shall provide values for all points on the non-BACnet side of the Gateway to BACnet devices as if the values were originating from BACnet objects. The Gateway shall also provide a way for BACnet devices to modify (write) all points specified by the AOC using standard BACnet services. All points are required to be writable for each site.

C. The Gateway shall implement BACnet schedule objects and permit both read and write access to the schedules from the BC.

D. Each Gateway shall provide a way to collect and archive or trend (time, value) data pairs.

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E. Each Gateway and any devices that the Gateway represents which have time-of-day information shall respond to workstation requests to synchronize the date and time. Each Gateway and any devices that the Gateway represents shall support dynamic device binding and dynamic object binding.

F. All points in the system shall be made network visible through the use of standard BACnet objects or through proprietary BACnet extensions that the workstation also supports. All points shall be writable using standard BACnet services.

G. All devices have a Device Object instance number that is unique throughout the entire inter-network. All BACnet devices shall be configured with a Device Object instance number that is based on the format specified (shown in decimal notation). This includes all physical devices as well as any logical BACnet devices that are physically represented by Gateways.

H. All BACnet Interoperability Building Blocks (BIBBs) are required to be supported for each native BACnet device or Gateway. The Gateway shall support all BIBBs defined in the BACnet Gateway's device profile as defined in the BACnet standard.

2.03 2.03 CONTROLLER LOCAL AREA NETWORK INTERFACE DEVICES (LANID)

A. The LANID shall be a microprocessor-based communications device which acts as a gateway/router between the Primary Controlling LAN and the Secondary Controlling LAN. It provides an operator interface. These may be provided within a BC or as a separate device.

B. The LANID shall perform information translation between the Primary Controlling LAN and the Secondary Controlling LAN, supervise communications on a polling Secondary Controlling LAN, and be applicable to systems in which the same functionality is not provided in the BC. In systems where the LANID is a separate device, it shall contain its own microprocessor, RAM, battery, real-time clock, communication ports, and power supply as specified for a BC in Section 23 09 53. Each LANID shall be mounted in a lockable enclosure.

C. Each LANID shall support interrogation, full control, and all utilities associated with all BCs on the Primary Controlling LAN, all AACs and ASCs connected to all Secondary Controlling LANs under the Primary Controlling LAN, and all points connected to those PCUs and SCUs.

D. Upon loss of power to a LANID, the battery shall provide for minimum 100-hour backup of all programs and data in RAM. The battery shall be sealed and self-charging.

E. The LANID shall be transparent to control functions and shall not be required to control information routing on the Primary Controlling LANControlling LANControlling LANControlling LANControlling LAN

F. All BACnet Interoperability Building Blocks (BIBBs) are required to be supported for each native BACnet device or Gateway. The Gateway shall support all BIBBs defined in the BACnet Gateway's device profile as defined in the BACnet standard.

2.04 LOCAL SUPERVISORY LAN GATEWAYS/ROUTERS

A. The gateway/router shall be a microprocessor-based communications device that acts as a gateway/router between the Supervisory LAN CSSs or OWS and the Controlling LAN.

B. The gateway/router shall perform information translation between the Controlling LAN and the Local Supervisory LAN, and shall use BACnet over IP. When BACnet is used, refer to the requirements of the BACnet Gateways specified herein.

C. The gateway/router shall contain its own microprocessor, RAM, battery, real-time clock, communication ports, and power supply as specified for a BC in Section 23 09 53. Each gateway/router shall be mounted in a lockable enclosure.

D. The gateway/router shall allow centralized overall system supervision, operator interface, management report generation, alarm annunciation, acquisition of trend data, and communication with control units. It shall allow system operators to perform the following functions from the CSS, and OWSs:
   1. Configure systems.
   2. Monitor and supervise control of all points.
   3. Change control setpoints.

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4. Override input values.
5. Override output values
6. Enter programmed start/stop time schedules.
7. View and acknowledge alarms and messages.
8. Receive, store and display trend logs and management reports.
9. Upload/Download programs, databases, etc. as specified.

E. Upon loss of power to the gateway/router, the battery shall provide for minimum 100 hour backup of all programs and data in RAM. The battery shall be sealed and self-charging.

F. The gateway/router shall be transparent to control functions and shall not be required to control information routing on the Controlling LAN

PART 3 - EXECUTION

3.01 INSPECTION:

A. Examine areas and conditions under which control systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 3.02 INSTALLATION OF CONTROL SYSTEMS:

A. General: Install systems and materials in accordance with manufacturer's instructions, roughing-in drawings and details shown on drawings.

B. Contractor shall provide all interface devices and software to provide an integrated system.

C. Contractor shall closely coordinate with the Owner, or designated representative, to establish IP addresses and communications to assure proper operation of the building control system on the Owner's network.

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SECTION 23 09 55

BAS SOFTWARE AND PROGRAMMING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. System Software
B. Programming Description
C. Control Algorithms
D. Energy Management Applications
E. Password Protection
F. Alarm Reporting
G. Trending
H. Data Acquisition and Storage
I. Point Structuring
J. Dynamic Color Graphics

1.02 RELATED DOCUMENTS:

A. Section 23 09 50 - Building Automation System (BAS) General
B. Section 23 09 51 - BAS Basic Materials, Interface Devices, and Sensors
C. Section 23 09 53 - BAS Field Panels
D. Section 23 09 54 - BAS Communications Devices
E. Section 23 09 58 - Sequences of Operation
F. Section 23 09 59 - BAS Commissioning

1.03 DESCRIPTION OF WORK:

A. Fully configure systems and furnish and install all software, programming and dynamic color graphics for a complete and fully functioning system as specified.
B. Refer to Section 23 09 50 - Building Automation System (BAS) for general requirements
C. Refer to 23 09 58 - Sequence of Operation for specific sequences of operation for controlled equipment.

1.04 LICENSING

A. Include licensing for all software packages at all required workstations.
B. All operator interface, programming environment, networking, database management and any other software used by the Contractor to install the system or needed to operate the system to its full capabilities shall be licensed and provided to the Owner.
C. All BAS software should be available on CSS(s) provided, and on all Portable Operator Terminals. All software keys to provide all rights shall be installed on CSS. At least 2 sets of media (CD or DVD) shall be provided with backup software and configurations for all software provided, so that the Owner may reinstall any software as necessary
D. Provide licensing and original software media for each device. Include all BAS software licenses and all required third party software licenses.
E. Upgrade all software packages to the release (version) in effect at the end of the Warranty Period.
F. Refer to Section 23 09 50 - Building Automation System (BAS) General for further requirements.

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PART 2 - PRODUCTS

2.01 SYSTEM SOFTWARE-GENERAL

A. Functionality and Completeness: The Contractor shall furnish and install all software and programming necessary to provide a complete and functioning system as specified. The Contractor shall include all software and programming not specifically itemized in these Specifications, which is necessary to implement, maintain, operate, and diagnose the system in compliance with these Specifications.

B. Configuration: The software shall support the system as a distributed processing network configuration.

2.02 CONTROLLER SOFTWARE

A. BC Software Residency: Each BC as defined below shall be capable of controlling and monitoring of all points physically connected to it. All software including the following shall reside and execute at the BC:
   1. Real-Time Operating System software
   2. Real-Time Clock/Calendar and network time synchronization
   3. BC diagnostic software
   4. LAN Communication software/firmware
   5. Direct Digital Control software
   6. Data Trending, Reporting, and Buffering software
   7. I/O (physical and virtual) database
   8. Remote Communications software

B. AAC/ASC Software Residency: Each AAC/ASC as defined below shall be capable of controlling and monitoring of all points physically connected to it. As a minimum, software including the following shall reside and execute at the AAC/ASC. Other software to support other required functions of the AAC/ASC may reside at the BC or LAN interface device (specified in Section 23 09 54) with the restrictions/exceptions per application provided in Section 23 09 53:
   1. Real-Time Operating System software
   2. AAC/ASC diagnostic software
   3. LAN Communications software
   4. Control software applicable to the unit it serves that will support a single mode of operation
   5. I/O (physical and virtual) database to support one mode of operation

C. Standalone Capability: BC shall continue to perform all functions independent of a failure in other BC/AAC/ASC, CSS, or other communication links to other BCs/AACs/ASCs or CSSs. Trends and runtime totalization shall be retained in memory. Runtime totalization shall be available on all digital input points that monitor electric motor status. Refer also to Section 23 09 53 for other aspects of standalone functionality.

D. Operating System: Controllers shall include a real-time operating system resident in ROM. This software shall execute independently from any other devices in the system. It shall support all specified functions. It shall provide a command prioritization scheme to allow functional override of control functions. Refer also to Section 23 09 53 for other aspects of the controller's operating system.

E. Network Communications: Each controller shall include software/firmware that supports the networking of CUs on a common communications trunk that forms the respective LAN. Network support shall include the following:
   1. Controller communication software shall include error detection, correction, and re-transmission to ensure data integrity.
   2. Operator/System communication software shall facilitate communications between other BCs, all subordinate AACs/ASCs, Gateways and LAN Interface Devices or CSS. Software shall allow point interrogation, adjustment, addition/deletion, and programming while the controller is online and functioning without disruption to unaffected points. The software architecture shall allow networked controllers to share selected physical and virtual point information throughout the entire system.

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F. Diagnostic Software: Controller software shall include diagnostic software that checks memory and communications and reports any malfunctions.

G. Alarm/Messaging Software: Controller software shall support alarm/message processing and buffering software as more fully specified below.

H. Application Programs: CUs shall support and execute application programs as more fully specified below:
   1. All Direct Digital Control software, Energy Management Control software, and functional block application programming software templates shall be provided in a 'ready-to-use' state, and shall not require (but shall allow) user programming.

I. Security: Controller software shall support multiple level privileges access restriction as more fully specified below.

J. Direct Digital Control: Controller shall support application of Direct Digital Control Logic. All logic modules shall be provided pre-programmed with written documentation to support their application. Provide the following logic modules as a minimum:
   1. Proportional-Integral-Derivative (PID) control with analog, PWM and floating output
   2. Two Position control (Hi or Low crossing with deadband)
   3. Single-Pole Double-Throw relay
   4. Delay Timer (delay-on-make, delay-on-break, and interval)
   5. Hi/Low Selection
   6. Reset or Scaling Module
   7. Logical Operators (AND, OR, NOT, XOR)

K. Psychrometric Parameters: Controller software shall provide preprogrammed functions to calculated and present psychrometric parameters (given temperature and relative humidity) including the following as a minimum: Enthalpy, Wet Bulb Temperature.

L. Updating/Storing Application Data: Site-specific programming residing in volatile memory shall be uploadable/downloadable from an OWS or CSS using BACnet services connected locally or through the network. Initiation of an upload or download shall include all of the following methods: Manual, Scheduled, and Automatic upon detection of a loss or change.

M. Restart: System software shall provide for orderly shutdown upon loss of power and automatic restart upon power restoration. Volatile memory shall be retained; outputs shall go to programmed fail-safe (open, closed, or last) position. Equipment restart shall include a user definable time delay on each piece of equipment to stagger the restart. Loss of power shall be alarmed at operator interface indicating date and time.

N. Time Synchronization: Automatic time synchronization shall be provided using BACnet services. Operators shall be able to set the time and date in any device on the network that supports time-of-day functionality. The operator shall be able to select to set the time and date for an individual device, devices on a single network, or all devices simultaneously.

O. Misc. Calculations: System software shall automate calculation of psychometric functions, calendar functions, kWh/kW, and flow determination and totalization from pulsed or analog inputs, curve-fitting, look-up table, input/output scaling, time averaging of inputs and A/D conversion coefficients.

2.03 APPLICATION PROGRAMMING DESCRIPTION

A. The application software shall be user programmable.

B. This specification generally requires a programming convention that is logical, easy to learn, use, and diagnose. General approaches to application programming shall be provided by one, or a combination, of the following conventions:
   1. Point Definition: Provide templates customized for point type, to support input of individual point information. Use standard BACnet Objects as applicable.
   2. Graphical Block Programming: Manipulation of graphic icon 'blocks', each of which represents a subroutine, in a functional/logical manner forming a control logic diagram. Blocks shall allow entry of adjustable settings and parameters via pop-up windows.

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Provide a utility that shall allow the graphic logic diagrams to be directly compiled into application programs. Logic diagrams shall be viewable either off-line, or on-line with real-time block output values.

3. Functional Application Programming: Pre-programmed application specific programs that allow/require limited customization via 'fill-in-the-blanks' edit fields. Typical values would be setpoints gains, associated point names, alarm limits, etc.

C. Provide a means for testing and/or debugging the control programs both off-line and on-line.

2.04 ACCESS PRIVILEGES

A. Multiple-level access privileges shall be provided. A minimum of four (4) levels of access shall be supported.

B. The highest level of access, Administrator Level access, shall allow the BAS administrator to perform application, database, and user management functions.

C. Each login credentials shall be assigned to a pre-defined level of access. Alternately, a comprehensive list of accessibility/functionality items shall be provided, to be enabled or disabled for each user according to the level of access granted.

D. Operators shall be able to perform only those commands available for the access level assigned to their login credentials.

E. Login credentials are stored in the BC's local database. A minimum of 20 user names shall be supported and programmed per the Owner's direction.

F. Login credentials can be looked up using the Lightweight Directory Access (LDAP) through the BAS server.

G. Strong password shall be used on all login credentials.

H. User-definable, automatic log-off timers from 1 to 60 minutes shall be provided to prevent users from inadvertently leaving interface device unattended.

I. At system handover, all default and Contractor created login credentials for the system shall be provided to the Owner and all temporary login credentials shall be removed.

2.05 ALARM AND EVENT MANAGEMENT REPORTING

A. Alarm management shall be provided to monitor, buffer, and direct alarms and messages to operator devices and memory files. Each BC shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic, and prevent alarms from being lost. At no time shall a BCs ability to report alarms be affected by either operator activity at an OWS or local handheld device, or by communications with other panels on the network.

1. Alarm Descriptor: Each alarm or point change shall include that point's English language description, and the time and date of occurrence. In addition to the alarm's descriptor and the time and date, the user shall be able to print, display and store an alarm message to more fully describe the alarm condition or direct operator response.
2. Alarm Prioritization: The software shall allow users to define the handling and routing of each alarm by their assignment to discrete priority levels. A minimum of five (5) priority levels shall be provided - Level 1 Life Safety (i.e. smoke detector), Level 2 Critical (i.e. controller failure), Level 3 Abnormal (i.e. out-of-range temperature), Level 4 Energy Waste(i.e. fighting valves), Level 5 Maintenance Message (i.e. runtime monitor, filter status). For each priority level, users shall have the ability to enable or disable an audible tone whenever an alarm is reported and whenever an alarm returns to normal condition. Users shall have the ability to manually inhibit alarm reporting for each individual alarm and for each priority level. Contractor shall coordinate with the Owner on establishing alarm priority definitions.
3. Alarm Report Routing: Each alarm priority level shall be associated with a unique user-defined list of operator devices including any combination of local or remote workstations, printers and workstation disk files. All alarms associated with a given priority level shall be routed to all operator devices on the user-defined list and/or email to designated Owner email address (mailbox resource) associated with that priority level. For

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each priority level, alarms shall be automatically routed to a default operator device in the event that alarms are unable to be routed to any operator device assigned to the priority level.

4. Auto-Dial Alarm Routing: For alarm priority levels that include a mobile device as one of the listed reporting destinations, the BC shall initiate a call to report the alarm, and shall terminate the call after alarm reporting is complete. System shall be capable of multiple retries and buffer alarms until a connection is made. If no connection is made, system shall attempt connection to an alternate mobile device. System shall also be able to dial multiple mobile devices upon alarm activation.
5. Alarm Acknowledgment: For alarm priority levels that are directed to a OWS, an indication of alarm receipt shall be displayed immediately regardless of the application is in use at the OWS, and shall remain on the screen until acknowledged by a user having a privilege that allows alarm acknowledgment. Upon acknowledgment, the complete alarm message string (including date, time, and user name of acknowledging operator) shall be stored in a selected file on the BC or CSS.

B. It shall be possible for any operator to receive a summary of all alarms regardless of acknowledgement status; for which a particular recipient is enrolled for notification; based on current event state; based on the particular BACnet event algorithm (e.g., change of value, change of state, out of range, and so on); alarm priority; and notification class.

C. BACnet Alarming Services: All alarms and events shall be implemented using standard BACnet event detection and notification mechanisms. The workstation shall receive BACnet alarm and event notifications from any gateway or BACnet controller in the system and display them to an operator. Either intrinsic reporting or algorithmic change reporting may be used but the intrinsic reporting method is preferred. The workstation shall also log alarms and events, provide a way for an operator with sufficient privilege to acknowledge alarms, and log acknowledgements of alarms. It shall be possible for an operator to receive, at any time, a summary of all alarms that are currently in effect at any site whether or not they have been acknowledged. Operators shall also be able to view and change alarm limits for any alarm at the appropriate access level.

D. Alarm Historical Database: The database shall store all alarms and events object occurrences in an ODBC or an OLE database-compliant relational database. Provide a commercially available ODBC driver or OLE database data provider, which would allow applications to access the data using standard Microsoft Windows data access services.

2.06 TRENDING

A. The software shall display historical data in both a tabular and graphical format. The requirements of this trending shall include the following:
   1. Provide trends for all physical points, virtual points and calculated variables.
   2. BACnet Trend Objects are preferred but where not possible trend data shall be stored in relational database format as specified in herein under Data Acquisition and Storage.
   3. In the graphical format, the trend shall plot at least 4 different values for a given time period superimposed on the same graph. The 4 values shall be distinguishable by using unique colors. In printed form the 4 lines shall be distinguishable by different line symbology. Displayed trend graphs shall indicate the engineering units for each trended value.
   4. The sample rate and data selection shall be selectable by the operator.
   5. The trended value range shall be selectable by the operator.
   6. Where trended values on one table/graph are COV, software shall automatically fill the trend samples between COV entries.

B. Control Loop Performance Trends: Controllers incorporating PID control loops shall also provide high resolution sampling in less than six second increments for verification of control loop performance.

C. Data Buffering and Archiving: Trend data shall be buffered at the BC, and uploaded to hard disk storage when archival is desired. All archived trends shall be transmitted to the CSS.

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Uploads shall occur based upon a user-defined interval, manual command, or automatically when the trend buffers become full.

D. Time Synchronization: Provide a time master that is installed and configured to synchronize the clocks of all BACnet devices supporting time synchronization. Synchronization shall be done using Coordinated Universal Time (UTC). All trend sample times shall be able to be synchronized. The frequency of time synchronization message transmission shall be selectable by the operator.

2.07 DYNAMIC PLOTTING

A. Provide a utility to dynamically plot in real-time at least four (4) values on a given 2-dimensional dynamic plot/graph with at least two Y-axes. At least five (5) dynamic plots shall be allowed simultaneously.

2.08 DATA ACQUISITION AND STORAGE

A. All points included in the typical equipment point list must be represented in a common, open or accessible format. All points should be provided as BACnet standard analog, binary, schedule, or trend objects when possible. Naming conventions for these points and network addressing are discussed in the 'Point Naming Conventions' paragraph below.

B. Non-BACnet data from the BAS shall be stored in relational database format. The format and the naming convention used for storing the database files shall remain consistent across the database and across time. The relational structure shall allow for storage of any additional data points, which are added to the BAS in future. The metadata/schema or formal descriptions of the tables, columns, domains, and constraints shall be provided for each database.

C. The database shall allow applications to access the data while the database is running. The database shall not require shutting down in order to provide read-write access to the data. Data shall be able to be read from the database without interrupting the continuous storage of trend data being carried by the BAS.

D. The database shall be ODBC or OLE database compliant. Provide a commercially-available ODBC driver or OLE database data provider, which would allow applications to access the data using standard Microsoft Windows data access services.

2.09 TOTALIZATION

A. The software shall support totalizing analog, digital, and pulsed inputs and be capable of accumulating, storing, and converting these totals to engineering units used in the documents. These values shall generally be accessible to the Operator Interfaces to support management-reporting functions.

B. Totalization of electricity use/demand shall allow application of totals to different rate periods, which shall be user definable.

C. When specified to provide electrical or utility Use/Demand, the Contractor shall obtain from the local utility all information required to obtain meter data, including k factors, conversion constants, and the like.

2.10 EQUIPMENT SCHEDULING

A. Provide a graphic utility for user-friendly operator interface to adjust equipment-operating schedules.

B. All schedules shall be implemented using BACnet objects and messages. All building systems with date and time scheduling requirements shall have schedules represented by the BACnet Schedule object. All operators shall be able to view the entries for a schedule. Operators with sufficient privilege shall be able to modify schedule entries from any BACnet workstation.

C. Scheduling feature shall include multiple seven-day master schedules, plus holiday schedule, each with start time and stop time. Master schedules shall be individually editable for each day and holiday.

D. Scheduling feature shall allow for each individual equipment unit to be assigned to one of the master schedules.

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E. Timed override feature shall allow an operator to temporarily change the state of scheduled equipment. An override command shall be selectable to apply to an individual unit, all units assigned to a given master schedule, or to all units in a building. Timed override shall terminate at the end of an operator selectable time, or at the end of the scheduled occupied/unoccupied period, whichever comes first. A privilege level that does not allow assignment of master schedules shall allow a timed override feature.

F. A yearly calendar feature shall allow assignment of holidays, and automatic reset of system real time clocks for transitions between daylight savings time and standard time.

2.11 POINT STRUCTURING AND NAMING

A. General: The intent of this section is to require a consistent means of naming points across all Owner's facilities. Contractor shall configure the systems from the perspective of the Enterprise, not solely the local project. The following requirement establishes a standard for naming points and addressing Buildings, Networks, Devices, Instances, and the like. The convention is tailored towards the BACnet-based format and as such, the interface shall always use this naming convention. Native BACnet systems shall also use this naming convention. For non-BACnet systems, the naming convention shall be implemented as much as practical, and any deviations from this naming convention shall be approved by the Owner. The Contractor shall contact the Owner to determine the Building number and abbreviation.

B. Point Summary Table
   1. The term 'Point' is a generic description for the class of object represented by analog and binary inputs, outputs, and values in accordance with ASHARE 135 standard.
   2. With each schematic, Contractor shall provide a Point Summary Table listing:
      a. Building number and abbreviation
      b. System type
      c. Equipment type
      d. Point suffix
      e. Full point name (see Point Naming Convention paragraph)
      f. Point description
      g. Ethernet backbone network number
      h. Network number
      i. Device ID
      j. Device MAC address
      k. Object ID (object type, instance number)
      l. Engineering units.
   3. Additional fields for non-BACnet systems shall be appended to each row. Point Summary Table shall be provided in both hard copy and in electronic format (ODBC-compliant).
   4. Point Summary Table shall also illustrate Network Variables/BACnet Data Links Bindings.
   5. The Contractor shall coordinate with the Owner's representative and compile and submit a proposed Point Summary Table for review prior to any object programming or project startup.
   6. The Point Summary Table shall be kept current throughout the duration of the project by the Contractor as the Master List of all points for the project. Project closeout documents shall include an up-to-date accurate Point Summary Table. The Contractor shall deliver to the Owner the final Point Summary Table prior to Substantial Completion of the system. The Point Summary Table shall be used as a reference and guide during the commissioning process.
   7. The Point Summary Table shall contain all data fields on a single row per point. The Point Summary Table is to have a single master source for all point information in the building that is easily sorted and kept up-to-date. Although a relational database of Device ID-to-point information would be more efficient, the single line format is required as a single master table that will reflect all point information for the building. The point description shall be an easily understandable English-language description of the point.
      a. Point Summary Table Example Row Headers and Examples (Transpose for a single point per row format)

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1) Campus RK Building Number 006 Building Association ZZ = no association (default to ZZ) System Type Cooling Equipment Type Chiller Point Suffix CHLR1KW *Point Name (Object Name) CA0006ZZ.COOLING.CHILLER.CHLR1KW *Point Description (Object Description) Chiller 1 kW Ethernet Network Number 600 Network Number 610 Device ID 1024006 Device MAC address 24 Object Type AI Instance Number 4 Engineering Units KW Network Variable? True Server Device 1024006 Client Devices 1028006 Included with Functional
2) *Represents information that shall reside in the relevant BACnet property for the object

C. Point Naming Convention
1. All point names shall adhere to the format as established below. Said objects shall include all physical I/O points, calculated points used for standard reports, and all application program parameters. For each BAS object, a specific and unique BACnet object name shall be required.
2. For each point, four (4) distinct descriptors shall be linked to form each unique object name: Building, System, Equipment, and Point. Use alphanumeric characters. Space and special characters are not allowed. Each of the four descriptors must be bound by a period to form the entire object name. Reference the paragraphs below for an example of these descriptors.
3. The Owner shall designate the Building descriptor. The System descriptor shall further define the object in terms of air handling, cooling, heating, or other system. The Equipment descriptor shall define the equipment category; e.g., Chiller, Air Handler, or other equipment. The Point descriptor shall define the hardware or software type or function associated with the equipment; e.g., supply temperature, water pressure, alarm, mixed air temperature setpoint, etc. and shall contain any numbering conventions for multiples of equipment; e.g., CHLR1KW, CHLR2KW, BLR2AL (Boiler 2 Alarm), HWP1ST (Hot Water Pump 1 Status).
4. A consistent object (point) naming convention shall be utilized to facilitate familiarity and operational ease across the BAS network. Inter-facility consistency shall be maintained to ensure transparent operability to the greatest degree possible. The table below details the object naming convention and general format of the descriptor string. BACnet Object Name Requirements Descriptors Comment Campus, Building Number & RK0006ZZ AZ0134ZZ The Master Building List also Building Association has the correct abbreviations for each building. System AIRHANDLING - EXHAUST - Boilers and ancillary HEATING - COOLING - equipment Chillers and UTILITY - ENDUSE - MISC ancillary equipment Main electrical and gas meters Specific building loads by type Equipment BOILERS - CHILLERS - Non-specific boiler system FACILITY - TOWERS - points - Non-specific chiller WEATHER system points Point Suffix See Input/Output point summary table for conventions
5. Examples: Within each object name, the descriptors shall be bound by a period. Within each descriptor, words shall not be separated by dashes, spaces, or other separators as follows:
   a. RK0006ZZ.COOLING.CHILLERS.CHWP1ST
   b. RK0006ZZ.HEATING.BOILERS.BLR1CFH

D. Device Addressing Convention:
1. BACnet network numbers and Device Object IDs shall be unique throughout the network.
2. All assignment of network numbers and Device Object IDs shall be coordinated with the Owner.
3. Each Network number shall be unique throughout all facilities and shall be assigned in the following manner unless specified otherwise:
   a. BBBFF, where: BBB = 1-655 assigned to each building, FF = 00 for building backbone network, 1-35 indicating floors or separate systems in the building.
4. Each Device Object Identifier property shall be unique throughout the system and shall be assigned in the following manner unless specified otherwise:

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a. XXFFBBB, where: XX = number 0 to 40, FF = 00 for building backbone network, 1-35 indicating floors or separate systems in the building. BBB = 1-655 assigned to each building.

5. The BAS Contractor shall coordinate with designated Owner representative to ensure that no duplicate Device Object IDs occur.
6. Alternative Device ID schemes or cross project Device ID duplication if allowed shall be approved before project commencement by the Owner.

2.12 OPERATOR INTERFACE GRAPHIC SOFTWARE

A. Graphic software shall facilitate user-friendly interface to all aspects of the System Software specified above. The intent of this specification is to require a graphic package that provides for intuitive operation of the systems without extensive training and experience. It shall facilitate logical and simple system interrogation, modification, configuration, and diagnosis.

B. Graphic software shall support multiple simultaneous screens to be displayed and resizable in a web-based environment. All functions excepting text entry functions shall be executable with a mouse.

C. Graphic software shall display current operating mode (i.e. warm-up, dehumidification, et al) for equipment with multiple modes of operation.

D. Graphic software shall provide for multitasking such that other application can be used while the operator is accessing the BAS. Software shall provide the ability to alarm graphically even when operator is in another software package.

E. The software shall be compatible to the current and current minus one versions of Microsoft Windows operating system. The software shall allow for the Owner's creation of user-defined, color graphic displays of geographic maps, building plans, floor plans, and mechanical and electrical system schematics. These graphics shall be capable of displaying all point information from the database including any attributes associated with each point (i.e., engineering units, etc.). In addition, operators shall be able to command equipment or change setpoints from a graphic through the use of a pointing device; e.g. mouse and touch screen.

F. Screen Penetration: The operator interface shall allow users to access the various system graphic screens via a graphical penetration scheme by using the pointing device to select from menus or 'button' icons. Each graphic screen shall be capable of having a unique list of other graphic screens that are directly linked through the selection of a menu item or button icon.

G. DYNAMIC DATA DISPLAYS: DYNAMIC PHYSICAL POINT VALUES SHALL AUTOMATICALLY UPDATED AT A MINIMUM FREQUENCY OF 6 UPDATES PER MINUTE WITHOUT OPERATOR INTERVENTION. POINT VALUE FIELDS SHALL BE DISPLAYED WITH A COLOR CODE DEPICTING NORMAL, ABNORMAL, OVERRIDE AND ALARM CONDITIONS.

H. Point Override Feature: Each displayed point shall be individually enabled/disabled to allow pointing device driven override of digital points or changing of analog points. Such overrides or changes shall occur in the control unit, not just in the BAS software. The graphic point override feature shall be subject to privilege level protection. Points that are overridden shall be reported as an alarm, and shall be displayed in a coded color. The alarm message shall include the operator's login name. A list of points that are currently in an override state shall be available through menu selection and include the time/date of the override along with the operator's login name that initiated that override.

I. Dynamic Symbols: Provide a selection of standard symbols that change in appearance based on the value of an associated point.
1. Analog symbol: Provide a symbol that represents the value of an analog point as the length of a line or linear bar.
2. Digital symbol: Provide symbols such as switches, pilot lights, rotating fan wheels, etc. to represent the value of digital input and output points.
3. Point Status Color: Graphic presentations shall indicate different colors for different point statuses. (For instance, green = normal, red = alarm, gray (or '???') for non-response.

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J. Graphics Development Package: Graphic development and generation software shall be provided to allow the user to add, modify, or delete system graphic displays.
   1. The Contractor shall provide libraries of pre-engineered screens and symbols depicting standard air handling unit components (e.g. fans, cooling coils, filters, dampers, etc.), mechanical system components (e.g., pumps, chillers, cooling towers, boilers, etc.), complete mechanical systems (e.g. constant volume-terminal reheat, VAV, etc.) and electrical symbols.
   2. The Graphic Development Package shall use a pointing device to allow the user to perform the following:
      a. Define symbols
      b. Position items on graphic screens
      c. Attach physical or virtual points to a graphic
      d. Define background screens
      e. Define connecting lines and curves
      f. Locate, orient and size descriptive text
      g. Define and display colors for all elements
      h. Establish correlation between symbols or text and associated system points or other displays
      i. Create hot spots or link triggers to other graphic displays or other functions in the software

K. Graphic images shall reside on the CSS.

L. The software shall be capable of initiating communication between the BC and the CSS:
   1. Upon user command, to perform all specified functions.
   2. In accordance with user-programmed time schedules to report alarms and upload trend and report data to the CSS.

M. The software shall automatically terminate the communication when all specified functions are completed.

PART 3 - EXECUTION

3.01 SYSTEM CONFIGURATION

A. Contractor shall thoroughly and completely configure BAS system software, supplemental software, network communications, BC and CSS, if necessary .

3.02 SITE-SPECIFIC APPLICATION PROGRAMMING

A. Provide all database creation and site-specific application control programming as required by these Specifications, national and local standards and for a fully functioning system. Contractor shall provide all initial site-specific application programming and thoroughly document programming. Generally meet the intent of the written sequences of operation. It is the Contractor's responsibility to request clarification on sequence issues that require such clarification.

B. All site-specific programming shall be fully documented and submitted for review and approval, both prior to downloading into the panel, at the completion of functional performance testing, and at the end of the warranty period.

C. All programming, graphics and data files must be maintained in a logical system of directories with self-explanatory file names. All files developed for the project will be the property of the Owner and shall remain on the BC and CSS at the completion of the project.

3.03 PRIVILEGE LEVELS SETUP

A. Set up the following privilege levels to include the specified capabilities:
   1. Level 1: (Owner's BAS Administrator)
      a. Level 1 capabilities
         1) Configure system software
         2) Modify graphic software
         3) View, add, change and delete user login credentials and privilege levels

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4) All unrestricted system capabilities including all network management functions.

2. Level 1a (Contractor Technician)
   a. Level 1a capabilities
   b. Configure system software
   c. cModify graphic software
3. Level 2: (Maintenance Manager)
   a. Level 2 capabilities
   b. Modify control unit programs
4. Level 3: (Senior BAS Technician)
   a. Level 3 capabilities
   b. Override output points
   c. Change setpoints
   d. Change equipment schedules
5. Level 4: (Junior BAS Technician and Trainee)
   a. Level 4 capabilities
   b. Acknowledge alarms
   c. Temporarily override equipment schedules
6. Level 5: (Read Only)
   a. a. Display all graphic data
   b. b. Trend point data

B. Contractor shall assist:
   1. Owner's BAS Administrator with assigning user login credentials and privilege levels, configure system software and modify graphic software.
   2. Maintenance Manger with modifying control unit programs.

3.04 POINT PARAMETERS

A. Provide the following minimum programming for each analog input:
   1. Name
   2. Address
   3. Scanning frequency or COV threshold
   4. Engineering units
   5. Offset calibration and scaling factor for engineering units
   6. High and low alarm values and alarm differentials for return to normal condition
   7. High and low value reporting limits (reasonableness values), which shall prevent control logic from using shorted or open circuit values.
   8. Default value to be used when the actual measured value is not reporting. This is required only for points that are transferred across the primary and/or secondary controlling networks and used in control programs residing in control units other than the one in which the point resides. Events causing the default value to be used shall include failure of the control unit in which the point resides, or failure of any network over which the point value is transferred.
   9. Selectable averaging function that shall average the measured value over a user selected number of scans for reporting.

B. Provide the following minimum programming for each analog output:
   1. Name
   2. Address
   3. Output updating frequency
   4. Engineering units
   5. Offset calibration and scaling factor for engineering units
   6. Output Range
   7. Default value to be used when the normal controlling value is not reporting.

C. Provide the following minimum programming for each digital input:
   1. Name
   2. Address

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3. Engineering units (on/off, open/closed, freeze/normal, etc.)
4. Debounce time delay
5. Message and alarm reporting as specified
6. Reporting of each change of state, and memory storage of the time of the last change of state
7. Totalization of on-time (for all motorized equipment status points), and accumulated number of off-to-on transitions.

D. Provide the following minimum programming for each digital output:
1. Name
2. Address
3. Output updating frequency
4. Engineering units (on/off, open/closed, freeze/normal, etc.)
5. Direct or Reverse action selection
6. Minimum on-time
7. Minimum off-time
8. Status association with a DI and failure alarming (as applicable)
9. Reporting of each change of state, and memory storage of the time of the last change of state.
10. Totalization of on-time (for all motorized equipment status points), and accumulated number of off-to-on transitions.
11. Default value to be used when the normal controlling value is not reporting.

3.05 TRENDS

A. Contractor shall establish and store trend logs. Trend logs shall be prepared for each physical input and output point, and all dynamic virtual points such as setpoints subject to a reset schedule, intermediate setpoint values for cascaded control loops, and the like as directed by the Owner.

B. The Owner will analyze trend logs of the system operating parameters to evaluate normal system functionality. Contractor shall establish these trends and ensure they are being stored properly.
1. Data shall include a single row of field headings and the data thereafter shall be contiguous. Each record shall include a date and time field or single date stamp. Recorded parameters for a given piece of equipment or component shall be trended at the same intervals and be presented in a maximum of two separate 2-dimensional formats with time being the row heading and field name being the column heading.

C. Sample times indicated as COV (±) or change-of-value mean that the changed parameter only needs to be recorded after the value changes by the amount listed. When output to the trending file, the latest recorded value shall be listed with any given time increment record. The samples shall be filled with the latest values also if the points include different time intervals. If the BAS does not have the capability to record based on COV, the parameter shall be recorded based on the interval common to the unit.

D. Trending intervals or COV thresholds shall be dictated by the State upon system start-up.

E. The Contractor shall demonstrate functional trends as specified for a period of 30 days after successful system demonstration before Substantial Completion of the system.

3.06 TREND GRAPHS

A. Prepare controller and graphic software to display graphical format trends. Trended values and intervals shall be the same as those specified.

B. Lines shall be labeled and shall be distinguishable from each other by using either different line types, or different line colors.

C. Indicate engineering units of the y-axis values; e.g. degrees F., inches w.g., Btu/lb, percent open, etc.

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D. The y-axis scale shall be chosen so that all trended values are in a readable range. Do not mix trended values on one graph if their unit ranges are incompatible.

E. Trend outside air temperature, humidity, and enthalpy during each period in which any other points are trended.

F. All points trended for one subsystem (e.g. air handling unit, chilled water system, etc.) shall be trended during the same trend period.

G. Each graph shall be clearly labeled with the subsystem title, date, and times.

3.07 ALARMS

A. Override Alarms: Any point that is overridden through the override feature of the graphic software shall be reported as a Level 3 alarm.

B. Analog Input Alarms: For each analog input, program an alarm message for reporting whenever the analog value is outside of the programmed alarm limits. Report a 'Return-to-Normal' message after the analog value returns to the normal range, using a programmed alarm differential. The alarm limits shall be individually selected by the Contractor based on the following criteria:
   1. Space temperature, except as otherwise stated in sequence of operation: Level 3
      a. Low alarm: 64°F
      b. Low return-to-normal: 68°F
      c. High alarm: 85°F
      d. High return-to-normal: 80°F
   2. Controlled media temperature other than space temperature (e.g. AHU discharge air temperature, steam converter leaving water temperature, condenser water supply, chilled water supply, etc.): Level 3 (If controlled media temperature setpoint is reset, alarm setpoints shall be programmed to follow setpoint)
      a. Low alarm: 3°F below setpoint
      b. Low return-to-normal: 2°F below setpoint
      c. High alarm: 3°F above setpoint
      d. High return-to-normal: 2°F above setpoint.
   3. AHU mixed air temperature: Level 4
      a. Low alarm: 45°F
      b. Low return-to-normal: 46°F
      c. High alarm: 90°F
      d. High return-to-normal: 89°F
   4. Duct Pressure:
      a. Low alarm: 0.5”w.g. below setpoint
      b. Low return-to-normal: 0.25”w.g. below setpoint
      c. High alarm: 0.5”w.g. above setpoint
      d. High return-to-normal: 0.25”w.g. above setpoint
   5. Space humidity:
      a. Low alarm: 35%
      b. Low return-to-normal: 40%
      c. High alarm: 75%
      d. High return-to-normal: 70%

C. HOA Switch Tampering Alarms: The Sequences of Operation are based on the presumption that motor starter Hand-Off-Auto (HOA) switches are in the 'Auto' position. [If a motorized equipment unit starts without a prior start command from the FMS, (as sensed by status sensing device), then FMS shall perform the remaining sequence as specified.] BAS shall also enunciate the following Level 5 alarm message if status indicates a unit is operational when the run command is not present:
   1. DEVICE XXXX FAILURE: Status is indicated on the device even though it has been commanded to stop. Check the HOA switch, control relay, status sensing device,

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contactors, and other components involved in starting the unit. Acknowledge this alarm when the problem has been corrected.

2. Maintenance Alarms: Enunciate Level 5 alarms when runtime accumulation exceeds a value specified by the operator
   a. DEVICE XXXX REQUIRES MAINTENANCE. Runtime has exceeded specified value since last reset.

D. See requirements for additional equipment-specific alarms specified in Section 23 09 59 - Sequences of Operation.

3.08 GRAPHIC SCREENS

A. Floor Plan Screens: The contract document drawings will be made available to the Contractor in AutoCAD (current version) format upon request. These drawings may be used only for developing backgrounds for specified graphic screens; however the Owner does not guarantee the suitability of these drawings for the Contractor's purpose.
   1. Provide graphic floor plan screens for each [floor] [wing] [tower] [other] of the building. Indicate the location of all equipment that is not located on the equipment room screens. Indicate the location of temperature sensors associated with each temperature-controlled zone (i.e., VAV terminals, fan-coils, single-zone AHUs, etc.) on the floor plan screens. [Zone background color shall change based on the temperature offset from setpoint]. Display the space temperature point adjacent to each temperature sensor symbol. Use a distinct line symbol to demarcate each terminal unit zone boundary. Use distinct colors to demarcate each air handling unit zone. [Mechanical floor plan drawings will be made available to the contractor upon request for the purpose of determining zone boundaries.] Indicate room numbers as provided by the Owner. Provide a drawing link from each space temperature sensor symbol and equipment symbol shown on the graphic floor plan screens to each corresponding equipment schematic graphic screen.
   2. Provide graphic floor plan screens for each mechanical equipment room and a plan screen of the roof. Indicate the location of each item of mechanical equipment. Provide a drawing link from each equipment symbol shown on the graphic plan view screen to each corresponding mechanical system schematic graphic screen.
   3. IF MULTIPLE FLOOR PLANS ARE NECESSARY TO SHOW ALL AREAS, PROVIDE A GRAPHIC BUILDING KEY PLAN. USE ELEVATION VIEWS AND/OR PLAN VIEWS AS NECESSARY TO GRAPHICALLY INDICATE THE LOCATION OF ALL OF THE LARGER SCALE FLOOR PLANS. LINK GRAPHIC BUILDING KEY PLAN TO LARGER SCALE PARTIAL FLOOR PLANS. PROVIDE LINKS FROM EACH LARGER SCALE GRAPHIC FLOOR PLAN SCREEN TO THE BUILDING KEY PLAN AND TO EACH OF THE OTHER GRAPHIC FLOOR PLAN SCREENS.
   4. Provide a graphic site plan with links to and from each building plan.

B. System Schematic Screens: Provide graphic system schematic screen for each subsystem controlled with each I/O point in the project appearing on at least one graphic screen. System graphics shall include flow diagrams with status, setpoints, current analog input and output values, operator commands, etc. as applicable. General layout of the system shall be schematically correct. Input/output devices shall be shown in their schematically correct locations. Include appropriate engineering units for each displayed point value. Verbose names (English language descriptors) shall be included for each point on all graphics; this may be accomplished by the use of a hover box when the operator moves the cursor over the displayed point. Indicate all adjustable setpoints on the applicable system schematic graphic screen or, if space does not allow, on a supplemental linked-setpoint screen.
   1. Provide graphic screens for each air handling system. Indicate outside air temperature and enthalpy, and mode of operation as applicable (i.e., occupied, unoccupied, warm-up, cool-down). Link screens for air handlers to the heating system and cooling system graphics. Link screens for supply and exhaust systems if they are not combined onto one screen.
   2. Provide a graphic screen for each zone. Provide links to graphic system schematic screens of air handling units that serve the corresponding zone.

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3. Provide a cooling system graphic screen showing all points associated with the chillers, cooling towers and pumps. Indicate outside air dry-bulb temperature and calculated wet-bulb temperature. Link screens for chilled water and condenser water systems if they cannot fit onto one cooling plant graphic screen.
4. Link screens for heating and cooling system graphics to utility history reports showingcurrent and monthly electric uses, demands, peak values, and other pertinent values.

C. Bar Chart Screens: On each graphic Bar Chart Screen, provide drawing links to the graphic air handling unit schematic screens.
1. Provide a graphic chilled water valve screen showing the analog output signal of all chilled water valves in a bar chart format, with signals expressed as percentage of fully open valve (percentage of full cooling). Indicate the discharge air temperature and setpoint of each air handling unit, cooling system chilled water supply and return temperatures and the outside air temperature and humidity on this graphic. Provide drawing links between the graphic cooling plant screen and this graphic screen.
2. Provide a graphic heating water valve screen showing the analog output signal of all air handling unit heating water valves in a bar chart format, with signals expressed as percentage of fully open valve (percentage of full heating). Indicate the temperature of the controlled medium (such as AHU discharge air temperature or zone hot water supply temperature) and the associated setpoint and the outside air temperature and humidity.

D. Alarms: Each programmed alarm shall appear on at least one graphic screen. In general, alarms shall be displayed on the graphic system schematic screen for the system that the alarm is associated with (for example, chiller alarm shall be shown on graphic cooling system schematic screen). For all graphic screens, display analog values that are in a 'high alarm' condition in a red color, 'low alarm' condition in a blue color. Indicate digital values that are in alarm condition in a red color.

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SECTION 23 09 58
SEQUENCE OF OPERATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Unit Heaters
B. Exhaust Fans
C. Ductless Split Heat Pumps
D. Engine Generators
E. Sumps
F. Oil Interceptors
G. Site Lighting
H. Heat Trace

1.02 RELATED DOCUMENTS:

A. Section 23 09 50 - Building Automation System (BAS) General
B. Section 23 09 51 - BAS Basic Materials, Interface Devices, and Sensors
C. Section 23 09 53 - BAS Field Panels
D. Section 23 09 54 - BAS Communications Devices
E. Section 23 09 55 - BAS Software

1.03 SYSTEM DESCRIPTION

A. The systems to be controlled under work of this section basically comprise the engine generator standby power system.
B. This Section defines the manner and method by which controls function.

1.04 SUBMITTALS

A. Refer to Section 23 09 50 and Division 01 for requirements for control shop drawings, product data, User Manual, etc.
B. Programming Manual: Provide BAS system programming manual as well as documentation of site-specific programming prior to the start of Acceptance Phase.

1.05 PROJECT RECORD DOCUMENTS

A. Within two weeks of the completion of commissioning, provide record documents to represent the final control configuration with actual setpoints and tuning parameters as existed at acceptance.
B. Record documents shall be modified control drawings with the actual installed information. Drawings shall be delivered in both reproducible hard copy and electronic format in AutoCAD (current version) drawing files. Provide all supporting files, blocks, fonts, etc. required by the drawings.
C. Provide final points list as described above.
D. Provide final detailed wiring diagrams with all wire numbers and termination points indicated.
E. Accurately record final sequences and control logic made after submission of shop drawings.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 GENERAL

A. Sequences specified herein indicate the functional intent of the systems operation and may not fully detail every aspect of the programming that may be required to obtain the indicated

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operation. Contractor shall provide all programming necessary to obtain the sequences/system operation indicated.

B. Except as specified otherwise, throttling ranges, proportional bands, and cycle differentials shall be centered on the associated setpoint. All modulating feedback control loops shall include the capability of having proportional, integral, and derivative action. Unless the loop is specified "proportional only" or "P+I", Contractor shall apply appropriate elements of integral and derivative gain to each control loop which shall result in stable operation, minimum settling time, and shall maintain the primary variable within the specified maximum allowable variance.

C. Scheduling Terminology: When HVAC operation is scheduled throughout the day, the following defines the terminology used (Designer coordinate with The State regarding actual occupancy schedules and initial setpoints):
   1. OCCUPIED PERIOD: PERIOD OF TIME WHEN THE BUILDING IS IN USE AND OCCUPIED. UNLESS INDICATED OTHERWISE, THIS PERIOD IS DEFINED AS 7:30 AM - 5:00 PM, USER ADJUSTABLE, WEEKDAYS AND X:XX AM TO 12:00PM (NOON) SATURDAYS. EXCLUDE ALL NATIONAL HOLIDAYS. GENERALLY SYSTEMS WILL BE FULLY OPERATIONAL THROUGHOUT THIS PERIOD AND VENTILATION AIR SHALL BE CONTINUOUSLY INTRODUCED. SPACE TEMPERATURE SETPOINTS WILL GENERALLY BE IN THE "NORMAL" RANGE OF 69-77°F.
   2. Unoccupied period: Period of time when the building or zone is not in use and unoccupied. Ventilation air shall not be introduced.
   3. Preoccupancy Period: Time prior to the Occupied period when the systems are returning the space temperatures from setback to "normal" or occupied setpoints (warm-up and cool-down). Ventilation air shall not be introduced unless outside air conditions permit free-cooling. Time period shall be determined by an optimum start strategy unless otherwise specified.
   4. Setback Period: Setback will typically coincide start with the end of the occupied period and end with the start of the preoccupancy period, however it shall be provided with its own schedule. Generally systems will be off except to maintain a "setback" temperature.
      a. Where any sequence or occupancy schedule calls for more than one motorized unit to start simultaneously, the BAS start commands shall be staggered by 5 second (adj.) intervals to minimize inrush current.

D. Alarm messages specified throughout the sequences are assigned to discrete priority levels. Priority levels dictate the handling and destination of alarm reports, and are defined in Section 23 09 55 - ATC System Software and Programming.

E. Wherever a value is indicated as adjustable (adj.), it shall be modifiable, with the proper privilege level, from the operator interface or via a function block menu. For these points, it is unacceptable to have to modify programming statements to change the setpoint.

F. When a power failure is detected in any phase, the BAS start commands shall be retracted immediately from all electrically powered units served by the failed power source. If the associated primary control unit (PCU) is powered by normal or emergency power, it may monitor its own power source as an indication of power status. If the PCU is powered by uninterruptable power supply (UPS), or if PCU is not capable of monitoring its own power for use in sequences, Contractor shall provide at least one voltage monitor (three phase when applicable) per building. When the BAS detects that power has been restored, all equipment for which the BAS start command had been retracted shall be automatically restarted on staggered 5 second intervals to minimize inrush current. When loss of equipment status coincides with a power failure, system shall not alarm individual equipment failures. Instead, only a single Level 2 alarm shall be enunciated as follows:
   1. BUILDING XXXX POWER FAILURE: Notify electric shop. Acknowledge alarm when power is restored.

G. Where "prove operation" of a device (generally controlled by a digital output) is indicated in the sequence, it shall require that the BAS shall, after an adjustable time delay after the device is commanded to operate (feedback delay) , confirm that the device is operational via the status input. If the status point does not confirm operation after the time delay or anytime thereafter for

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an adjustable time delay (debounce delay) while the device is commanded to run, an alarm shall be enunciated audibly and via an alarm message at the operator interface and print at the alarm printers. A descriptive message shall be attached to the alarm message indicating the nature of the alarm and actions to be taken. Contractor shall provide messages to meet this intent. [Upon failure of equipment with redundant backup, run command shall be removed from equipment and the device shall be locked out until the alarm is manually acknowledged. Upon failure of equipment without redundant backup, run command shall remain energized and the alarm shall be latched until reset by an operator.BAS shall provide for adjustable maximum rates of change for increasing and decreasing output from the following analog output points:

1. Speed control of variable speed drives
2. Chiller supply water temperature setpoint reset
3. Chiller demand limit
4. Travel rate of tower isolation and chiller isolation valves

3.02 ELECTRIC UNIT HEATERS

A. User-adjustable temperature is maintained by room thermostat set at 50 deg. F (user adj.) maintains consistent space temperature by cycling unit fan motor and electric heating element.

B. BAS shall annunciate a "low temperature warning" if the space temperature falls below 35 deg. F (user adj.).

C. The following items shall be displayed at the Operator's Terminal:
   1. Temperature setpoint
   2. Actual space temperature
   3. Commanded status of heater

3.03 DUCTLESS SPLIT HEAT PUMPS

A. See drawings for project-specific sequence of operation.

3.04 EXHAUST FANS

A. See Drawings for project-specific sequence of operations.

3.05 ENGINE GENERATORS

A. The contractor is to connect the generator to the Building Automation System (BAS) via the remote annunciator panel, provide CT sensors on normal and emergency legs of the Automatic Transfer Switch (ATS) and provide the following programming:
   1. Report generator status to BAS terminal -- running / standby / off.
   2. Log generator run hours at BAS terminal.
   3. Report current draw on generator to BAS terminal.
   4. Report alarm at BAS terminal when both generator is running AND current draw on generator is below an adjustable threshold (virtually zero) to indicate failure of ATS.
   5. Display the following parameters at the BAS terminal:
      a. Voltage
      b. Current
      c. Frequency
      d. Starting Battery Voltage
      e. Engine Speed
      f. Engine Temperature
      g. Engine Oil Pressure
      h. Engine Oil Temperature
      i. Intake Manifold Temperature
      j. Fault History
      k. Fuel Level
      l. Low Fuel Alarm
      m. Tank Leak Alarm
   6. Once the generator engages and building is operating under emergency power, contractor is to provide a sequence of operations in order to stage loads with a duration between 5 seconds and two minutes (adj.) between stages.

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7. Generator steps: A minimum of 12 steps shall be required to stage existing and proposed electrical loads at the Parking Garage site and Legislative Hall, to be directed by engineer during BAS submittal review.

3.06 PLUMBING SUMPS

A. The BAS shall monitor sump control panels via auxiliary dry contacts.

B. BAS shall anunciate an alarm at the Operator's Terminal in the event of a "high level" alarm.

C. The following items shall be displayed at the Operator's Terminal:
   1. High water level alarm
   2. Pump operational status
   3. Pump commanded status
   4. Seal failure alarm
   5. High temperature indicator and alarm

3.07 OIL INTERCEPTORS

A. The BAS shall monitor oil interceptor control panels via auxiliary dry contacts.

B. BAS shall anunciate an alarm at the Operator's Terminal in the event of a "tank full" alarm.

C. The following items shall be displayed at the Operator's Terminal:
   1. Tank level
   2. Tank high level alarm

3.08 SITE LIGHTING CONTROL

A. Provide schedule-based control of site lighting and all exterior lighting. Control via 365 day calendar with automatic adjustment for annual solar variance as well as daylight savings time.

B. Control will be via contactor on the site lighting power circuit. See electrical drawings for locations and quantity of contactors required.

C. Provide photocell connected to BAS for daylighting sensing override input.

D. Each zone shall be able to scheduled independently.

E. The following shall be displayed at the Operator's Terminal:
   1. Commanded status of each lighting circuit.
   2. Actual status of each lighting circuit via CT sensor feedback.
   3. Scheduling calendar for each lighting zone.
   4. Optional overrides for each zone -- manual or via photocell sensor.

3.09 HEAT TRACE

A. Provide CT sensors at each heat trace circuit and provide field-located temperature monitoring probe in first level of parking garage.

B. BAS shall monitor heat trace current and garage space temperature, and display readings.

C. Provide a critical alarm at the operator's terminal to annunciate in the event the CT sensor fails to read current above nominally zero and the garage space temperature is below 32 deg. (adj) for a period of more than 5 minutes (adj).

D. The following shall be displayed at the Operator's Terminal:
   1. Garage space temperature
   2. Actual status of each heat trace circuit via CT sensor feedback.
   3. Alarm status.
   4. Faults from heat trace controller interface.

END OF SECTION

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SECTION 23 21 13
HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Equipment drains and overflows.

1.02 RELATED REQUIREMENTS

A. Section 23 25 00 - HVAC Water Treatment: Pipe cleaning.

1.03 REFERENCE STANDARDS

A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.

B. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.

C. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

D. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2016.

E. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2016.

F. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Include data on pipe materials, pipe fittings, valves, and accessories.
   2. Provide manufacturers catalog information.

1.05 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.

PART 2 PRODUCTS

2.01 EQUIPMENT DRAINS AND OVERFLOWS

A. 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; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

2.02 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.

PART 3 EXECUTION

3.01 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 using jointing system specified.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

E. After completion, fill, clean, and treat systems. See Section 23 25 00 for additional requirements.

NOT FOR BIDDING

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Route piping in orderly manner, parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and to avoid interference with use of space.

D. Group piping whenever practical at common elevations.

E. Slope piping and arrange to drain at low points.

END OF SECTION

NOT FOR BIDDING

SECTION 23 23 00
REFRIGERANT PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping.
B. Moisture and liquid indicators.
C. Valves.
D. Pressure relief valves.
E. Filter-driers.
F. Solenoid valves.
G. Expansion valves.
H. Flexible connections.

1.02 REFERENCE STANDARDS

A. AHRI 495 - Performance Rating of Refrigerant Liquid Receivers; 2005.
B. AHRI 710 - Performance Rating of Liquid-Line Driers; 2009.
C. AHRI 730 (I-P) - Flow Capacity Rating of Suction-Line Filters and Suction-Line Filter-Driers; 2013.
D. AHRI 750 - Thermostatic Refrigerant Expansion Valves; 2007.
E. AHRI 760 - Performance Rating of Solenoid Valves for Use With Volatile Refrigerants; 2007.
F. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2013.
G. ASHRAE Std 34 - Designation and Safety Classification of Refrigerants; 2013.
H. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; 2017.
I. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing and Fusing Operators; 2017.
J. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.
K. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; 2013.
L. ASME B31.5 - Refrigeration Piping and Heat Transfer Components; 2016.
M. ASME B31.9 - Building Services Piping; 2014.
N. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.
O. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2017.
P. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2016.
Q. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2016.
R. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service; 2016.
S. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992 (Reapproved 2008).
T. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011 (Amended 2012).
U. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015, with Errata (2016).
V. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

NOT FOR BIDDING

W. MSS SP-69 - Pipe Hangers and Supports - Selection and Application; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.

X. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.

Y. UL 429 - Electrically Operated Valves; Current Edition, Including All Revisions.

1.03 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. Provide pipe hangers and supports in accordance with MSS SP-69 unless indicated otherwise.

C. Liquid Indicators:
1. Use line size liquid indicators in main liquid line leaving condenser.
2. If receiver is provided, install in liquid line leaving receiver.
3. Use line size on leaving side of liquid solenoid valves.

D. Valves:
1. Use service valves on suction and discharge of compressors.
2. Use gage taps at compressor inlet and outlet.
3. Use gage taps at hot gas bypass regulators, inlet and outlet.
4. Use check valves on compressor discharge.
5. Use check valves on condenser liquid lines on multiple condenser systems.

E. Refrigerant Charging (Packed Angle) Valve: Use in liquid line between receiver shut-off valve and expansion valve.

F. Strainers:
1. Use line size strainer upstream of each automatic valve.
2. Where multiple expansion valves with integral strainers are used, use single main liquid line strainer.
3. On steel piping systems, use strainer in suction line.
4. Use shut-off valve on each side of strainer.

G. Pressure Relief Valves: Use on ASME receivers and pipe to outdoors.

H. Filter-Driers:
1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.
2. Use a filter-drier on suction line just ahead of compressor.
3. Use sealed filter-driers in lines smaller than 1/2 inch outside diameter.
4. Use sealed filter-driers in low temperature systems.
5. Use sealed filter-driers in systems utilizing hermetic compressors.
6. Use replaceable core filter-driers in lines of 1/2 inch outside diameter or greater.
7. Use replaceable core liquid-line filter-driers in systems utilizing receivers.
8. Use filter-driers for each solenoid valve.

I. Solenoid Valves:
1. Use in liquid line of systems operating with single pump-out or pump-down compressor control.
2. Use in liquid line of single or multiple evaporator systems.
3. Use in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into the suction line when system shuts down.

J. Flexible Connectors: Utilize at or near compressors where piping configuration does not absorb vibration.

NOT FOR BIDDING

1.04 SUBMITTALS

A. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.

B. Shop Drawings: Indicate schematic layout of system, including equipment, critical dimensions, and sizes.

C. Design Data: Submit design data indicating pipe sizing. Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.

D. Test Reports: Indicate results of leak test, acid test.

E. Manufacturer's Installation Instructions: Indicate support, connection requirements, and isolation for servicing.

F. Submit welders certification of compliance with ASME (BPV IX) or AWS D1.1.

G. Project Record Documents: Record exact locations of equipment and refrigeration accessories on record drawings.

H. Maintenance Data: Include instructions for changing cartridges, assembly views, spare parts lists.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum five years of documented experience.

B. Design piping system under direct supervision of a Professional Engineer experienced in design of this type of work.

C. Design piping 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.

1.06 REGULATORY REQUIREMENTS

A. Conform to ASME B31.9 for installation of piping system.

B. Welding Materials and Procedures: Conform to ASME BPVC-IX and applicable state labor regulations.

C. Welders Certification: In accordance with ASME (BPV IX) or AWS D1.1.

D. Products Requiring Electrical Connection: Listed and classified by UL, as suitable for the purpose indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Filter-Driers:

1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.

2.02 REGULATORY REQUIREMENTS

2.03 PIPING

A. Copper Tube: ASTM B280, H58 hard drawn .
   1. Fittings: ASME B16.22 wrought copper.
   2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy.

B. Copper Tube to 7/8 inch OD: ASTM B88 (ASTM B88M), Type K (A), annealed.

NOT FOR BIDDING

1. Fittings: ASME B16.26 cast copper.
2. Joints: Flared.

C. Pipe Supports and Anchors:
1. Conform to ASTM F 708, MSS SP-58, MSS SP-69, and MSS SP-89.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Carbon steel adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
10. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
11. 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.

2.04 MOISTURE AND LIQUID INDICATORS

A. Manufacturers:
1. Henry Technologies: www.henrytech.com/#sle.
2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com/#sle.
3. Sporlan Valve Company: www.sporlan.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Indicators: Single or Doubleport type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

2.05 VALVES

A. Manufacturers:
1. Hansen Technologies Corporation: www.hantech.com/#sle.
2. Henry Technologies: www.henrytech.com/#sle.
3. Flomatic Valves; Model _____: www.flomatic.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Diaphragm Packless Valves:
1. UL listed, globe or angle pattern, forged brass body and bonnet, phosphor bronze and stainless steel diaphragms, rising stem and handwheel, stainless steel spring, nylon seat disc, solder or flared ends, with positive backseating; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.

C. Packed Angle Valves:
1. Forged brass or nickel plated forged steel, forged brass seal caps with copper gasket, rising stem and seat with backseating, molded stem packing, solder or flared ends; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.

D. Ball Valves:
1. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psi and maximum temperature of 300 degrees F.

E. Service Valves:
1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psi.

NOT FOR BIDDING

2.06 STRAINERS

A. Manufacturers:
   1. Hansen Technologies Corporation: www.hantech.com/#sle.
   2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com/#sle.
   3. Sporlan, a Division of Parker Hannifin: www.parker.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Straight Line or Angle Line Type:
   1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi.

C. Straight Line, Non-Cleanable Type:
   1. Steel shell, copper plated fittings, stainless steel wire screen, for maximum working pressure of 500 psi.

2.07 FILTER-DRIERS

A. Manufacturers:
   1. Flow Controls Division of Emerson Electric: www.emersonflowcontrols.com/#sle.
   2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com/#sle.
   3. Sporlan Valve Company: www.sporlan.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Performance:
   1. Flow Capacity - Liquid Line: As indicated in schedule, minimum, rated in accordance with AHRI 710.
   2. Flow Capacity - Suction Line: As indicated in schedule, minimum, rated in accordance with AHRI 730 (I-P).
   3. Water Capacity: As indicated in schedule, rated in accordance with AHRI 710.
   4. Pressure Drop: 2 psi, As indicated in schedule, maximum, when operating at full connected evaporator capacity.
   5. Design Working Pressure: As indicated in schedule or 350 psi, minimum.

C. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns; of construction that will not pass into refrigerant lines.

D. Construction: UL listed.
   1. Replaceable Core Type: Steel shell with removable cap.
   2. Sealed Type: Copper shell.
   3. Connections: As specified for applicable pipe type.

2.08 SOLENOID VALVES

A. Manufacturers:
   1. Flow Controls Division of Emerson Electric: www.emersonflowcontrols.com/#sle.
   2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com/#sle.
   3. Sporlan Valve Company: www.sporlan.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Valve: AHRI 760, pilot operated, copper or brass body and internal parts, synthetic seat, stainless steel stem and plunger assembly (permitting manual operation in case of coil failure), integral strainer, with flared, solder, or threaded ends; for maximum working pressure of 500 psi.

C. Coil Assembly: UL 429, UL listed, replaceable with molded electromagnetic coil, moisture and fungus proof, with surge protector and color coded lead wires, integral junction box with pilot light.

D. Electrical Characteristics: per drawings.

NOT FOR BIDDING

2.09 EXPANSION VALVES

A. Manufacturers:
   1. Flow Controls Division of Emerson Electric: www.emersonflowcontrols.com/#sle.
   2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com/#sle.
   3. Sporlan Valve Company: www.sporlan.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Angle or Straight Through Type: AHRI 750; design suitable for refrigerant, brass body, internal or external equalizer, mechanical pressure limit (maximum operating pressure MOP feature), adjustable superheat setting, replaceable inlet strainer, with replaceable capillary tube and remote sensing bulb and remote bulb well.

C. Selection: Evaluate refrigerant pressure drop through system to determine available pressure drop across valve. Select valve for maximum load at design operating pressure and minimum 10 degrees F superheat. Select to avoid being undersized at full load and excessively oversized at part load.

2.10 ELECTRONIC EXPANSION VALVES

A. Manufacturers:
   1. Flomatic Valves: www.flomatic.com/#sle.
   2. Danfoss Automatic Controls: www.danfoss.com.
   3. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com/#sle.
   4. Sporlan Valve Company: www.sporlan.com/#sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Valve:
   1. Brass body with flared or solder connection, needle valve with floating needle and machined seat, stepper motor drive.
   2. Capacity: per drawings.
   3. Electrical Characteristics: per drawings.

C. Evaporation Control System:
   1. Electronic microprocessor based unit in enclosed case, proportional integral control with adaptive superheat, maximum operating pressure function, preselection allowance for electrical defrost and hot gas bypass.
   2. Electrical Characteristics: per drawings.

D. Refrigeration System Control: Electronic microprocessor based unit in enclosed case, with proportional integral control of valve, on/off thermostat, air temperature alarm (high and low), solenoid valve control, liquid injection adaptive superheat control, maximum operating pressure function, night setback thermostat, timer for defrost control.

2.11 FLEXIBLE CONNECTORS

A. Manufacturers:
   1. Circuit Hydraulics, Ltd: www.circuit-hydraulics.co.uk.
   2. Flexicraft Industries: www.flexicraft.com/#sle.
   3. Penflex: www.penflex.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Corrugated stainless steel or bronze hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure of 500 psi.

PART 3 EXECUTION

3.01 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.

NOT FOR BIDDING

3.02 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. 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. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
   4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
   5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of or recessed into and grouted flush with slab.

G. Pipe Hangers and Supports:
   1. Install in accordance with ASTM F 708 and MSS SP-89.
   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. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.
   6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
   7. Provide copper plated hangers and supports for copper piping.

H. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

I. Provide clearance for installation of insulation and access to valves and fittings.

J. Provide access to concealed valves and fittings.

K. Flood piping system with nitrogen when brazing.

L. Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.

M. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.

N. Provide replaceable cartridge filter-driers, with isolation valves and valved bypass.

O. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.

P. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.

Q. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.

R. Fully charge completed system with refrigerant after testing.

3.03 FIELD QUALITY CONTROL

A. Test refrigeration system in accordance with ASME B31.5.

NOT FOR BIDDING

B. Pressure test system with dry nitrogen to 200 psi. Perform final tests at 27 inches vacuum and 200 psi using electronic leak detector. Test to no leakage.

3.04 SCHEDULES

A. Hanger Spacing for Copper Tubing.
   1. 1/2 inch, 5/8 inch, and 7/8 inch OD: Maximum span, 5 feet; minimum rod size, 3/8 inch.
   2. 1-1/8 inch OD: Maximum span, 6 feet; minimum rod size, 3/8 inch.
   3. 1-3/8 inch OD: Maximum span, 7 feet; minimum rod size, 3/8 inch.
   4. 1-5/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.
   5. 2-1/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.
   6. 2-5/8 inch OD: Maximum span, 9 feet; minimum rod size, 3/8 inch.
   7. 3-1/8 inch OD: Maximum span, 10 feet; minimum rod size, 3/8 inch.
   8. 3-5/8 inch OD: Maximum span, 11 feet; minimum rod size, 1/2 inch.
   9. 4-1/8 inch OD: Maximum span, 12 feet; minimum rod size, 1/2 inch.

B. Hanger Spacing for Steel Piping.
   1. 1/2 inch, 3/4 inch, and 1 inch: Maximum span, 7 feet; minimum rod size, 3/8 inch.
   2. 1-1/4 inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
   3. 1-1/2 inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
   4. 2 inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
   5. 2-1/2 inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.
   6. 3 inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.
   7. 4 inches: Maximum span, 12 feet; minimum rod size, 1/2 inch.

END OF SECTION

NOT FOR BIDDING

SECTION 23 31 00
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flexible ducts.

B. Metal ductwork.

1.02 RELATED REQUIREMENTS

A. Section 23 07 13 - Duct Insulation: External insulation and duct liner.

B. Section 23 33 00 - Air Duct Accessories.

C. Section 23 37 00 - Air Outlets and Inlets.

D. Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.

1.03 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

D. 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; 2016.

E. 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; 2017.

F. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

G. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

H. ASTM C14 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe; 2015a.

I. ASTM C14M - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, Culvert Pipe and (Metric); 2015a.

J. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets; 2012 (Reapproved 2017).

K. ASTM C443M - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric); 2011 (Reapproved 2017).

L. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2018.

M. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2018.

N. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2017.

O. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2012, 2nd Edition.

P. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).

Q. SMACNA (FGD) - Fibrous Glass Duct Construction Standards; 2003.

R. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

NOT FOR BIDDING

S. IECC 2012 - International Energy Conservation Code - Duct construciton standards, leakage testing

1.04 PERFORMANCE REQUIREMENTS

A. No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for duct materials and duct connections.

C. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for all systems.

D. Manufacturer's Certificate: Certify that installation of glass fiber ductwork meet or exceed recommended fabrication and installation requirements.

E. Project Record Documents: Record actual locations of ducts 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.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum five years of documented experience.

1.07 REGULATORY REQUIREMENTS

A. Construct ductwork to NFPA 90A, NFPA 90B, and NFPA 96 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.

PART 2 PRODUCTS

2.01 DUCT ASSEMBLIES

2.02 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.

B. Hanger Rod: ASTM A36/A36M; steel, galvanized; continuously threaded.

C. Hanger Support: 3-5/8" strut rack, stainless steel hardware, threaded rods at each end.

D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, per typical details where applicable.

E. Insulated Flexible Ducts:
1. Two ply vinyl film supported by helically wound spring steel wire; fiberglass insulation; aluminized vapor barrier film.
    a. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.
    b. Maximum Velocity: 4000 fpm.
    c. Temperature Range: -10 degrees F to 160 degrees F.

F. All Ducts: Galvanized steel, unless otherwise indicated.

G. Low Pressure Supply (Heating Systems): 1 inch w.g. pressure class, galvanized steel.

H. Low Pressure Supply (System with Cooling Coils): 2 inch w.g. pressure class, galvanized steel.

I. Return, Relief, and Exhaust Air: 1 inch w.g. pressure class, galvanized steel.

NOT FOR BIDDING

J. 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.

2.03 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards and as indicated.

B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. 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 turning vanes. .

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA HVAC Duct Construction Standards.

F. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard. Joints shall be minimum 4 inch cemented slip joint, brazed or electric welded. Prime coat welded joints.

G. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.

H. 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. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages,reinforcing, and sealing for operating pressures indicated.

C. Transverse Duct Connection System: SMACNA "J" rated rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA HVAC Duct Construction Standards.

B. Install in accordance with manufacturer's instructions.

C. Comply with safety standards NFPA 90A and NFPA 90B.

D. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.

E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

F. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

G. Install and seal metal and flexible ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

NOT FOR BIDDING

H. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

I. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

J. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.

K. Use double nuts and lock washers on threaded rod supports.

L. Tape joints of PVC coated metal ductwork with PVC tape.

M. Connect terminal units to supply ducts with one foot maximum length of flexible duct. Do not use flexible duct to change direction.

N. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.

O. Set plenum doors 6 to 12 inches above floor. Arrange door swings so that fan static pressure holds door in closed position.

P. Use stainless steel for ductwork exposed to view and stainless steel or carbon steel for ducts where concealed.

Q. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

R. Paint new and existing ducts matte black behind all new grilles and registers.

S. At exterior wall louvers, seal duct to louver frame and install blank-out panels as required.

3.02 SCHEDULES

A. Ductwork Material:
   1. Low Pressure Supply (Heating Systems): Galvanized Steel.
   2. Low Pressure Supply (System with Cooling Coils): Galvanized Steel.
   3. Medium and High Pressure Supply: Galvanized Steel.
   4. Return and Relief: Galvanized Steel.
   5. General Exhaust: Galvanized Steel.
   6. Kitchen Hood Exhaust: Stainless Steel.
   7. Outside Air Intake: Galvanized Steel.
   8. Exposed round metal ductwork: Double-wall spiral.

B. Ductwork Pressure Class:
   1. Supply (Heating Systems): 1 inch
   2. Supply (System with Cooling Coils): 2 inch.
   3. Return and Relief: 1 inch.
   4. General Exhaust: 1 inch.
   5. Outside Air Intake: 1 inch.

END OF SECTION

NOT FOR BIDDING

SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air turning devices/extractors.
B. Backdraft dampers.
C. Duct access doors.
D. Duct test holes.
E. Flexible duct connections.
F. Volume control dampers.

1.02 RELATED REQUIREMENTS

A. Section 23 31 00 - HVAC Ducts and Casings.
B. Section 23 36 00 - Air Terminal Units: Pressure regulating damper assemblies.

1.03 REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2018.
B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 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. See Section 01 33 00 - Administrative Requirements, for submittal procedures.
B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.
C. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers.
D. Project Record Drawings: Record actual locations of access doors and test holes.

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 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.01 AIR TURNING DEVICES/EXTRACTORS

A. Manufacturers:
   1. Krueger: www.krueger-hvac.com/#sle.
   2. PCI Industries, Inc; Pottorff Brand : www.portorff.com.
   3. Ruskin Company: www.ruskin.com/#sle.
   4. Titus: www.titus-hvac.com/#sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.
B. Multi-blade device with radius blades attached to pivoting frame and bracket, steel construction, with push-pull operator strap.

NOT FOR BIDDING

2.02 BACKDRAFT DAMPERS

A. Manufacturers:
   1. Louvers & Dampers, Inc: www.louvers-dampers.com/#sle.
   2. Nailor Industries Inc: www.nailor.com/#sle.
   3. PCI Industries, Inc; Pottorff Brand : www.portorff.com.
   4. Ruskin Company: www.ruskin.com/#sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.03 DUCT ACCESS DOORS

A. Manufacturers:
   1. Acudor Products Inc: www.acudor.com/#sle.
   2. Nailor Industries Inc: www.nailor.com/#sle.
   3. Ruskin Company: www.ruskin.com/#sle.
   4. SEMCO Incorporated: www.semcoinc.com/#sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. 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.
   1. Less Than 12 inches Square: Secure with sash locks.
   2. Up to 18 inches Square: Provide two hinges and two sash locks.
   3. Up to 24 x 48 inches: Three hinges and two compression latches with outside and inside handles.
   4. Larger Sizes: Provide an additional hinge.

C. Access doors with sheet metal screw fasteners are not acceptable.

2.04 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.

2.05 FIRE DAMPERS

A. Manufacturers:
   1. Louvers & Dampers, Inc, a brand of Mestek, Inc: www.louvers-dampers.com/#sle.
   2. Nailor Industries, Inc: www.nailor.com/#sle.
   3. NCA, a brand of Metal Industries Inc: www.ncamfg.com/#sle.
   4. Pottorff: www.pottorff.com/#sle.
   5. Ruskin Company: www.ruskin.com/#sle.
   6. Ward Industries, a brand of Hart and Cooley, Inc: www.wardind.com/#sle.
   7. Substitutions: See Section 01 60 00 - Product Requirements.

B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

C. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1.0 inch pressure class ducts up to 12 inches in height.

D. Multiple Blade Dampers: 16 gauge, 0.0598 inch galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 by 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

E. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

NOT FOR BIDDING

2.06 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.

2.07 VOLUME CONTROL DAMPERS

A. Manufacturers:
   1. Louvers & Dampers, Inc: www.louvers-dampers.com/#sle.
   2. Nailor Industries Inc: www.nailor.com/#sle.
   3. PCI Industries, Inc; Pottorff Brand : www.portorff.com.
   4. Ruskin Company: www.ruskin.com/#sle.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Splitter Dampers:
   1. Material: Same gage as duct to 24 inches size in either direction, and two gages heavier for sizes over 24 inches.
   2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.
   3. Operator: Minimum 1/4 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw .

D. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch.

E. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

F. 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.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 31 00 HVAC Ducts and Casings 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, 18 x 18 inch 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. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by Authorities Having Jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

F. Demonstrate re-setting of fire dampers to Owner's representative.

G. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

NOT FOR BIDDING

H. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

I. 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.

J. Use splitter dampers only where indicated.

K. 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

NOT FOR BIDDING

SECTION 23 37 00
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rectangular exhaust air grilles and registers.

B. Louvers:
   1. Combination louvers.

1.02 RELATED REQUIREMENTS

A. Section 09 90 00 - Painting and Coating: Painting of ducts visible behind outlets and inlets.

1.03 REFERENCE STANDARDS

A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2015.

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 (Reaffirmed 2011).

D. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

E. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

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. Samples: Submit one of each required air outlet and inlet type.

D. Project Record Documents: Record actual locations of air outlets and inlets.

1.05 WARRANTY

A. Manufacturer must provide a 10 Year Product Warranty for products supplied for the fabric portion of this system as well as a Design and Performance Warranty.

1.06 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 [five] years of documented experience.

1.07 DELIVERY, STORAGE AND HANDLING:

A. Where possible, store products inside and protect from weather. Where necessary to store outside, store above grade and enclose with a vented waterproof wrapping

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Krueger: www.krueger-hvac.com/#sle.

B. Price Industries: www.price-hvac.com/#sle.

C. Ruskin Company: www.ruskin.com/#sle.

D. Titus: www.titus-hvac.com/#sle.

E. Tuttle and Bailey: www.tuttleandbailey.com.

F. Substitutions: See Section 01 60 00 - Product Requirements.

NOT FOR BIDDING

2.02 RECTANTULAR EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with blades set at 45 degrees, horizontal face.

B. Frame: 1 inch margin with countersunk screw mounting.

C. Color: To be selected by Architect from manufacturer's standard range.

D. Fabrication: Stainless steel or aluminum extrusions as scheduled, with factory powder-coated or brushed aluminum finish as scheduled.

E. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face where not individually connected to exhaust fans.

2.03 LOUVERS

A. Manufacturers:
   1. NCA, a brand of Metal Industries Inc: www.ncamfg.com/#sle.
   2. Ruskin Company: www.ruskin.com/#sle.
   3. Greenheck: www.greenheck.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Type: 4 inch or 6 inch deep as indicated on drawings with blades on 45 degree slope , heavy channel frame, 1/2 inch square mesh screen over exhaust and 1/2 inch square mesh screen over intake.

C. Color: To be selected by Architect from manufacturer's standard range. Provide Kynar / Hylar 500 Finish.

D. Fabrication: 12 gage thick extruded aluminum or 16 gage galvanized steel, welded assembly, with factory prime coat, baked enamel, anodized or fluoropolymer spray finish as indicated on drawings or selected by architect.

E. Fabrication: 12 gage thick extruded aluminum or 16 gage galvanized steel, welded assembly, with color selected by architect.

F. Mounting: Furnish with exterior angle flange, screw holes in jambs or masonry strap anchors for installation.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Insulate opposite side of air distribution for all supply diffusers or registers (top-side or back-side).

C. Comply with SMACNA (ASMM) for flashing/counter-flashing of roof penetrations and supports for roof curbs and roof mounted equipment.

D. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

E. Install diffusers to ductwork with air tight connection.

F. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09 90 00 Paints and Coatings.

3.02 AIR OUTLET AND INLET SCHEDULE

A. See Drawings

END OF SECTION

NOT FOR BIDDING

SECTION 23 81 01
TERMINAL HEAT TRANSFER UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Baseboard radiation.

B. Electric unit heaters.

1.02 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

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. 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.
   3. Indicate mechanical and electrical service locations and requirements.,

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 manufacturers 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.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum 5 years documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.04 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturers warranty for all motors.

C. Provide two year parts and labor warranty for enitre unit, from substitute and completion.

PART 2 PRODUCTS

2.01 ELECTRIC BASEBOARD

A. Manufacturers:
   1. QMark.
   2. Marley.
   3. Trane.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Assembly: UL listed and labelled with terminal box and cover, and built-in controls.

C. Heating Elements: Enclosed copper tube, aluminum finned element of coiled nickel-chrome resistance wire centered in tubes and embedded in refractory material.

D. Enclosure: Minimum 0.030 inch steel with 7 inch high back and top of one piece; front panel, end panel, end caps, corners, and joiner pieces to snap together, and front panel easily removable. Provide full length damper.

E. Disconnect Switch: Provide with factory-furnished disconnect switch having thermal overload as required per NEC.

NOT FOR BIDDING

F. Control: Electronic control system with baseboard mounted power module, wall mounted electronic thermostat .

2.02 ELECTRIC UNIT HEATERS

A. Manufacturers:
1. QMark.
2. Marley.
3. Trane.
4. Berko.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Assembly: UL listed and labelled assembly with terminal box and cover, and built-in controls. See sequence of operations for additonal ATC requirements.

C. Heating Elements: Enclosed copper tube, aluminum finned element of coiled nickel-chrome resistance wire centered in tubes and embedded in refractory material or exposed helical coil of pickel chrome resistance wire refractory ceramic support bushings.

D. Cabinet: 0.0478 inch steel with easily removed front panel with integral air outlet and inlet grilles.

E. Element Hangers: Quiet operating, ball bearing cradle type providing unrestricted longitudinal movement, on enclosure brackets.

F. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard.

G. Motor: Permanently lubricated, sleeve bearings for horizontal models, ball bearings for vertical models.

H. Control: Separate fan speed switch and thermostat heat selector switch, factory wired, with switches built-in behind cover. Provide thermal overload. Provide low voltage, wall-mounted thermostat.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install equipment exposed to finished areas after walls and ceiling are finished and painted. Do not damage equipment or finishes.

C. Protection: Provide finished cabinet units with protective covers during balance of construction.

D. Baseboard Radiation: Locate on outside walls and run cover continuously wall-to-wall unless otherwise indicated. Center elements under windows. Install end caps where units butt against walls.

E. Install electric heating equipment including devices furnished by manufacturer but not factory-mounted. Furnish copy of manufacturer's wiring diagram submittal. Install electrical wiring in accordance with manufacturer's submittals and Section 26 05 83.

3.02 CLEANING

A. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.

B. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

C. Install new filters.

END OF SECTION

NOT FOR BIDDING

SECTION 23 81 27
SMALL SPLIT-SYSTEM HEATING AND COOLING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Air-source heat pumps.

B. Indoor ductless fan & coil units.

C. Controls.

1.02 RELATED REQUIREMENTS

A. Section 23 09 13 - Instrumentation and Control Devices for HVAC: Thermostats, humidistats, time clocks.

B. Section 23 09 23 - Direct Digital Controls Systems for HVAC.

C. Section 23 09 93 - Sequence of Operations for HVAC.

D. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections and installation and wiring of thermostats and other controls components.

1.03 REFERENCE STANDARDS

A. AHRI 270 - Sound Performance Rating of Outdoor Unitary Equipment; 2015.

B. AHRI 520 - Performance Rating of Positive Displacement Condensing Units; 2004.

C. AHRI 610 (I-P) - Performance Rating Of Central System Humidifiers for Residential Applications; 2014.

D. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2013.

E. ASHRAE Std 23.1 - Methods for Performance Testing Positive Displacement Refrigerant Compressors and Condensing Units that Operate at Subcritical Pressures of the Refrigerant; 2019.

F. 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.

G. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. ASHRAE Std 90.2 - Energy-Efficient Design of Low-Rise Residential Buildings; 2018.

I. ASHRAE Std 103 - Methods of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers; 2017, with Errata (2019).

J. NEMA MG 1 - Motors and Generators; 2017.

K. NFPA 31 - Standard for the Installation of Oil Burning Equipment; 2018.

L. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2018.

M. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2018.

N. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances; 2019.

O. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

NOT FOR BIDDING

C. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.

D. Design Data: Indicate refrigerant pipe sizing.

E. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

F. Project Record Documents: Record actual locations of components and connections.

G. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

H. Warranty: Submit manufacturers warranty and ensure forms have been filled out 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 10 years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years of documented experience and approved by manufacturer.

1.06 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturers warranty for heat exchangers, condensing units, and compressors.

1.07 EXTRA MATERIALS

A. See Section 01 6000 - Project Requirements, for additional provisions.

B. Provide two filters for each indoor unit.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Mitsubishi:

B. LG:

C. Daikin.

D. Samsung

E. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 SYSTEM DESIGN

A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.
   1. Heating and Cooling: Air-source electric heat pump located in outdoor unit with evaporator .
   2. Cooling: Outdoor electric condensing unit with evaporator coil in central ducted indoor unit or coils in multiple .
   3. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.

B. Performance Requirements: See Drawings for additional requirements.
   1. Efficiency: Energy Efficiency Rating (EER)/Coefficient of Performance (COP) not less than requirements of ASHRAE Std 90.1; seasonal efficiency to ASHRAE Std 103.

2.03 INDOOR UNITS FOR DUCTLESS SYSTEMS

A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, evaporator coil, and controls; wired for single power connection with control transformer.

NOT FOR BIDDING

B. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
   1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
   2. Manufacturer: System manufacturer.

2.04 OUTDOOR UNITS

A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.
   1. Refrigerant: R-454B.
   2. Cabinet: Steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.
   3. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23.1 and UL 207.

B. Compressor: As scheduled ARI 520; hermetic, single or two speed 1800 and 3600 rpm, resiliently mounted integral with condenser, with positive lubrication, crankcase heater, high pressure control, motor overload protection, service valves and drier. Provide time delay control to prevent short cycling and rapid speed changes.

C. Air Cooled Condenser: ARI 520; Aluminum fin and copper tube coil, with direct drive axial propeller fan resiliently mounted, galvanized fan guard.

D. Accessories: Filter drier, high pressure switch (manual reset), low pressure switch (automatic reset), service valves and gage ports, thermometer well (in liquid line).
   1. Provide thermostatic expansion valves.
   2. Provide heat pump reversing valves.

E. Operating Controls:
   1. Control by room thermostat to maintain room temperature setting.
   2. Low Ambient Kit: Provide refrigerant pressure switch to cycle condenser fan on when condenser refrigerant pressure is above 285 psig and off when pressure drops below 140 psig for operation to 0 degrees F.

2.05 ACCESSORY EQUIPMENT

A. Room Thermostat: Electric solid state microcomputer based room thermostat with remote sensor to maintain temperature setting; low-voltage; with following features:
   1. System selector switch (heat-off-cool) and fan control switch (auto-on).
   2. Automatic switching from heating to cooling.
   3. Preferential rate control to minimize overshoot and deviation from setpoint.
   4. Set-up for four separate temperatures per day.
   5. Instant override of setpoint for continuous or timed period from one hour to 31 days.
   6. Short cycle protection.
   7. Programming based on every day of the week.
   8. Selection features including degree F or degree C display, 12 or 24 hour clock, keyboard disable, remote sensor, fan on-auto.
   9. Battery replacement without program loss.
   10. Thermostat display:
      a. Time of day.
      b. Actual room temperature.
      c. Programmed temperature.
      d. Programmed time.
      e. Duration of timed override.
      f. Day of week.
      g. System mode indication: heating, cooling, fan auto, off, and on, auto or on, off.
   11. Manufacturers:
      a. Matching unit manufacturer or provided by Building Automation System vendor..

NOT FOR BIDDING

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.

B. Verify that proper power supply is available and in correct location.

C. Verify that proper fuel supply is available for connection.

D. Verify that water supply is available for humidifier.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and requirements of local authorities having jurisdiction.

B. Install in accordance with NFPA 90A and NFPA 90B.

C. Provide vent connections in accordance with NFPA 211.

D. Install refrigeration systems in accordance with ASHRAE Std 15.

E. Mount counterflow furnaces installed on combustible floors on additive base.

END OF SECTION

NOT FOR BIDDING

SECTION 26 05 05
SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical demolition.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify field measurements and circuiting arrangements are as indicated.

B. Demolition drawings are based on casual field observation and existing record documents.

C. Report discrepancies to Architect before disturbing existing installation.

D. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

A. Coordinate utility service outages with utility company.

B. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove, relocate, and extend existing installations to accommodate new construction.

B. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

C. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.04 CLEANING AND REPAIR

A. See Section 01 74 19 - Construction Waste Management and Disposal for additional requirements.

B. Clean and repair existing materials and equipment that remain or that are to be reused.

C. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

D. Any lighting or ceiling-mounted devices removed during construction must be reinstalled.

END OF SECTION

NOT FOR BIDDING

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SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.
B. Metal-clad cable.
C. Wiring connectors.
D. Electrical tape.
E. Heat shrink tubing.
F. Wire pulling lubricant.

1.02 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013.
B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011.
C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010 (Reapproved 2014).
D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2014).
E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2010.
F. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2013.
G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
H. NECA 120 - Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC); 2012.
I. NEMA WC 70 - Nonshielded Power Cable 2000 V or Less for the Distribution of Electrical Energy; 2009.
J. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.
K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
L. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.
M. UL 83 - Thermoplastic-Insulated Wires and Cables; 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.

NOT FOR BIDDING

3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

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. Sustainable Design Documentation: Submit manufacturer's product data on conductor and cable showing compliance with specified lead content requirements.

D. 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.

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 routing for underground circuits.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

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 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 and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. The use of MC cable is not permitted - the only exception will be the drop from a junction box to a light fixture, where concealed. No exposed MC cable is permitted.

B. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

C. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

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. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

NOT FOR BIDDING

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductors for Grounding and Bonding: Also comply with Section 26 05 26 - Grounding and Bonding for Electrical Systems.

H. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.

I. 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.

J. Minimum Conductor Size:
   1. Branch Circuits: 12 AWG.
      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.
   2. Control Circuits: 14 AWG.

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. Isolated Ground, All Systems: Green with yellow stripe.
      e. Travelers for 3-Way and 4-Way Switching: Pink.
      f. For control circuits, comply with manufacturer's recommended color code.

2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:
   1. Copper Building Wire:
      a. Cerro Wire LLC: www.cerrowire.com/#sle.
      b. Southwire Company: www.southwire.com/#sle.
      c. Houston Wire & Cable co.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: Single conductor insulated wire.

NOT FOR BIDDING

C. Conductor Stranding:
   1. Feeders and Branch Circuits:
      a. Size 10 AWG and Smaller: Solid.
      b. Size 8 AWG and Larger: Stranded.
   2. Control Circuits: Stranded.

D. Insulation Voltage Rating: 600 V.

E. 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. Fixture Wiring Within Luminaires: Type TFFN/TFN for luminaires with labeled maximum temperature of 90 degrees C; Approved suitable type for luminaires with labeled maximum temperature greater than 90 degrees C.

2.04 METAL-CLAD CABLE

A. The use of MC cable is not permitted - the only exception will be the drop from a junction box to a light fixture, where concealed. No exposed MC cable is permitted.

B. Manufacturers:
   1. AFC Cable Systems Inc: www.afcweb.com/#sle.
   2. Encore Wire Corporation: www.encorewire.com/#sle.
   3. Southwire Company: www.southwire.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

C. 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.

D. Conductor Stranding:
   1. Size 10 AWG and Smaller: Solid.
   2. Size 8 AWG and Larger: Stranded.

E. Insulation Voltage Rating: 600 V.

F. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

G. Provide dedicated neutral conductor for each phase conductor where indicated or required.

H. Grounding: Full-size integral equipment grounding conductor.
   1. Provide additional isolated/insulated grounding conductor where indicated or required.

I. Armor: Steel, interlocked tape.

J. Provide PVC jacket applied over cable armor where indicated or required for environment of installed location.

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 26 05 26.

C. Wiring Connectors for Splices and Taps:
   1. Copper Conductors Sizes 10 and under: Use twist-on insulated spring connectors.
   2. Copper Conductors Sizes 8 and larger: Use mechanical 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.

NOT FOR BIDDING

4. Conductors for Control Circuits: Use crimped terminals for all connections.

E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

G. 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.
   1. Manufacturers:
      a. 3M: www.3m.com/#sle.
      b. Ideal Industries, Inc: www.idealindustries.com/#sle.
      c. NSI Industries LLC: www.nsiindustries.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

H. Mechanical Connectors: Provide bolted type or set-screw type.
   1. Manufacturers:
      a. Burndy: www.burndy.com.
      b. Ilsco: www.ilsco.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

I. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
   1. Manufacturers:
      a. Burndy: www.burndy.com.
      b. Ilsco: www.ilsco.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

2.06 ACCESSORIES

A. Electrical Tape:
   1. Manufacturers:
      a. 3M: www.3m.com/#sle.
      b. Plymouth Rubber Europa: www.plymouthrubber.com/#sle.
      c. Substitutions: See Section 01 60 00 - Product Requirements.
   2. 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.
      a. Product: 3 M.
      b. Substitutions: See Section 01 60 00 - Product Requirements.
   3. 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.
      a. Product: 3 M.
      b. Substitutions: See Section 01 60 00 - Product Requirements.
   4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
   5. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.
   6. Varnished Cambric Electrical Tape: Cotton cambric fabric tape, with or without adhesive, oil-primed and coated with high-grade insulating varnish; minimum thickness of 7 mil; suitable for continuous temperature environment up to 221 degrees F.
   7. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.

NOT FOR BIDDING

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
   1. Manufacturers:
      a. 3M: www.3m.com/#sle.
      b. Burndy: www.burndy.com.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

C. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.
   1. Manufacturers:
      a. 3M: www.3m.com/#sle.
      b. American Polywater Corporation: www.polywater.com/#sle.
      c. Ideal Industries, Inc: www.idealindustries.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

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 field measurements are as indicated.

E. 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 indicated as separate, combining them together in a single raceway is not permitted.

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.

NOT FOR BIDDING

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.

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.

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, electrical tape, or heat shrink tubing.
      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.
      b. For taped connections likely to require re-entering, including motor leads, first apply varnished cambric electrical tape, followed by adequate amount of rubber splicing electrical 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.

NOT FOR BIDDING

Q. Identify conductors and cables in accordance with Section 26 05 53 - Identification for Electrical Systems.

R. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00 - Firestopping.

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. See Section 01 40 00 - Quality Requirements, 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 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.

D. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

NOT FOR BIDDING

SECTION 26 05 26
GROUNDING & BONDING 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. Grounding and bonding components.

G. Provide all components necessary to complete the grounding system(s) consisting of:
   1. Existing metal underground water pipe.
   2. Metal frame of the building.
   3. Existing metal underground gas piping system.
   4. Metal underground gas piping system.

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; 2010.

C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2007.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

E. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2007.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

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 of any conflicts with or deviations from the 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 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 25 ohms.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

C. Shop Drawings:
   1. Indicate proposed arrangement for signal reference grids. Include locations of items to be bonded and methods of connection.

D. Product Data: Provide for grounding electrodes and connections.

NOT FOR BIDDING

E. Test Reports: Indicate overall resistance to ground and resistance of each electrode.

F. 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.

G. Project Record Documents: Record actual locations of components and grounding electrodes.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

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 HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience with service facilities within 100 miles of Project.

C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

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. 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.

NOT FOR BIDDING

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. 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.
5. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
6. 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 2 by 12 inches unless otherwise indicated or required.

F. Service-Supplied System Grounding:
1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.

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.
    c. Metal process piping.
8. Provide bonding for interior metal air ducts.
9. Provide bonding for metal building frame.

H. Isolated Ground System:
1. Where isolated ground receptacles or other isolated ground connections are indicated, provide separate isolated/insulated equipment grounding conductors.

NOT FOR BIDDING

2. Connect isolated/insulated equipment grounding conductors only to separate isolated/insulated equipment ground busses.
3. Connect the isolated/insulated equipment grounding conductors to the solidly bonded equipment ground bus only at the service disconnect or separately derived system disconnect. Do not make any other connections between isolated ground system and normal equipment ground system on the load side of this connection.

I. Communications Systems Grounding and Bonding:
1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
b. Raceway Size: 3/4 inch trade size unless otherwise indicated or required.
c. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:
1. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.
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 26 05 19:
1. Use insulated copper conductors unless otherwise indicated.
a. Exceptions:
1) Use bare copper conductors where installed underground in direct contact with earth.
2) Use bare copper conductors where directly encased in concrete (not in raceway).

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.
4. Manufacturers - Mechanical and Compression Connectors:
a. Advanced Lightning Technology (ALT): www.altfab.com/#sle.
b. Burndy LLC: www.burndy.com.
c. Harger Lightning & Grounding: www.harger.com/#sle.
d. Thomas & Betts Corporation: www.tnb.com/#sle.
e. Substitutions: See Section 01 60 00 - Product Requirements.

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.

2.03 MANUFACTURERS

A. Cooper Power Systems: www.cooperpower.com.

B. Framatome Connectors International: www.fciconnect.com.

NOT FOR BIDDING

C. Lightning Master Corporation: www.lightningmaster.com.

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 CONNECTORS AND ACCESSORIES

A. Mechanical Connectors: Bronze.
   1. Product: Type H manufactured by Thomas and Betts or equal.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Wire: Stranded copper.

C. Grounding Electrode Conductor: Size to meet NFPA 70 requirements.

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 shown on the drawings.

C. Verify that conditions are satisfactory for installation prior to starting work.

D. Verify existing conditions prior to beginning work.

E. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install grounding and bonding system components in a neat and workmanlike manner in accordance with NECA 1.

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 or provide ground plates.
   1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.

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 26 05 53 - Identification For Electrical Systems.

F. Provide bonding to meet requirements described in Quality Assurance.

G. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing. Each of branch circuits and feeder circuits shall have dedicated equipment grounding conductor, sharing this conductor with other grounding conductors is not permitted.

3.03 FIELD QUALITY CONTROL

A. Perform inspection in accordance with Section 01 40 00 - Quality Requirements.

NOT FOR BIDDING

B. Inspect and test in accordance with NETA STD ATS except Section 4.

C. Perform inspections and tests listed in NETA STD 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.

END OF SECTION

NOT FOR BIDDING

SECTION 26 05 29
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; 2010.

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 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 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 03 30 00 - Cast-in-Place Concrete.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

D. Installer's Qualification Statement: Include evidence of compliance with specified requirements.

E. Product Data: Provide manufacturer’s catalog data for fastening systems.

F. 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 NFPA 70.

NOT FOR BIDDING

B. Comply with applicable building code.

C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

D. Installer Qualifications for Powder-Actuated Fasteners (when specified): Certified by fastener system manufacturer with current operator's license.

E. Installer Qualifications for Field-Welding: As specified in Section 05 50 00 - Metal Fabrications.

F. 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 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 all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical 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 products for applications other than as permitted by NFPA 70 and product listing.
   6. Steel Components: Use corrosion resistant materials suitable for the 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. Materials for Metal Fabricated Supports: Comply with Section 05 50 00 - Metal Fabrications.

C. Conduit and Cable Supports: Straps, clamps, etc. suitable for the 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.
   3. Manufacturers:
      a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
      b. Erico International Corporation: www.erico.com/#sle.
      c. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
      d. Thomas & Betts Corporation: www.tnb.com/#sle.
      e. Substitutions: See Section 01 60 00 - Product Requirements.

D. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
   1. Manufacturers:

NOT FOR BIDDING

a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
b. Erico International Corporation: www.erico.com/#sle.
c. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
d. Thomas & Betts Corporation: www.tnb.com/#sle.
e. Substitutions: See Section 01 60 00 - Product Requirements.

E. 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 (Strut) Used as Raceway (only where specifically indicated): Listed and labeled as complying with UL 5B.
3. Channel Material:
a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
4. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch.
5. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.
6. Manufacturers:
a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
b. Thomas & Betts Corporation: www.tnb.com/#sle.
c. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
d. Substitutions: See Section 01 60 00 - Product Requirements.
e. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

F. 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. Single Conduit up to 1 inch (27 mm) trade size: 1/4 inch diameter.
c. Single Conduit larger than 1 inch (27 mm) trade size: 3/8 inch diameter.
d. Trapeze Support for Multiple Conduits: 3/8 inch diameter.
e. Outlet Boxes: 1/4 inch diameter.
f. Luminaires: 1/4 inch diameter.

G. 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. Powder-actuated fasteners are not permitted.
9. Hammer-driven anchors and fasteners are not permitted.
10. 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.

2.02 MANUFACTURERS

A. Thomas & Betts Corporation: www.tnb.com.

B. Threaded Rod Company: www.threadedrod.com.

C. Or Approved Equal.

NOT FOR BIDDING

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 MATERIALS

A. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.

B. Supports: Fabricated of structural steel or formed steel members; galvanized.

C. Anchors and Fasteners:
1. Do not use powder-actuated anchors.
2. Obtain permission from Architect before using powder-actuated anchors.
3. Concrete Structural Elements: Use precast inserts.
4. Steel Structural Elements: Use beam clamps.
5. Concrete Surfaces: Use self-drilling anchors or expansion anchors.
6. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use hollow wall fasteners.
7. Solid Masonry Walls: Use expansion anchors.
8. Sheet Metal: Use sheet metal screws.
9. Wood Elements: Use wood screws.

D. Formed Steel Channel:
1. Product: manufactured by [B-Line.
2. Substitutions: See Section 01 60 00 - Product Requirements.

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. Perform work in accordance with NECA 1 (general workmanship).

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, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, 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. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Conduit Support and Attachment: Also comply with Section 26 05 33.13 - Conduit.

I. Box Support and Attachment: Also comply with Section 26 05 33.16 - Boxes for Electrical Systems.

J. Interior Luminaire Support and Attachment: Also comply with Section 26 51 00 - Interior Lighting.

NOT FOR BIDDING

K. Exterior Luminaire Support and Attachment: Also comply with Section 26 56 00 - Exterior Lighting.

L. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

M. Secure fasteners according to manufacturer's recommended torque settings.

N. Remove temporary supports.

O. Identify independent electrical component support wires above accessible ceilings (only where specifically indicated or permitted) with color distinguishable from ceiling support wires in accordance with NFPA 70.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - 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

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SECTION 26 05 33.13

CONDUIT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).
B. Flexible metal conduit (FMC).
C. Liquidtight flexible metal conduit (LFMC).
D. Electrical metallic tubing (EMT).
E. Rigid polyvinyl chloride (PVC) conduit.
F. Conduit fittings.
G. Conduit, fittings and conduit bodies.

1.02 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005.
B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); 2005.
C. ANSI C80.5 - American National Standard for Electrical Rigid Aluminum Conduit (ERAC); 2005.
D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2013.
F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2003.
G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2012.
H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
I. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.
J. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
K. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.
L. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
M. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.
N. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
   4. 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.
   5. Notify Architect of any 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 is complete between outlet, junction and splicing points.

NOT FOR BIDDING

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

C. Shop Drawings:
   1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.
   2. Include proposed locations of roof penetrations and proposed methods for sealing.

D. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2 inch (53 mm) trade size and larger.

E. Project Record Documents: Accurately record actual routing of conduits larger than 2 inches.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

D. 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. Accept conduit on site. Inspect for damage.

C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

D. 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 and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:
   1. Under Slab on Grade: Use rigid PVC conduit.
   2. Exterior, Direct-Buried: Use rigid PVC conduit.
   3. Exterior, Embedded Within Concrete: Use rigid PVC conduit.
   4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit 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 elbows for bends.

D. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit.

E. Concealed Within Hollow Stud Walls: Use electrical metallic tubing (EMT).

F. Concealed Above Accessible Ceilings: Use electrical metallic tubing (EMT).

G. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit.

NOT FOR BIDDING

H. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit.

I. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit.
   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.

J. Exposed, Exterior: Use galvanized steel rigid metal conduit.

K. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit.

L. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
   1. Maximum Length: 6 feet.

M. Connections to Vibrating Equipment:
   1. Dry Locations: Use flexible metal conduit.
   2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
   3. Maximum Length: 6 feet unless otherwise indicated.
   4. Vibrating equipment includes, but is not limited to:
      a. Transformers.
      b. Motors.
      c. HVAC equipment.

N. Fished in Existing Walls, Where Necessary: Use flexible metal conduit.

2.02 CONDUIT REQUIREMENTS

A. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Minimum Conduit Size, Unless Otherwise Indicated:
   1. Branch Circuits: 3/4 inch (21 mm) trade size.
   2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
   3. Control Circuits: 1/2 inch (16 mm) trade size.
   4. Flexible Connections to Luminaires: 1/2 inch (16 mm) trade size.
   5. Underground, Interior: 3/4 inch (21 mm) trade size.
   6. Underground, Exterior: 1 inch (27 mm) trade size.

D. 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. Manufacturers:
   1. Allied Tube & Conduit: www.alliedeg.com/#sle.
   2. Republic Conduit: www.republic-conduit.com/#sle.
   3. Wheatland Tube, a Division of Zekelman Industries: www.wheatland.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
      b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.

NOT FOR BIDDING

4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 METAL CONDUIT

A. Manufacturers:
   1. Allied Tube & Conduit: www.alliedtube.com.
   2. Beck Manufacturing, Inc: www.beckmfg.com.
   3. Wheatland Tube Company: www.wheatland.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Rigid Steel Conduit: ANSI C80.1.

C. Fittings and Conduit Bodies: NEMA FB 1; material to match conduit.

2.05 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
   1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
   2. Electri-Flex Company: www.electriflex.com/#sle.
   3. International Metal Hose: www.metalhose.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. 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 to be used.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
      b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.

D. Description: Interlocked steel construction.

E. Fittings: NEMA FB 1.

F. The use of MC Cable is not permitted except for the drop from a junction box to a light fixture.

2.06 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:
   1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
   2. Electri-Flex Company: www.electriflex.com/#sle.
   3. International Metal Hose: www.metalhose.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
      b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
      c. Thomas & Betts Corporation: www.tnb.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.

2.07 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:

NOT FOR BIDDING

1. Allied Tube & Conduit: www.alliedeg.com/#sle.
2. Republic Conduit: www.republic-conduit.com/#sle.
3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
4. Or Approved Equal.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:
1. Manufacturers:
a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
c. Thomas & Betts Corporation: www.tnb.com/#sle.
d. Substitutions: See Section 01 60 00 - Product Requirements.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
4. Connectors and Couplings: Use compression (gland) or set-screw type.
a. Do not use indenter type connectors and couplings.
5. Damp or Wet Locations (where permitted): Use fittings listed for use in wet locations.
6. Embedded Within Concrete (where permitted): Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

2.08 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:
1. Cantex Inc: www.cantexinc.com/#sle.
2. Carlon, a brand of Thomas & Betts Corporation: www.carlon.com/#sle.
3. JM Eagle: www.jmeagle.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. 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.

C. 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.

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. Perform work in accordance with NECA 1 (general workmanship).

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

E. Conduit Routing:

NOT FOR BIDDING

1. Unless dimensioned, conduit routing indicated is diagrammatic.
2. When conduit destination is indicated without specific routing, determine exact routing required.
3. Conceal all 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. Arrange conduit to maintain adequate headroom, clearances, and access.
6. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
7. Arrange conduit to provide no more than 150 feet between pull points.
8. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
9. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
10. 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.
11. Group parallel conduits in the same area together on a common rack.

F. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 and Section 26 05 29 - Hangers and Supports for Electrical Systems using suitable supports and methods approved by the authority having jurisdiction.
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 conduit strap to support single surface-mounted conduit.
   a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
5. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
7. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
8. Use of spring steel conduit clips for support of conduits is not permitted.
9. Use of wire for support of conduits is not permitted.
   a. For securing conduits to studs in hollow stud walls.
   b. For suspending conduits supported by spring steel conduit clips (only where specifically indicated or permitted).

G. 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 or insulated throats at all conduit terminations to protect conductors.

NOT FOR BIDDING

7. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

H. 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. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
7. 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. Include proposed locations of penetrations and methods for sealing with submittals.
8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

I. Underground Installation:
1. Provide trenching and backfilling in accordance with Section 31 23 16.13 - Trenching.
2. Minimum Cover, Unless Otherwise Indicated or Required:
   a. Underground, Exterior: 24 inches.
   b. Under Slab on Grade: 12 inches to bottom of slab.
3. Provide underground warning tape in accordance with Section 26 05 53 - Identification for Electrical Systems along entire conduit length.

J. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Section 03 30 00 - Cast-in-Place Concrete with minimum concrete cover of 3 inches on all sides unless otherwise indicated.

K. Hazardous (Classified) Locations: Where conduits cross boundaries of hazardous (classified) locations, provide sealing fittings located as indicated or in accordance with NFPA 70.

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.
3. Where conduits are subject to earth movement by settlement or frost.

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.

NOT FOR BIDDING

N. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
   1. Where conduits pass from outdoors into conditioned interior spaces.
   2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

O. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

P. Provide grounding and bonding in accordance with Section 26 05 26 - Grounding and Bonding for Electrical Systems.

Q. Identify conduits in accordance with Section 26 05 53 - Identifications for Electrical Systems.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

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 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.

3.06 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00 - Firestopping.

B. Route conduit through roof openings for piping and ductwork wherever possible. Where separate roofing penetration is required, coordinate location and installation method with roofing installation specified in Section roofing section.

END OF SECTION

NOT FOR BIDDING

SECTION 26 05 33.16
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. Underground boxes/enclosures.

D. Wall and ceiling outlet boxes.

E. Floor boxes.

F. Pull and junction boxes.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2012.

D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013.

E. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; 2013.

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. SCTE 77 - Specification for Underground Enclosure Integrity; 2013.

I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

K. UL 508A - Industrial Control Panels; 2013.

L. 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 the work with other trades to preserve insulation integrity.
   7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
   8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

NOT FOR BIDDING

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Project Record Documents: Record actual locations and mounting heights of outlet, pull, and junction boxes on project record documents.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

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. Use shallow boxes where required by the type of wall construction.
   7. Do not use "through-wall" boxes designed for access from both sides of wall.
   8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
   9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
   10. 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.
   11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
   12. Wall Plates: Comply with Section 26 27 26 - Wiring Devices.

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:
   3. Junction and Pull Boxes Larger Than 100 cubic inches:
      a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

D. 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 12 inches.

NOT FOR BIDDING

4. Provide logo on cover to indicate type of service.
5. Applications:
6. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.
   a. Manufacturers:
      1) Hubbell Incorporated; Quazite Products: www.hubbellpowersystems.com/#sle.
      2) MacLean Highline: www.macleanhighline.com/#sle.
      3) Oldcastle Precast, Inc: www.oldcastleprecast.com/#sle.
      4) Substitutions: See Section 01 60 00 - Product Requirements.
   b. Combination fiberglass/polymer concrete boxes/enclosures are acceptable.

2.02 MANUFACTURERS

A. Appleton Electric: www.appletonelec.com.

B. Steel City: www-public.tnb.com/pub/en/brands/steel-city

C. Or Approved Equal.

D. Substitutions: Reco, Inc. See Section 01 60 00 - Product Requirements.

2.03 OUTLET BOXES

A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.
   1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch male fixture studs where required.
   2. Concrete Ceiling Boxes: Concrete type.

B. Nonmetallic Outlet Boxes: NEMA OS 2.

C. Cast Boxes: NEMA FB 1, Type FD, aluminum. Provide gasketed cover by box manufacturer. Provide threaded hubs.

D. Wall Plates for Finished Areas: As specified in Section 26 27 26 - Wiring Devices.

2.04 FLOOR BOXES

A. Floor Boxes: NEMA OS 1, fully adjustable, _4 inches deep.

B. Material: Cast metal.

C. Shape: Rectangular.

D. Service Fittings: As specified in Section 26 27 26 - Wiring Devices.

2.05 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

B. Hinged Enclosures: As specified in Section 26 27 16 - Panelboards.

C. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:
   1. Material: Galvanized cast iron; Cast Aluminum.
   2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.

D. In-Ground Cast Metal Box: NEMA 250, Type 6, outside flanged, recessed cover box for flush mounting:
   1. Material: Galvanized cast iron; Cast Aluminum.
   2. Cover: Nonskid cover with neoprene gasket and stainless steel cover screws.
   3. Cover Legend: "ELECTRIC".

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 and outlets in offices and work areas prior to rough-in.

NOT FOR BIDDING

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. Box Supports:
   1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 - Hangers and Supports for Electrical Systems 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.

E. Install boxes plumb and level.

F. 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.

G. Install boxes as required to preserve insulation integrity.

H. Underground Boxes/Enclosures:
   1. Install enclosure on gravel base, minimum 6 inches deep.
   2. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.

I. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

J. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00 - Firestopping.

K. Close unused box openings.

L. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

M. Provide grounding and bonding in accordance with Section 26 05 26 - Grounding and Bonding for Electrical Systems.

N. Identify boxes in accordance with Section 26 05 53 - Identification for Electrical Systems.

O. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1.

P. Install in locations as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and as required by NFPA 70.

Q. Set wall mounted boxes at elevations to accommodate mounting heights indicated.

R. Electrical boxes are shown on Drawings in approximate locations unless dimensioned.
   1. Adjust box locations up to 10 feet if required to accommodate intended purpose.

S. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26 - Wiring Devices.

T. Maintain headroom and present neat mechanical appearance.

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U. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

V. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

W. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00 - Firestopping.

X. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

Y. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.

Z. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

AA. Use flush mounting outlet box in finished areas.

AB. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

AC. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches separation. Provide minimum 24 inches separation in acoustic rated walls.

AD. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

AE. Use stamped steel bridges to fasten flush mounting outlet box between studs.

AF. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

AG. Use adjustable steel channel fasteners for hung ceiling outlet box.

AH. Do not fasten boxes to ceiling support wires.

AI. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.

AJ. Use gang box where more than one device is mounted together. Do not use sectional box.

AK. Use gang box with plaster ring for single device outlets.

AL. Use cast outlet box in exterior locations exposed to the weather and wet locations.

AM. Use cast floor boxes for installations in slab on grade; formed steel boxes are acceptable for other installations.

AN. Set floor boxes level.

AO. Large Pull Boxes: Use hinged enclosure in interior dry locations, surface-mounted cast metal box in other locations.

3.03 ADJUSTING

A. Adjust floor boxes flush with finish flooring material.

B. Adjust flush-mounting outlets to make front flush with finished wall material.

C. Install knockout closures in unused box openings.

3.04 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.05 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

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SECTION 26 05 53
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.

1.02 REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011.
B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011.
C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
D. 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. See Section 01 30 00 - Administrative Requirements for submittals procedures.
B. Product Data: Provide catalog data for nameplates, labels, and markers.
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.

1.06 EXTRA MATERIALS

A. See Section 01 60 00 - Product Requirements for additional requirements.

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 power source and circuit number. Include location when not within sight of equipment.
         2) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
      b. Panelboards:
         1) Identify voltage and phase.

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2) Identify power source and circuit number. Include location when not within sight of equipment.
3) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
4) 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.
3) Identify load(s) served. Include location when not within sight of equipment.

2. Service Equipment:
a. Use identification nameplate to identify each service disconnecting means.

3. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.

4. 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. Industrial control panels.
c. Motor control centers.
d. Elevator control panels.
e. Industrial machinery.

5. Arc Flash Hazard Warning Labels: Comply with Section 26 05 73.

6. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.

B. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
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.

C. Identification for Devices:
1. Identification for Communications Devices: Comply with Section 27 10 05.
2. Wiring Device and Wallplate Finishes: Comply with Section 26 27 26.
3. Use identification label to identify fire alarm system devices.
4. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.

D. Identification for Luminaires:
1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.

NOT FOR BIDDING

2.02 MANUFACTURERS

A. Brady Corporation: www.bradycorp.com.

B. Seton Identification Products: www.seton.com/aec.

C. HellermannTyton: www.hellermanntyton.com.

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 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. Equipment designation or other approved description.
   3. Text: All capitalized unless otherwise indicated.
   4. Minimum Text Height:
      a. Equipment Designation: 1/2 inch.
   5. Color:
      a. Normal Power System: White text on black background.
      b. Emergency Power System: White text on red background.

D. 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.

E. 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.

F. 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.

NOT FOR BIDDING

4. Minimum Text Height: 3/16 inch.
5. Color: Red text on white background.

G. Nameplates: Engraved three-layer laminated plastic, black letters on white background.

H. Locations:
1. Each electrical distribution and control equipment enclosure.
2. Communication cabinets.
3. Disconnect switches, and starters.

I. Letter Size:
1. Use 1/8 inch letters for identifying individual equipment and loads.
2. Use 1/4 inch letters for identifying grouped equipment and loads.

2.04 WIRE AND CABLE MARKERS

A. Manufacturers:
1. Brady Corporation: www.bradyid.com/#sle.
2. HellermannTyton: www.hellermanntyton.com/#sle.
3. Panduit Corp: www.panduit.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. 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.

C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

D. Legend: Power source and circuit number or other designation indicated.

E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

F. Minimum Text Height: 1/8 inch.

G. Color: Black text on white background unless otherwise indicated.

H. Description: split sleeve type wire markers.

I. Locations: Each conductor at panelboard gutters, pull boxes, outlet boxes, and junction boxes each load connection.

J. Legend:
1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.
2. Control Circuits: Control wire number indicated on shop drawings.

2.05 VOLTAGE MARKERS

A. Manufacturers: Panduit Corp
1. Brady Corporation: www.bradyid.com/#sle.
2. Brimar Industries, Inc: www.brimar.com/#sle.
3. Seton Identification Products: www.seton.com/#sle.
4. Panduit Corp: www.panduit.com/#sle..
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. 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.

C. Legend:
1. Markers for Voltage Identification: Highest voltage present.
2. Markers for System Identification:
a. Emergency Power System: Text "EMERGENCY".
b. Other Systems: Type of service.

NOT FOR BIDDING

D. Color: Black text on orange background unless otherwise indicated.

E. Location: Furnish markers for each conduit longer than 6 feet.

F. Spacing: 20 feet on center.

G. Color:
   1. 480 Volt System: Brown.
   2. 208 Volt System: Yellow.
   3. Fire Alarm System: Red.

H. Legend:
   1. 480 Volt System: brown.
   2. 208 Volt System: yellow.
   3. Fire Alarm System: red.

2.06 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:
   1. Materials:
   2. 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. Elevated Equipment: Legible from the floor or working platform.
   5. Branch Devices: Adjacent to device.
   6. Interior Components: Legible from the point of access.
   7. Conductors and Cables: Legible from the point of access.
   8. 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. Mark all handwritten text, where permitted, to be neat and legible.

END OF SECTION

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SECTION 26 05 73
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; 2011.

B. IEEE 141 - IEEE Recommended Practice for Electrical 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; 2017.

H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

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; 2015.

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 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.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Study reports, stamped or sealed and signed by study preparer.

C. Certification that field adjustable protective devices have been set in accordance with requirements of studies.

1.05 POWER SYSTEM STUDIES

A. Scope of Studies:

NOT FOR BIDDING

1. 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).
2. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.

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. Generators: Include manufacturer/model, kW and voltage ratings, and impedance.
   c. 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.
   d. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.
   e. 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).
   f. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.
   g. 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).
3. Analyze protective devices and associated settings for suitable margins between time-current curves to achieve full selective coordination while providing adequate protection for equipment and conductors.

F. Arc Flash and Shock Risk Assessment:

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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.
3. 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.
      7) Capacitors: Full load current 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.

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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 minimum five years experience in the preparation of studies of similar type and complexity using specified computer software.

B. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.

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 26 05 53.
2. 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 the following information:
1) Arc flash boundary.
2) Available incident energy and corresponding working distance.
3) Nominal system voltage.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install arc flash warning labels in accordance with Section 26 05 53.

3.02 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

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 of any conflicts with or deviations from studies. Obtain direction before proceeding.

END OF SECTION

NOT FOR BIDDING

SECTION 26 05 83
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 (R 2010).

B. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2012.

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. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

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.

1.06 COORDINATION

A. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.

B. Determine connection locations and requirements.

C. Sequence rough-in of electrical connections to coordinate with installation of equipment.

D. Sequence electrical connections to coordinate with start-up of equipment.

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.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Disconnect Switches: As specified in Section 26 28 16.16 - Enclosed Switches and in individual equipment sections.

NOT FOR BIDDING

C. Wiring Devices: As specified in Section 26 27 26 - Wiring Devices.

D. Flexible Conduit: As specified in Section 26 05 33.13 - Conduit.

E. Wire and Cable: As specified in Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

F. Boxes: As specified in Section 26 05 33.16 - Boxes for Electrical Systems.

2.02 EQUIPMENT CONNECTIONS

A. As required by equipment manufacturer:

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.

END OF SECTION

NOT FOR BIDDING

SECTION 26 09 23

LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Occupancy sensors.

B. Outdoor motion sensors.

C. Outdoor photo controls.

D. Lighting contactors.

1.02 REFERENCE STANDARDS

A. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2010.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

C. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

E. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).

F. NEMA ICS 6 - Industrial Control and Systems: Enclosures; 1993 (R2011).

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control; Current Edition, Including All Revisions.

I. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

J. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules; Current Edition, Including All Revisions.

K. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contractors and Motor-starters - Electromechanical Contractors and Motor-starters; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
   2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
   3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
   4. Notify Architect of any conflicts or deviations from the 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 Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

C. Field Quality Control Reports.

NOT FOR BIDDING

D. 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.

E. Operation and Maintenance Data: Include detailed information on device programming and setup.

F. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.05 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

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 PROTECTION

A. Store products in a 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 Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 ALL LIGHTING CONTROL DEVICES

A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

2.02 OCCUPANCY SENSORS

A. Manufacturers:
1. Legrand North America, Inc; _____: www.legrand.us/#sle.
2. Hubbell Building Automation, Inc: www.hubbellautomation.com
3. Lutron Electronics Company, Inc: www.lutron.com/#sle.
4. Sensor Switch Inc: www.sensorswitch.com/#sle.
5. WattStopper: www.wattstopper.com/#sle.
6. Substitutions: See Section 01 60 00 - Product Requirements.
7. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. All Occupancy Sensors:
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 (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.

NOT FOR BIDDING

b. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.

3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
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 an 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. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
7. Sensitivity: Field adjustable.
8. Adaptive Technology: Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.
9. 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.
10. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on drawings.

C. Wall Switch Occupancy Sensors:
1. All Wall Switch Occupancy Sensors:
a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual 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: 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 the delayed-off time interval.
2. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.
a. Products:
1) Hubbell Building Automation.
2) Watt Stopper.
3) Sensor switch.
4) Substitutions: See Section 01 60 00 - Product Requirements.

D. 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 a field of view of 180 degrees, integrated dimming control capability , and no leakage current to load in off mode.
b. 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 the delayed-off time interval.
c. 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.
d. Provide field adjustable dimming preset for occupied state.

E. Ceiling Mounted Occupancy Sensors:
1. All Ceiling Mounted Occupancy Sensors:
a. Description: Low profile occupancy sensors designed for ceiling installation.

NOT FOR BIDDING

b. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.
c. Provide field selectable setting for disabling LED motion detector visual indicator.
d. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
e. Finish: White unless otherwise indicated.

2. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
   a. Standard Range Sensors: Capable of detecting motion within an area of 2000 sqft at a mounting height of 9 feet, with a field of view of 360 degrees.
      1) Products:
         (a) Hubbell Building Automation.
         (b) Sensor Switch.
         (c) Watt Stopper.
         (d) Substitutions: See Section 01 60 00 - Product Requirements.

F. 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. Standard Range Sensors: Capable of detecting motion within distance of 40 feet at mounting height of 10 feet.

G. 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:
      a. Incandescent Load: Not less than 15 A.
      b. Fluorescent Load: Not less than 20 A.
      c. Motor Load: Not less than 1 HP.

2.03 OUTDOOR MOTION SENSORS

A. Description: Factory-assembled wet location listed device suitable for wall or ceiling/eave mounting, with integral swivel for field adjustment of coverage, capable of detecting motion for automatic control of load indicated.

B. Sensor Technology: Passive Infrared (PIR) designed to detect occupancy by sensing movement of thermal energy between zones.

C. Operation: Unless otherwise indicated, motion sensor to turn load on when motion is detected and to turn load off when no motion is detected during an adjustable turn-off delay time interval.

D. Turn-Off Delay: Field adjustable, with time delay settings available up to 15 minutes.

E. Integral Photocell: For dusk to dawn operation.

F. Manual Override: Activated by switching power off to unit and then back on.

G. Load Rating: 1,000 W incandescent and fluorescent load at 120 V ac.

H. Coverage: Capable of detecting motion within a distance of 50 feet at a mounting height of 8 feet, with a field of view of 270 degrees.

2.04 OUTDOOR PHOTO CONTROLS

A. Manufacturers:
   1. Intermatic, Inc: www.intermatic.com/#sle.
   2. Paragon, a brand of Invensys Controls: www.invensyscontrols.com.
   3. Tork, a division of NSI Industries LLC: www.tork.com/#sle.

NOT FOR BIDDING

4. Substitutions: See Section 01 60 00 - Product Requirements.

B. 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 the load indicated on the drawings.
7. Failure Mode: Fails to the on position.
8. Load Rating: As required to control the load indicated on the drawings.
9. Provide accessory wall-mounting bracket where indicated or as required to complete installation.

2.05 LIGHTING CONTACTORS

A. Manufacturers:
1. ABB; _____: www.electrification.us.abb.com/#sle.
2. Eaton Corporation; _____: www.eaton.com/#sle.
3. Schneider Electric; _____: www.se.com/#sle.
4. Siemens Industry, Inc; _____: www.new.siemens.com/#sle.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: Magnetic lighting contactors complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; noncombination type unless otherwise indicated; ratings, configurations and features as indicated on the drawings.

C. 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.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

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 the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the 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.

NOT FOR BIDDING

3.03 INSTALLATION

A. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Install lighting control devices in accordance with manufacturer's instructions.

C. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

D. Install lighting control devices plumb and level, and held securely in place.

E. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 27 26.

F. Provide required supports in accordance with Section 26 05 29.

G. 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.

H. Identify lighting control devices in accordance with Section 26 05 53.

I. Occupancy Sensor Locations:
   1. Location Adjustments: Do not make adjustments to locations without obtaining approval from the Architect.
   2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a 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.

J. 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 the photo control itself.

K. 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 the photo control.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect each lighting control device for damage and defects.

C. Test outdoor photo controls to verify proper operation, including time delays where applicable.

D. Correct wiring deficiencies and replace damaged or defective 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.

C. Adjust position of directional occupancy sensors and outdoor motion 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.

NOT FOR BIDDING

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. Demonstration: Demonstrate proper operation of lighting control devices to Architect, and correct deficiencies or make adjustments as directed.

C. 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.

END OF SECTION

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SECTION 26 22 00

LOW-VOLTAGE TRANSFORMERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General purpose transformers.

1.02 REFERENCE STANDARDS

A. IEEE C57.94 - IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type General Purpose Distribution and Power Transformers; 1982 (R2006).

B. IEEE C57.96 - Guide for Loading Dry-Type Distribution and Power Transformers; 2013.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

D. NECA 409 - Standard for Installing and Maintaining Dry-Type Transformers; 2009.

E. NEMA ST 1 - Specialty Transformers (Except General Purpose Type); National Electrical Manufacturers Association; 1988 (R1997).

F. NEMA ST 20 - Dry-Type Transformers for General Applications; 2014.

G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 506 - Standard for Specialty Transformers; Current Edition, Including All Revisions.

K. 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 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.

C. NEMA TR-1/ANSI 57.12.51 and 57.12.50

D. Federal Register - US department of Energy, Office of Energy Efficiency and Renewable Energy, 10 CFR Part 30, July 29, 2004. Energy Conservation Program for Commercial and Industrial Equipment, Energy Conservaiton Standards for Distribution Transformers, Proposed Rule.

E. ANSI/ASHRAE/IESNA 90.1 - Energy Efficient Design on New Buildings Except Low- Rise Residential Buildings.
   1. Transformer selection based on optimizing the combination of no-load, part-load, and full-load losses without compromising operational and reliability requirements for the building.

F. ANSI/NEMA TP-1 - Guide for Determining Energy Efficiency for Distribution Transformers.

NOT FOR BIDDING

1. For Reference only. US DOE deos not consider NEMA TP-1 efficiency levels to reflect low life cycle cost.

G. ANSI/NEMA TP-2 - Standard Test Method for Measuring Energy Consumption of Distribution Transformers.

H. IEEE C57.110-1998 - IEEE Recommended Practice for establishing transformer capability when feeding nonsinusoidal load currents.
1. Transformers losses increase in proportion to the mix of electronic equipment in the overall load fed from transformer.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

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. Provide linear load efficiency data at 25 %, 35%, 50 %, 75 % , and 100 % full load.
1. Vibration Isolators: Include attachment method and rated load and deflection.

D. Shop Drawings: Provide dimensioned plan and elevation views of transformers and adjacent equipment with all required clearances indicated.

E. Product Data: Provide outline and support point dimensions of enclosures and accessories, unit weight, voltage, kVA, and impedance ratings and characteristics, tap configurations, insulation system type, core and coil material and rated temperature rise.

F. Test Reports: Indicate loss data, efficiency at 0, 25, 50, 75 and 100 percent rated load, and sound level.

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, and installation of product.

H. Maintenance Data: Include recommended maintenance procedures and intervals.

I. Project Record Documents: Record actual locations of transformers.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

E. 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 the following maximum temperatures during and after installation of transformers.
1. Greater than 10 kVA: 104 degrees F maximum.

NOT FOR BIDDING

2. Less than 10 kVA: 77 degrees F maximum.

B. 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.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Schneider Electric; Square D Products; Premium 30 energy efficient: www.schneider-electric.us/#sle.

B. Eaton Electrical/Cutler-Hammer: www.eatonelectrical.com.

C. GE Industrial: www.geindustrial.com.

D. Powersmiths International Corp.

E. Substitutions: See Section 01 60 00 - Product Requirements.

F. Source Limitations: Furnish transformers produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 TRANSFORMERS - GENERAL REQUIREMENTS

A. Description: High performance,energy efficient, copper wound transformer with 30 % less loses than NEMA TP_1 . Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

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.

2.03 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 4 wire.

D. Insulation System and Allowable Average Winding Temperature Rise:

NOT FOR BIDDING

1. 15 kVA and Larger: Class 220 degrees C insulation system with 115 degrees C average winding temperature rise.

E. Coil Conductors: Continuous copper windings with terminations brazed or welded.

F. Winding Taps:
1. Less than 3 kVA: None.
2. 3 kVA through 15 kVA: Two 5 percent full capacity primary taps below rated voltage.
3. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.
4. 500 kVA and Larger: Two 2.5 percent full capacity primary taps above and two 2.5 percent full capacity primary taps below rated voltage.

G. Energy Efficiency: DOE 2016 energy efficiency levels.

H. Sound Levels: Low sound levels at least 5 db less than NEMA ST 20 standard sound levels.

I. Mounting Provisions:
1. Less than 15 kVA: Suitable for wall mounting.
2. 15 kVA through 75 kVA: Suitable for wall, floor, or trapeze mounting.
3. 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 2.
   b. Outdoor locations: Type 3R.
2. Construction: Steel.
   a. Less than 15 kVA: Totally enclosed, non-ventilated.
   b. 15 kVA and Larger: Ventilated.
3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
4. Provide lifting eyes or brackets.

K. Accessories:
1. Lug Kits: Sized as required for termination of conductors as indicated on the drawings.

L. Primary Voltage: 480 volts, 3 phase.

M. Secondary Voltage: 208Y/120 volts, 3 phase.

N. Insulation system and average winding temperature rise for rated kVA as follows:
1. 1-15 kVA: Class 185 with 115 degrees C rise, in a 40 C ambient setting.
2. 16-500 kVA: Class 220 with 115 degrees C rise, in a 40 C ambient setting.

O. Case Temperature: Do not exceed 35 degrees C rise above ambient at warmest point at full load.

P. Winding Taps:
1. Transformers Less than 15 kVA: Two 5 percent below rated voltage, full capacity taps on primary winding.
2. Transformers 15 kVA and Larger: Two 2-1/2% full capacity taps above and below normal primary voltage.

Q. Sound Levels: NEMA ST 20.

R. Energy Standard
1. Efficiency at 50% load is at least 0.9% higher than NEMA TP-1 for transformers up to 750 KVA.

S. Basic Impulse Level: 10 kV

T. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

U. Mounting:
1. 1-15 kVA: Suitable for wall mounting.

NOT FOR BIDDING

2. 16-75 kVA: Suitable for wall mounting.
3. Larger than 75 kVA: Suitable for floor mounting.

V. Coil Conductors: Continuous copper windings with terminations brazed or welded.

W. Transformer Enclosure: NEMA ST 20.
1. Type 1.
2. Ventilated.
3. Provide lifting eyes or brackets.
4. All terminals, including those for changing taps, must be readily accessible by removing front cover plates.

X. Isolate core and coil from enclosure using vibration-absorbing mounts.

Y. Nameplate: Include transformer connection data and overload capacity based on rated allowable temperature rise.

2.04 SOURCE QUALITY CONTROL

A. Factory test transformers according to NEMA ST 20.

B. Production test each unit 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 26 05 33.13 - Conduit, 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 26 05 29 - Hangers and Supports for Electrical Systems, 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 Section 03 30 00 - Cast-in-Place Concrete.
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. Set transformers plumb and level.

I. Use flexible conduit, under the provisions of Section 26 05 33.13 - Conduit, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

NOT FOR BIDDING

J. Mount wall-mounted transformers using integral flanges or accessory brackets furnished by the manufacturer.

K. Mount floor-mounted transformers on properly sized 4 inch high concrete pad constructed in accordance with Section 03 30 00 - Cast-in-Place Concrete.

L. Mount floor-mounted transformers using vibration isolators suitable for isolating the transformer noise from the building structure.

M. Mount floor-mounted transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure.

N. Mount trapeze-mounted transformers as indicated.

O. Provide seismic restraints.

P. Provide grounding and bonding in accordance with Section 26 05 26 - Grounding and Bonding for Electrical Systems.

Q. 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.

R. Where not factory-installed, install lugs sized as required for termination of conductors as indicated.

S. Identify transformers in accordance with Section 26 05 53 - Identification for Electrical Systems.

T. Install transformer identification nameplate in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Perform field inspection, testing, and adjusting in accordance with Section 01 40 00 - Quality Requirements.

C. Inspect and test in accordance with NETA STD ATS, except Section 4.

D. Perform inspections and tests listed in NETA STD ATS, Section 7.2.1.1. In addition to the basic requirements of Section 7.2, include the following:
   1. Perform turns ratio tests at all tap positions.
   2. Verification that as-left tap connections are as specified.
   3. Perform excitation-current tests on each phase.
   4. Measure the resistance of each winding at each tap connection.
   5. Overpotential 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

NOT FOR BIDDING

SECTION 26 24 16
PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.02 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; Federal Specification; Revision E, 2013.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2009.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

E. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).

F. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

G. NEMA PB 1 - Panelboards; 2011.

H. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; 2013.

I. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

L. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

M. UL 67 - Panelboards; Current Edition, Including All Revisions.

N. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

O. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

P. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

Q. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

R. 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 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.

NOT FOR BIDDING

5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
   1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.

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.
   1. Include wiring diagrams showing all factory and field connections.
   2. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.

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. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

F. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Panelboard Keys: Two of each different key.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

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 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.

1.08 MAINTENANCE MATERIALS

A. See Section 01 60 00 - Product Requirements, for additional provisions.

B. Furnish two of each panelboard key.

NOT FOR BIDDING

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of design: Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

B. General Electric Company: www.geindustrial.com/#sle.

C. Eaton Corporation: www.eaton.com/#sle.

D. Substitutions: See Section 01 60 00 - Product Requirements.

E. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this 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 indicated on the drawings.
   2. Listed series ratings are acceptable, except where not permitted by motor contribution according to NFPA 70.
   3. Label equipment utilizing series ratings as required by NFPA 70.

D. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

E. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

F. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

G. 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.
   3. Provide separate isolated/insulated ground bus where indicated or where isolated grounding conductors are provided.

H. Conductor Terminations: Suitable for use with the conductors to be installed.

I. 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. Boxes: Galvanized steel unless otherwise indicated.
      a. Provide wiring gutters sized to accommodate the conductors to be installed.
      b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
   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.

NOT FOR BIDDING

d. Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable continous hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.

4. Lockable Doors: All locks keyed alike unless otherwise indicated.
5. Metal frame for type written directory

J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

K. Panelboard Contactors: Where panelboard contactors are indicated, provide electrically operated, mechanically held magnetic contactor complying with NEMA ICS 2.
1. Ampere Rating: Not less than ampere rating of panelboard bus.
2. Short Circuit Current Rating: Not less than the panelboard short circuit current rating.
3. Coil Voltage: As required for connection to control system indicated.

L. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.
1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.

M. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

N. Load centers are not acceptable.

O. Provide the following features and accessories where indicated or where required to complete installation:
1. Feed-through lugs.
2. Sub-feed lugs.

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. Products:
1. SQ D .
2. General Electric.
3. Eaton Cutler Hammer.
4. Substitutions: See Section 01 60 00 - Product Requirements.

C. Conductor Terminations:
1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
2. Main and Neutral Lug Type: Mechanical.

D. Bussing:
1. Phase and Neutral Bus Material: Copper.
2. Ground Bus Material: Copper.

E. Circuit Breakers:
1. Provide bolt-on type or plug-in type secured with locking mechanical restraints.
2. Provide thermal magnetic circuit breakers unless otherwise indicated.
3. Provide electronic trip circuit breakers where indicated.

F. Enclosures:
1. Provide surface-mounted enclosures unless otherwise shown or indicated.
2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable continous hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide metal circuit directory holder mounted on inside of door.

G. Manufacturers:
1. SQ.D or Equal.

NOT FOR BIDDING

2. Substitutions: See Section 01 60 00 - Product Requirements.

H. Description: NEMA PB 1, circuit breaker type.

I. Service Conditions:
1. Altitude: 1000 feet.
2. Temperature: 55 degrees F.

J. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard.

K. Minimum integrated short circuit rating: As indicated.
1. 240 Volt Panelboards: 14,000 amperes rms symmetrical (minimum).
2. 480 Volt Panelboards: 21,000 amperes rms symmetrical (minimum).

L. Molded Case Circuit Breakers: With integral thermal and instantaneous magnetic trip in each pole; UL listed. For air conditioning equipment branch circuits provide circuit breakers UL listed as Type HACR.

M. Molded Case Circuit Breakers with Current Limiters: With replaceable current limiting elements, in addition to integral thermal and instantaneous magnetic trip in each pole; UL listed.

N. Current Limiting Molded Case Circuit Breakers: With integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole: UL listed. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.

O. Circuit Breaker Accessories: Trip units and auxiliary switches as indicated.

P. Enclosure: NEMA PB 1, Type 1, 5 34" deep, 20" wide, cabinet box. With continued hinge and lock.

2.04 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Products:
1. SQD.
2. General Electric.
3. Eaton Cutler Hammer.
4. Substitutions: See Section 01 60 00 - Product Requirements.

C. Conductor Terminations:
1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
2. Main and Neutral Lug Type: Mechanical.

D. Bussing:
1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
2. Phase and Neutral Bus Material: Copper.
3. Ground Bus Material: Copper.

E. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

F. Enclosures:
1. Provide surface-mounted or flush-mounted enclosures as indicated.
2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable continous hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide metal circuit directory holder mounted on inside of door.

G. Manufacturers:
1. SQ.D or Equal.
2. Substitutions: See Section 01 60 00 - Product Requirements.

H. Description: NEMA PB1, circuit breaker type, lighting and appliance branch circuit panelboard.

NOT FOR BIDDING

I. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard; provide insulated ground bus where scheduled.

J. Minimum Integrated Short Circuit Rating: As indicated.
   1. 240 Volt Panelboards: 14,000 amperes rms symmetrical (minimum).
   2. 480 Volt Panelboards: 21,000 amperes rms symmetrical (minimum).

K. Molded Case Circuit Breakers: Thermal magnetic trip circuit breakers, bolt-on type, with common trip handle for all poles; UL listed.
   1. Type SWD for lighting circuits.
   2. Type HACR for air conditioning equipment circuits.
   3. Class A ground fault interrupter circuit breakers where scheduled.
   4. Do not use tandem circuit breakers, or miniature circuit breakers.

L. Enclosure: NEMA PB 1, Type 1.

M. Cabinet Box: 6 inches deep, 20 inches wide for 240 volt and less panelboards, 20 inches wide for 480 volt panelboards.

N. Cabinet Front: Flush or Surface cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.

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, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on 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) 14000 rms symmetrical amperes at 240 VAC or 208 VAC.
         2) 21000 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.
      c. Series Rated Systems: Provide circuit breakers listed in combination with upstream devices to provide interrupting rating not less than the short circuit current rating indicated.
   3. Conductor Terminations:
      a. Provide mechanical lugs unless otherwise indicated.
      b. Lug Material: Copper, suitable for terminating copper conductors only.
   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 larger than 225 amperes.
      b. Provide interchangeable trip units where indicated.
   5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
      a. Provide the following field-adjustable trip response settings:
         1) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
         2) Long time delay.
         3) Short time pickup and delay.
         4) Instantaneous pickup.
         5) Ground fault pickup and delay where ground fault protection is indicated.
   6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
   7. Provide the following circuit breaker types where indicated:

NOT FOR BIDDING

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. 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. Provide listed switching duty rated circuit breakers with SWD marking where indicated.
9. Provide listed high intensity discharge lighting rated circuit breakers with HID marking where indicated.
10. Do not use tandem circuit breakers.
11. Do not use handle ties in lieu of multi-pole circuit breakers.

2.06 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. 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 26 05 29 - Hangers and Supports for Electrical Systems.

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 Section 03 30 00 - Cast-in-Place Concrete.

J. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

K. Provide grounding and bonding in accordance with Section 26 05 26 - Grounding and Bonding for Electrical Systems.
1. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on isolated/insulated ground bus.
2. Terminate branch circuit isolated grounding conductors on isolated/insulated ground bus only. Do not terminate on solidly bonded equipment ground bus.

L. Install all field-installed branch devices, components, and accessories.

M. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 26 05 73.

NOT FOR BIDDING

N. Install panelboards in accordance with NEMA PB 1.1 and NECA 1.

O. Install panelboards plumb. Install recessed panelboards flush with wall finishes, where installed surface mounted secure or anchor panelboard to brick or cinder block wall.

P. Height: 6 feet to top of panelboard; install panelboards taller than 6 feet with bottom no more than 4 inches above floor.

Q. Provide filler plates to cover unused spaces in panelboards.

R. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
   1. Emergency and night lighting circuits.
   2. Fire detection and alarm circuits.
   3. Communications equipment circuits.
   4. Intrusion detection and access control system circuits.
   5. Video surveillance system circuits.

S. Identify panelboards in accordance with Section 26 05 53 - Identification for Electrical Systems.

T. Provide computer-generated circuit directory for each lighting and appliance panelboard and each power distribution panelboard provided with a door, clearly and specifically indicating the loads served. Identify spares and spaces.

U. Provide identification nameplate for each panelboard in accordance with Section 26 0553.

V. Provide arc flash warning labels in accordance with NFPA 70.

W. Provide spare conduits out of each recessed panelboard to an accessible location above ceiling. Identify each as SPARE.
   1. Minimum spare conduits: 5 empty 1 inch.

X. Ground and bond panelboard enclosure according to Section 26 05 26 - Grounding and Bonding for Electrical Systems.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Perform inspection, testing, and adjusting in accordance with Section 01 40 00 - Quality Requirements.

C. Perform field inspection and testing in accordance with Section 01 40 00 - Quality Requirements.

D. Inspect and test in accordance with NETA ATS, except Section 4.

E. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

F. Test GFCI circuit breakers to verify proper operation.

G. Test shunt trips to verify proper operation.

H. 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.

I. Correct deficiencies and replace damaged or defective panelboards or associated components.

J. Perform inspections and tests listed in NETA STD ATS, Section 7.5 for switches, Section 7.6 for circuit breakers.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

NOT FOR BIDDING

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

NOT FOR BIDDING

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SECTION 26 27 26
WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall switches.

B. Wall dimmers.

C. Receptacles.

D. Wall plates.

1.02 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; Federal Specification; Revision G, 2001.

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); Federal Specification; Revision F, 1999.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R 2010).

F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2012.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.

I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.

J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.

K. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

L. UL 1472 - Solid-State Dimming Controls; 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. Notify Architect 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 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

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.

NOT FOR BIDDING

D. Operation and Maintenance Data:
   1. GFCI Receptacles: Include information on status indicators.

E. Project Record Documents: Record actual installed locations of wiring devices.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Wall Plates: One of each style, size, and finish.
   3. Extra Flush Floor Service Fittings: Two of each type.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Products: Listed, classified, and labeled as suitable for the purpose intended.

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 PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

1.07 EXTRA MATERIALS

A. See Section 01 6000 - Product Requirements, for additional provisions.

B. Furnish two of each style, size, and finish wall plate.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hubbell Incorporated; : www.hubbell-wiring.com.

B. Leviton Manufacturing Company, Inc; : www.leviton.com.

C. Lutron Electronics Company, Inc: www.lutron.com.

D. Pass & Seymour, a brand of Legrand North America, Inc; : www.legrand.us

E. Cooper Wiring Devices: www.cooperwiringdevices.com.

F. Substitutions: See Section 01 60 00 - Product Requirements.

G. Source Limitations: Where possible, for each type of wiring device furnish products produced by a single manufacturer and obtained from a single supplier.

2.02 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.

D. Provide GFCI protection for receptacles installed within 6 feet of sinks.

E. Provide GFCI protection for receptacles serving electric drinking fountains.

F. Unless noted otherwise, do not use combination switch/receptacle devices.

G. For flush floor service fittings, use carpet flanges for installations in carpeted floors.

NOT FOR BIDDING

2.03 ALL WIRING DEVICES

A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.04 WALL SWITCHES

A. Manufacturers:
   1. Hubbell Incorporated; : www.hubbell-wiring.com.
   2. Leviton Manufacturing Company, Inc; : www.leviton.com/#sle.
   3. Pass & Seymour, a brand of Legrand North America, Inc; : www.legrand.us/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
   1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

C. Standard Wall Switches: Commercial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

D. Wall Switches: Heavy Duty, AC only general-use snap switch, complying with NEMA WD 6 and WD 1.
   1. Body and Handle: _____ plastic with toggle handle. Finish to be selected by architect.
   2. Ratings:
      a. Voltage: 120 - 277 volts, AC.
      b. Current: 20 amperes.
   3. Ratings: Match branch circuit and load characteristics.

E. Switch Types: Single pole, double pole, 3-way, and 4-way.

2.05 WALL DIMMERS

A. Manufacturers:
   1. Leviton Manufacturing Company, Inc; _____: www.leviton.com/#sle.
   2. Lutron Electronics Company, Inc; Maestro Series: www.lutron.com.
   3. Pass & Seymour, a brand of Legrand North America, Inc; _____: www.legrand.us/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Wall Dimmers - General Requirements: 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, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

C. Control: Slide control type with separate on/off switch.

2.06 RECEPTACLES

A. Manufacturers:
   1. Hubbell Incorporated; : www.hubbell-wiring.com.
   2. Leviton Manufacturing Company, Inc; : www.leviton.com/#sle.
   3. Pass & Seymour, a brand of Legrand North America, Inc; : www.legrand.us/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; 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:

NOT FOR BIDDING

1. Standard Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R, tamper resistant; single or duplex as indicated on the drawings.
   a. Products:
      1) Hubbell Wiring Devices.
      2) Leviton.
      3) Pass & Saymore.
      4) Substitutions: See Section 01 60 00 - Product Requirements.
2. Isolated Ground Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R, tamper resistant, with ground contacts isolated from mounting strap; isolated ground triangle mark on device face; single or duplex as indicated on the drawings.
3. Weather Resistant Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R, tamper resistant, 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.
2. Standard GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, tamper resistant.
3. Weather Resistant GFCI Receptacles: Commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, tamper resistant, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.

E. Receptacles: Heavy duty, complying with NEMA WD 6 and WD 1.
1. Device Body: _____ plastic. Finish to be selected by architect.
2. Configuration: NEMA WD 6, type as specified and indicated.

F. Convenience Receptacles: Type 5 - 20.

G. Single Convenience Receptacles.

H. Duplex Convenience Receptacles.

I. GFCI Receptacles: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

2.07 WALL PLATES

A. Manufacturers:
1. Hubbell Incorporated; : www.hubbell-wiring.com/#sle.
2. Leviton Manufacturing Company, Inc; : www.leviton.com/#sle.
3. Pass & Seymour, a brand of Legrand North America, Inc; : www.legrand.us/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Wall Plates: Comply with UL 514D.
1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
2. Type: Stainless Steel.
3. Size: Standard; .
4. Screws: Metal with slotted heads finished to match wall plate finish.

C. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

D. Weatherproof Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.

NOT FOR BIDDING

E. Weatherproof Covers for Wet 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. Decorative Cover Plates: stainless steel.

G. Jumbo Cover Plates: stainless steel.

H. Weatherproof Cover Plates: Gasketed cast metal with hinged cover.

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 branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

F. Verify that openings in access floor are in proper locations.

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. 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. Perform work in a neat and workmanlike manner in accordance with NECA 1, including mounting heights specified in that standard unless otherwise indicated.

C. Coordinate locations of outlet boxes provided under Section 26 05 33.16 - Boxes for Electrical Systems, 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. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.

D. Install wiring devices in accordance with manufacturer's instructions.

E. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

F. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

G. 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.

H. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

I. For isolated ground receptacles, connect wiring device grounding terminal only to identified branch circuit isolated equipment grounding conductor. Do not connect grounding terminal to outlet box or normal branch circuit equipment grounding conductor.

J. Unless otherwise indicated, GFCI receptacles may be connected to provide feed-through protection to downstream devices. Label such devices to indicate they are protected by upstream GFCI protection.

NOT FOR BIDDING

K. Install securely, in a neat and workmanlike manner, as specified in NECA 1.

L. Install wiring devices plumb and level with mounting yoke held rigidly in place.

M. Install wall switches with OFF position down.

N. Do not share neutral conductor on branch circuits utilizing wall dimmers.

O. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

P. 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.

Q. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

R. Identify wiring devices in accordance with Section 26 05 53.

S. Install receptacles with grounding pole on top.

T. Connect wiring device grounding terminal to outlet box with bonding jumper.

U. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

V. Connect wiring devices by wrapping conductor around screw terminal.

W. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

3.04 INTERFACE WITH OTHER PRODUCTS

A. Install wall switch 48 inches above finished floor.

B. Install convenience receptacle 18 inches above finished floor.

3.05 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Perform field inspection, testing, adjusting, and balancing in accordance with Section 01 40 00 - Quality Requirements.

C. Inspect each wiring device for damage and defects.

D. Operate each wall switch and fan speed controller with circuit energized to verify proper operation.

E. Operate each wall switch with circuit energized and verify proper operation.

F. Verify that each receptacle device is energized.

G. Test each receptacle to verify operation and proper polarity.

H. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

I. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.06 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.07 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

NOT FOR BIDDING

SECTION 26 28 13
FUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fuses.

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 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses; Current Edition, Including All Revisions.

E. 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 Switches for Enclosed Motor Controllers: See Section 26 29 13.
   2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
   3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Fuses: One set(s) of three for each type and size installed.
   3. 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 minimum three years 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.

D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.

E. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 MAINTENANCE MATERIALS

A. See Section 01 6000 - Product Requirements, for additional provisions.

B. Furnish two fuse pullers.

NOT FOR BIDDING

C. Furnish three of each size and type fuse installed.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Bussmann, a division of Eaton Corporation: www.cooperindustries.com/#sle.

B. Mersen (formerly Ferraz Shawmut): ferrazshawmut.mersen.com.

C. Littelfuse, Inc: www.littelfuse.com/#sle.

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 APPLICATIONS

A. Service Entrance:
   1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.

B. General Purpose Branch Circuits: Class RK1, time-delay.

C. Primary Protection for Control Transformers: Class CC, time-delay.

2.03 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 CC Fuses: Comply with UL 248-4.

I. Power Load Feeder Switches: Class RK1 (time delay).

J. Motor Load Feeder Switches: Class RK1 (time delay).

K. Other Feeder Switches: Class RK1 (time delay).

L. General Purpose Branch Circuits: Class RK1 (time delay).

M. Motor Branch Circuits: Class L time delay.

N. Lighting Branch Circuits: Class G.

2.04 CLASS RK1 (TIME DELAY) FUSES

A. Manufacturers:
   1. Bussman Corp.
   2. Or Approved Equal.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Construction: Current limiting, dual-element fuse, 10 seconds minimum at 500% rated amps, with copper fuse element.

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 conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

NOT FOR BIDDING

B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION

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SECTION 26 28 16.16
ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed safety switches.

B. Fusible switches.

C. Nonfusible switches.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

C. NEMA FU 1 - Low Voltage Cartridge Fuses; National Electrical Manufacturers Association; 2002 (R2007).

D. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

E. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

I. 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 of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

C. Project Record Documents: Record actual locations of enclosed switches.

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.

NOT FOR BIDDING

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. Basis of Design: Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

B. General Electric Company: www.geindustrial.com/#sle.

C. Eaton Corporation: www.eaton.com/#sle.

D. Substitutions: See Section 01 60 00 - Product Requirements.

E. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a 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 indicated on the drawings.

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 solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

K. 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.

L. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

M. Heavy Duty Switches:
   1. Products:
      a. Schneider Electric.
      b. General Electric Co.
      c. Cutler Hammer.
      d. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Comply with NEMA KS 1.
   3. Conductor Terminations:

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a. Provide mechanical lugs unless otherwise indicated.
b. Provide compression lugs where indicated.
c. Lug Material: Copper, suitable for terminating copper conductors only.

4. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.

2.03 COMPONENTS

A. Fusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch.
1. Externally operable handle interlocked to prevent opening front cover with switch in ON position.
2. Handle lockable in OFF position.
3. Fuse clips: Designed to accommodate NEMA FU1, Class R fuses.

B. Nonfusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch.
1. Externally operable handle interlocked to prevent opening front cover with switch in ON position.
2. Handle lockable in OFF position.

C. Enclosures: NEMA KS 1.
1. Interior Dry Locations: Type 1.
2. Exterior Locations: Type 3R.

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 26 05 29 - Hangers and Supports for Electrical Systems.

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 26 05 26 - Grounding and Bonding for Electrical Systems.

H. Provide fuses complying with Section 26 28 13 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

I. Provide identification nameplate for each enclosed switch in accordance with Section 26 05 53 - Identification for Electrical Systems.

J. Provide arc flash warning labels in accordance with NFPA 70.

K. Install fuses in fusible disconnect switches.

L. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

NOT FOR BIDDING

B. Perform field inspection, testing, and adjusting in accordance with Section 01 40 00 - Quality Requirements.

C. Inspect and test in accordance with NETA ATS, except Section 4.

D. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

E. 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

NOT FOR BIDDING

SECTION 26 29 13
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.

B. Overcurrent protective devices for motor controllers, including overload relays.

1.02 REFERENCE STANDARDS

A. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2008.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

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; 2000 (R2010).

F. NEMA ICS 6 - Industrial Control and Systems: Enclosures; 1993 (R2011).

G. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules; Current Edition, Including All Revisions.

J. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contractors and Motor-starters - Electromechanical Contractors and Motor-starters; 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 of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. See Section 01 33 00 - Administrative Requirements, for submittal procedures.

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. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.

NOT FOR BIDDING

D. Test Reports: Indicate field test and inspection procedures and test results.

E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Maintenance Data: Replacement parts list for controllers.

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 minimum three years 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 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 MANUFACTURERS

A. Eaton Corporation: www.eaton.com/#sle.

B. General Electric Company: www.geindustrial.com/#sle.

C. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 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 under the following service conditions without derating:
      a. Altitude:
         1) Class 1 Km Equipment (devices utilizing power semiconductors, e.g. variable frequency controllers): Less than 3,300 feet.
         2) Class 2 Km Equipment (electromagnetic and manual devices): Less than 6,600 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 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 indicated on the drawings.

F. Conductor Terminations: Suitable for use with the conductors to be installed.

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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. Instrument Transformers:
1. Comply with IEEE C57.13.
2. Select suitable ratio, burden, and accuracy as required for connected devices.
3. Current Transformers: Connect secondaries to shorting terminal blocks.
4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

I. 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. Disconnects: Circuit breaker type.
   a. Circuit Breakers: Motor circuit protectors (magnetic-only) unless otherwise indicated or required.
   b. 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.
   c. Provide auxiliary interlock for disconnection of external control power sources where applicable.
4. Overload Relays: Bimetallic thermal type unless otherwise indicated.

J. 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 where not within sight of equipment.

2.03 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. Trip-free operation.
4. Visible trip indication.
5. Resettable.
   a. Employ manual reset unless otherwise indicated.
   b. Do not employ automatic reset with two-wire control.
6. Bimetallic Thermal Overload Relays:
   a. Interchangeable current elements/heaters.
   b. Adjustable trip; plus/minus 10 percent of nominal, minimum.
   c. Trip test function.
7. Melting Alloy Thermal Overload Relays:
   a. Interchangeable current elements/heaters.

NOT FOR BIDDING

2.04 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. Selector Switches: Unless otherwise indicated, provide maintained, non-illuminated 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 and Timing Relays:
   1. Comply with NEMA ICS 5.
   2. Provide number and type of relays indicated or required to perform necessary functions.

D. Control Power Transformers:
   1. Size to accommodate burden of contactor coil(s) and all connected auxiliary devices, plus _____ VA spare capacity.
   2. Include primary and secondary fuses.

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 26 05 29 - Hangers and Supports for Electrical Systems.

E. Install enclosed controllers plumb and level.

F. Provide grounding and bonding in accordance with Section 26 05 26 - Grounding and Bonding for Electrical Systems.

G. Install all field-installed devices, components, and accessories.

H. Height: 5 ft to operating handle.

I. Provide fuses complying with Section 26 28 13 - Fuses, 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 controllers and associated components according to installed motor requirements, in accordance with manufacturer's recommendations and NFPA 70.

L. Select and install overload heater elements in motor controllers to match installed motor characteristics.

NOT FOR BIDDING

M. Identify enclosed controllers in accordance with Section 26 05 53 - Identification for Electrical Systems.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Perform field inspection and testing in accordance with Section 01 45 00.

C. Inspect and test in accordance with NETA ATS, except Section 4.

D. Motor Starters: Perform inspections and tests listed in NETA ATS, Section 7.16.1.1. Tests listed as optional are not required.

E. Correct deficiencies and replace damaged or defective enclosed controllers or associated components.

F. Perform inspections and tests listed in NETA STD ATS, Section 7.16.1.

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 PROTECTION

A. Protect installed enclosed controllers from subsequent construction operations.

END OF SECTION

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SECTION 26 31 00
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.

1.02 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. IEC 61215-1 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 1: Test Requirements; 2021, with Corrigendum.

C. 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.

D. 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).

E. 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).

F. 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).

G. IEC 61215-2 - Terrestrial Photovoltaic (PV) Modules - Design Qualification and Type Approval - Part 2: Test Procedures; 2021.

H. IEEE 1547 - IEEE Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces; 2018, with Amendment (2020).

I. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

J. NECA 412 - Standard for Installing and Maintaining Photovoltaic (PV) Power Systems; 2012.

K. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

N. UL 1699B - Outline of Investigation for Photovoltaic (PV) DC Arc-Fault Circuit Protection; Current Edition; Current Edition, Including All Revisions.

O. UL 1703 - Flat Plate Photovoltaic Modules and Panels; Current Edition, Including All Revisions.

P. UL 1741 - Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources; 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.

NOT FOR BIDDING

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 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. 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 Section 01 30 00 - Administrative Requirements, for submittal procedures.

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 products of this section meet or exceed specified requirements.

F. Certify that work of this section does not void roof warranty.

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. Utility interconnection documentation.

I. Source quality control test reports.

J. Field quality control test reports.

K. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

L. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

M. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

N. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.

NOT FOR BIDDING

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. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

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 Section 01 78 00 - Closeout Submittals, 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 minimum five year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

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.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Photovoltaic Modules, Crystalline Silicon:
   1. Basis of Design: Hanwha QCells / Q.Peak Duo XL-G10.2.495.
   2. Or Approved Equal.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Photovoltaic Module Mounting System:
   1. Basis of Design - SnapNrack; www.snapnrack.com
   2. Or Approved Equal.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

C. Photovoltaic Combiner Boxes:
   1. SMA America, LLC: www.sma-america.com/#sle.
   2. SolarBOS, Inc: www.solarbos.com/#sle.
   3. Solectria Renewables, LLC: solectria.com/#sle.
   4. Or Approved Equal.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

D. Photovoltaic Inverters:
   1. Solaredge.

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2. Or Approved Equal.
3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 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 South.
3. Photovoltaic DC system is negative grounded.
4. System includes interconnection with utility grid (grid-tied system).
5. System includes DC system surge protection.

C. Provide photovoltaic system and associated components suitable for wind loads, snow loads, seismic loads, and other structural design considerations of the installed location.
1. Comply with ASCE 7.

D. Provide photovoltaic system and associated components suitable for continuous operation under the service conditions at the installed location.

E. Provide products listed, classified, and labeled as suitable for the purpose intended.

F. Provide photovoltaic system and associated components that qualify for available federal, state, and utility company rebate and incentive programs.

G. 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.

H. 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.

I. Rapid Shutdown of Photovoltaic Systems on Buildings: Provide listed equipment arranged to provide rapid shutdown in accordance with NFPA 70.

J. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

K. Arrange array to minimize shading during peak production periods.

L. 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 required by authority having jurisdiction.
3. Arrange array to maintain access and clearance requirements for other roof-mounted equipment.
4. Arrange array to avoid spanning of expansion joints.

2.03 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.

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6. Factory-Installed Cables: Type USE-2 or listed photovoltaic (PV) wire with polarized locking connectors.
7. Unless otherwise indicated, specified module performance characteristics are rated under Standard Test Conditions (STC).

2.04 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. Provide system compatible with the roof at the installed location.
      b. Module Tilt Angle: As required to provide maximum energy production for installed location.
      c. 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.
   6. Provide integral load-break rated disconnect.
   7. Provide with capability of current monitoring for individual strings.

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.
   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. Grounded Photovoltaic DC Systems: Furnish with integral isolation transformer. Transformerless inverters may be used if a separate isolation transformer is provided.
   5. Total Harmonic Distortion: Less than five percent.
   6. 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. Surge Protective Devices, in Addition to Requirements of Section 26 43 00:
   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.

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2.05 SOURCE QUALITY CONTROL

A. Factory test the following products to verify operation and performance characteristics. Include test reports with submittals.
   1. Photovoltaic modules.
   2. Photovoltaic inverters.

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 26 05 29.

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 26 05 19:
   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.
   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 26 05 26:
   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.

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2. Grounded DC Systems: Ensure that there is only one point of system grounding connection to the grounded conductor, including external connections and connections internal to equipment.

H. Identification Requirements, in Addition to Those Specified in Section 26 05 53:
1. Color for Photovoltaic System Identification Nameplates and Labels: White text on red 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.
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 Section 01 40 00 - Quality Requirements, for additional requirements.

B. See article "SYSTEM STARTUP" below for additional requirements related to testing and inspection.

C. 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. Measure and record voltages at the inverter AC and DC inputs.
6. Measure and record AC output power.
7. Perform inverter functional test.
a. Grid-Tied Inverters: Include simulation of loss of utility power and subsequent power restoration.

D. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

E. 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.

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2. If a malfunction occurs, start diagnostic period over after correction of malfunction.

F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

G. Repair roof or adjacent roof-mounted items damaged as a result of work of this section.

3.05 SYSTEM STARTUP

A. Obtain Owner's approval prior to performing system startup.

B. Grid-Tied Systems: Obtain Utility Company's approval prior to performing system startup.

C. 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 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.

C. 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.

3.08 PROTECTION

A. Protect installed products from subsequent construction operations.

END OF SECTION

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SECTION 26 32 13
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.

B. Packaged engine generator set.

C. Exhaust silencer, emissions controls, and fittings.

D. Remote control panel.

E. Battery and charger.

F. Sound enclosure.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

B. NECA/EGSA 404 - Standard for Installing Generator Sets; 2014.

C. NEMA MG 1 - Motors and Generators; 2017.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2008.

E. NFPA 30 - Flammable and Combustible Liquids Code; 2018.

F. NFPA 37 - Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines; 2018.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. NFPA 99 - Health Care Facilities Code; 2015.

I. NFPA 110 - Standard for Emergency and Standby Power Systems; 2016.

J. UL 142 - Steel Aboveground Tanks for Flammable and Combustible Liquids; Current Edition, Including All Revisions.

K. UL 1236 - Battery Chargers for Charging Engine-Starter Batteries; Current Edition, Including All Revisions.

L. 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 26 36 00 - Transfer Switches.
   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 of any conflicts with or deviations from the 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.

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1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. 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.

C. 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.

D. Evidence of qualifications for installer.

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 operation of product.

F. Manufacturer's factory emissions certification.

G. Manufacturer's certification that products meet or exceed specified requirements.

H. Source quality control test reports.

I. Provide NFPA 110 required documentation from manufacturer where requested by authorities having jurisdiction, including but not limited to:
   1. Certified prototype tests.
   2. Torsional vibration compatibility certification.
   3. NFPA 110 compliance certification.
   4. Certified rated load test at rated power factor.

J. Manufacturer’s detailed field testing procedures.

K. 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.

L. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.

M. Maintenance contracts.

N. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

O. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Fuses: One of each type and size.
   3. Extra Filter Elements: One of each type, including fuel, oil and air.

P. Shop Drawings: Indicate electrical characteristics and connection requirements. Show plan and elevation views with overall and interconnection point dimensions, fuel consumption rate curves at various loads, ventilation and combustion air requirements, electrical diagrams including schematic and interconnection diagrams.Provide generator damage curve and protective relay(breaker) curves.

Q. Product Data: Provide data showing dimensions, weights, ratings, interconnection points, and internal wiring diagrams for engine, generator, control panel, battery, battery rack, battery charger, exhaust silencer, vibration isolators, day tank, and remote radiator.

R. Test Reports: Indicate results of performance testing.

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S. 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.

T. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

U. Manufacturer's Field Reports: Indicate procedures and findings.

V. Operation Data: Include instructions for normal operation.

W. Maintenance Data: Include instructions for routine maintenance requirements, service manuals for engine and day tank, oil sampling and analysis for engine wear, and emergency maintenance procedures.

X. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
   1. Extra Filter Elements: One of each type, including fuel, oil and air.
   2. Tools: One set of tools required for preventative maintenance of the engine generator system. Package tools in adequately sized metal tool box.

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).

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with engine generator systems of similar size, type, and complexity; manufacturer's authorized installer.

E. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

F. Products: Listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authorities having jurisdiction as suitable for the purpose indicated.

G. Conform to requirements of NFPA 70.
   1. Maintain one copy of each document on site.

H. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience with service facilities within 100 miles of Project.

I. Supplier Qualifications: Authorized distributor of specified manufacturer with minimum three years documented experience.

J. Products: Furnish products listed and classified by Underwriters Laboratories as suitable for purpose specified and indicated.

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.

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1.07 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.08 WARRANTY & SERVICE CONTRACTS

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide minimum five year manufacturer warranty covering full parts and labor repair or replacement due to defective materials or workmanship.

C. Provide 2 year service contract for manufacturer's recommended maintenance which is to include, at minimum, quarterly service visits and all preventative and routine maintenance as recommended by the manufacturer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Packaged Engine Generator Set - Basis of Design: Kohler Power Systems.

B. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

C. Source Limitations: Furnish engine generator sets and associated components and accessories produced by a single manufacturer and obtained from a single supplier.

D. Cummins Power Systems: www.powersystems.cummins.com.

E. Caterpillar Inc: www.caterpillar.com.

F. Substitutions: See Section 01 60 00 - Product Requirements. Submit substitution request at least 10 days prior to bid opening. Substitution request shall include entire submittal package with explicit notations from vendor identifying all deviations from basis of design. Failure to comply will result in disqualification of substitution request.

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).
   3. Total System Power Rating: 150 kW, standby.

D. Packaged Engine Generator Set:
   1. Type: Diesel (compression ignition).
   2. Power Rating: 150 kW, standby., Max alternate tempt. 125 deg centigrade.
   3. Voltage: As indicated on drawings.
   4. Main Line Circuit Breaker Number Two:
      a. Type: Thermal magnetic with solid state trip unit capable of providing field-adjustable, long, short, instantaneous, and ground fault protection. Ground fault detection is for indication only.
      b. Trip Rating: Select according to generator set rating.

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.

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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.
1. Altitude: 1000 feet.
2. Ambient Temperature: Between 20 and 104 degrees F.

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.
   a. Maximum Voltage Deviation with Load Step: 35 percent.
   b. Maximum Frequency Deviation with Load Step: 5 percent.

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 86.4 dBA 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.

J. Description: NFPA 110, engine generator system to provide source of power for Level 1 applications .

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. 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.
2. Engine Fuel Connections: Provide suitable, approved flexible fuel lines for coupling engine to fuel source.
3. 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.

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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 three 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. Recognized 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.
5. Battery Heater: Provide thermostatically controlled battery heater to improve starting under cold ambient conditions.

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 Governor: 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. 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.

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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.

H. Type: Water-cooled inline or V-type, four stroke cycle, electric ignition internal combustion engine.

I. Rating: Sufficient to operate under 10 percent overload for one hour in an ambient of 90 degrees F at elevation of 1000 feet.

J. Fuel System: No. 2 fuel oil. Include manufacturer's approved regulator for pressure reduction from supply pressure.

K. Engine speed: 1800 rpm.

L. Governor: Isochronous type to maintain engine speed within 0.5 percent, steady state, and 5 percent, no load to full load, with recovery to steady state within 2 seconds following sudden load changes. Equip governor with means for manual operation and adjustment.

M. Safety Devices: Engine shutdown on high water temperature, low oil pressure, overspeed, and engine overcrank. Limits as selected by manufacturer.

N. Engine Starting: DC starting system with positive engagement, number and voltage of starter motors in accordance with manufacturer's instructions. Include remote starting control circuit, with MANUAL-OFF-REMOTE selector switch on engine-generator control panel.

O. Engine Jacket Heater: Thermal circulation type water heater with integral thermostatic control, sized to maintain engine jacket water at 90 degrees F, and suitable for operation on 208 volts AC.

P. Radiator: Radiator using glycol coolant, with blower type fan, sized to maintain safe engine temperature in ambient temperature of 110 degrees F. Radiator air flow restriction 0.5 inches of water maximum.

Q. Engine Accessories: Lube oil filter, intake air filter, lube oil cooler, fuel transfer pump, fuel priming pump, gear-driven water pump. Include fuel pressure gage, water temperature gage, and lube oil pressure gage on engine/generator control panel.

R. Mounting: Provide unit with suitable spring-type vibration isolators and mount on structural steel base.

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.

C. PMG Excitation Short-Circuit Current Support: Capable of sustaining 300 percent of rated output current for 10 seconds.
1. Voltage Regulation (with PMG excitation): Plus/minus 0.5 percent for any constant load from no load to full load.

D. Temperature Rise: Comply with UL 2200.

E. Insulation System: NEMA MG 1, Class H; suitable for 105 deg Centigrade alternator temperature rise.

F. Enclosure: NEMA MG 1, drip-proof.

G. Total Harmonic Distortion: Not greater than five percent.

NOT FOR BIDDING

2.05 GENERATOR SET CONTROL SYSTEM

A. Provide microprocessor-based control system for automatic control, local and remote 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. 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).

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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 system indicated. Provide all accessories necessary for proper interface.
   c. Remote monitoring capability via PC.

C. Remote Annunciator: Provide two (2) in parallel.
   1. Remote Annunciator Mounting: Wall-mounted; Provide flush-mounted annunciator for finished areas and surface-mounted annunciator for non-finished areas unless otherwise indicated in NEMA 1 metal enclosure.
   2. See drawings for locations of remote annunciators. Annunciators noted to be "field located" as directed by owner.
      a. One annunciator shall be located with the Legislative Hall Garage.
      b. One annunciator shall be located with the Legislative Hall building (existing or new addition, as directed by owner). This annuncaitor shall be supplied with the generator and stored on site and turned over to the owner as a spare for future installation by others.
   3. Generator Set Status Indications:
      a. Generator powering load (via position signal from transfer switch).
      b. Communication functional.
   4. Generator Set Warning/Shutdown Indications:
      a. Comply with NFPA 110 for Level 1 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 (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. 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: Level-2 sound-attenuated, non-walk in.

B. Enclosure Material: Panels made of 14 gauge,low carbon,hotrolled ASTM A569 steel construction,posts made of 12 gauge,low carbon,hot rolled ASTM A569 steel..

C. Hardware Material: Stainless steel.

D. Color: Manufacturer's standard.

E. Access Doors: Lockable, with all locks keyed alike.

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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. 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.

I. Enclosure Space Heater: Provide thermostatically controlled enclosure space heater to prevent condensation and improve starting under cold ambient conditions; size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature.

2.07 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Perform production tests on generator sets at factory to verify operation and performance characteristics prior to shipment. Include certified test report with submittals.

C. 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.

D. Diesel Fuel Storage Tanks: Perform pressurized leak test prior to shipment.

2.08 ACCESSORIES

A. Exhaust Silencer: Critical type silencer, with muffler companion flanges and flexible stainless steel exhaust fitting, sized in accordance with engine manufacturer's instructions.

B. Batteries: Heavy duty, diesel starting type lead-acid storage batteries, 1100 amps min. at -18 deg C to 0 deg C ampere-hours minimum capacity. Match battery voltage to starting system. Include necessary cables and clamps.

C. Battery Tray: Treated for electrolyte resistance, constructed to contain spillage.

D. Battery Charger: Current limiting type designed to float at 2.17 volts per cell and equalize at 2.33 volts per cell. Include overload protection, full wave rectifier, DC voltmeter and ammeter, and 120 volts AC fused input. Provide wall-mounted enclosure to meet NEMA 250, Type 1 requirements.

E. Line Circuit Breaker: Molded case circuit breaker on generator output with integral thermal and instantaneous magnetic trip in each pole, sized in accordance with NFPA 70; UL listed. Include battery-voltage operated shunt trip, connected to open circuit breaker on engine failure. Unit mount in enclosure to meet NEMA 250, Type 1 requirements. Circuit breaker shall be thermal magnetic with solid state trip unit capable of providing field-adjustable, long, short, instantaneous, and ground fault protection. Ground fault detection is for indication only.

F. Engine-Generator Control Panel: NEMA 250, Type 1 generator mounted control panel enclosure with engine and generator controls and indicators. Include provision for padlock and the following equipment and features:
1. Frequency Meter: 45-65 Hz. range, 3.5 inch dial.
2. AC Output Voltmeter: 3.5 inch dial, 2 percent accuracy, with phase selector switch.
3. AC Output Ammeter: 3.5 inch dial, 2 percent accuracy, with phase selector switch.
4. Output voltage adjustment.
5. Push-to-test indicator lamps, one each for low oil pressure, high water temperature, overspeed, and overcrank.
6. Engine start/stop selector switch.
7. Engine running time meter.
8. Oil pressure gage.
9. Water temperature gage.

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10. Auxiliary Relay: 3PDT, operates when engine runs, with contact terminals prewired to terminal strip.
11. Additional visual indicators and alarms as required by NFPA 110.
12. Remote Alarm Contacts: Pre-wire SPDT contacts to terminal strip for remote alarm functions required by NFPA 110.

G. Remote Annunciator Panels: Surface mounted panel with painted finish, standard factory color. Provide audible and visible indicators and alarms required by NFPA 110.

H. Sub base fuel tank: 48 hour capacity with fittings, vents, pumps, level indicators, complete with steel frame.

I. Emissions controls: Catalyst based, meeting State of Delaware Department of Natural Resourcese and Environmental Controls standards for stand-by generators.

J. Diesel Oxidation Catalyst:
1. Manufacturers:
   a. M-Series by Nett Technologies, Inc or approved equal.
2. Provide metallic (M-series or approved equal) diesel oxidation catalyst, to be field-installed.
3. Requirements:
   a. Metallic DOC technology.
   b. EPA verified for stationary applications.
   c. Maintenance-free.
   d. Fabricated entirely from corrosion-resistant aluminized and stainless steels.
   e. Emissions reduction performance shall include 90% reduction in carbon monoxide, 80% reduction in hydrocarbons, and 25% reduction in particulate matter.
4. Product Description: The diesel exhaust catalytic converter utilizes metallic, monolith catalyst supports. The supports are made from a corrugated, high temperature stainless steel foil. Packages of several foil layers are fitted in stainless steel housings and secured in place by stainless steel rings. A special herringbone foil corrugation pattern creates a mixed flow cell structure. Exhaust gases from the Diesel Oxidation Catalyst are forced into the turbulent flow regime resulting in better contact between gas and catalyst, enhanced mass-transfer conditions, and higher conversion efficiency. The catalyst is deposited onto the foil prior to forming the substrate. A special foil washcoating process provides unequaled control of washcoat uniformity, adhesion, and efficient catalyst use. Thick washcoat concentrations in cell corners, which are inherent for other designs of metallic substrates, completely disappear with the precoated foil technology.
5. The product size and capacity are to be selected to match the provided engine generator.

K. Sound Enclosure: Lift based steel construction with hinged doors. Accoustic insulation meeting UL94HF1 flammibility classification and repels moisture absorbption. Maximium sound level shall be @ 86.4dBA @ 23 feet.

2.09 PLATFORM

A. Provide minimum 3'-6" wide work platform with stairs and hand rails. The work platform shall be pre-engineered and height shall be coordinated with generator, tank, and enclosure package such that the platform height is not more than two inches lower than the base of generator enclosure but shall not interfere with access to enclosure. See drawings.

B. Manufacturers:
1. Kohler GM74974-TPLX or approved equal.

C. Frame to consist of 10 gauge formed steel construction utilized in the design of the staircase, platform, walkway and walkaround. Frame design is predrilled to accept handrail mounting supports and serves as he walkway toe-board support.

D. Compression members are predrilled to connect the stairway and frame to the tank and utilize 7 gauge fromed steel construction. Tanks are to be pre-drilled to accept compression members as required.

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E. Walkway tread and stairs are to be open, utilizing 13 gauge galvanized steel tread plates with small raised projections and large drainage holes, to provide a non-abrasive, high-traction surface. The entire platform is to be field-painted.

F. Handrails are to be a nominal 42" from the walkway surface and a nominal 32" from the leading edge of teh stair riser. Center rails are to be provided on all walkways and stair risers with vertical posts not spaced more than 8' apart. Handrails are to be aluminum 6063-T6 alloy round (1.5" OD) whcih offers a corrision resistant design that combines light weight with strength. Hand rail upright supports are to be constructed of aluminum B-535-2 alloy to offer easy installation to frame with hex drive set screws.

G. All steel components (non-aluminum and galvanized) are to be pressure washed clean with an iron phosphate solution, and a high gloss back powder-baked paint is applied at 3 mils thickness offering a tough, scratch-resistant surface.

H. The access platform and associated stairs and handrails shall meet standards of OSHA 3124 (Stairways and Ladders) and OSHA 1910.24 (Fixed Industrial Stairs).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

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 a neat and workmanlike manner in accordance with NECA 1.

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 6 inch high concrete pad constructed in accordance with Section 03 30 00. Provide suitable vibration isolators, where not factory installed.

F. Provide required support and attachment in accordance with Section 26 05 29 Hangers and Supports For Electrical Systems.

G. Use manufacturer's recommended oil and coolant, suitable for the worst case ambient temperatures.

H. Provide diesel fuel piping and venting in accordance with Section 23 11 13 - , where not factory installed.

I. Provide engine exhaust piping where not factory installed.
   1. Include piping expansion joints, piping insulation, thimble, condensation trap/drain, rain cap, hangers/supports, etc. as indicated or as required.
   2. Do not exceed manufacturer's maximum back pressure requirements.

J. Do not insulate piping for engine components restricted by manufacturer.

K. Install exhaust silencer where not factory installed.

L. Provide grounding and bonding in accordance with Section 26 05 26 - Grounding and Bonding For Electrical Systems.

M. Identify system wiring and components in accordance with Section 26 05 53 - Identifications For Electrical Systems.

N. The first fuel fill up of new permanent generator set will be by owner.

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3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. 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.

C. Notify Owner and Architect at least two weeks prior to scheduled inspections and tests.

D. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

E. Provide all equipment, tools, and supplies required to accomplish inspection and testing, including load bank and fuel.

F. 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.

G. Prepare and start system in accordance with manufacturer's instructions.

H. Perform acceptance test in accordance with NFPA 110.

I. 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.).

J. Provide field emissions testing where necessary for certification.

K. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

L. Provide full load test utilizing portable test bank for four hours minimum. Simulate power failure including operation of transfer switch, automatic starting cycle, and automatic shutdown and return to normal.

M. Test alarm and shutdown circuits by simulating conditions.

3.04 ADJUSTING

A. Adjust generator output voltage and engine speed.

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. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.

D. 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.

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E. After successful acceptance test and just prior to Substantial Completion, replace air, oil, and fuel filters and fill fuel storage tank.

3.07 PROTECTION

A. Protect installed engine generator system from subsequent construction operations.

3.08 MAINTENANCE

A. See Section 01 70 00 - Execution And Closeout Requirements, for additional requirements relating to maintenance service.

B. Maintain an on-site log listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced.

C. Provide service and maintenance of engine generator for two years from Date of Substantial Completion.

END OF SECTION

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SECTION 26 36 00
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. Remote annunciators.

1.02 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

C. NEMA ICS 10 Part 1 - Industrial Control and Systems Part 1: Electromechanical AC Transfer Switch Equipment; 2005, with Errata (2006).

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

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; 2016.

G. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

H. 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 26 32 13 - Engine Generators.
   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. Closed Transition Transfer Switches:
      a. Coordinate source interconnection requirements with Utility Company.
      b. Where applicable, coordinate the work to provide engine generators with isochronous governors suitable for closed transition transfer.
      c. Coordinate the work to provide shunt trip breakers necessary for protection from source interconnection for longer than specified maximum interconnection time.
      d. Arrange for inspections necessary to obtain Utility Company approval of installation.
   6. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. 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.

C. 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.

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D. Specimen Warranty: Submit sample of manufacturer's warranty.

E. Evidence of qualifications for installer.

F. Evidence of qualifications for maintenance contractor (if different entity from installer).

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 certification that products meet or exceed specified requirements.

I. Source quality control test reports.

J. Manufacturer’s detailed field testing procedures.

K. 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.

L. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.

M. Maintenance contracts.

N. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

O. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

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 system Level specified in Section 26 32 13 - Engine Generators.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. 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.

D. 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.

E. Products: Listed, classified, and labeled by Underwriters Laboratories Inc. (UL) or testing firm acceptable to authorities having jurisdiction as suitable for the purpose indicated.

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.

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1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Transfer Switches - Basis of Design: ASCO 4000 series- 4 poles .

B. Transfer Switches - Other Acceptable Manufacturers:
   1. ASCO Power Technologies, a brand of Emerson Network Power: www.emersonnetworkpower.com/#sle.
   2. Eaton Corporation: www.eaton.com.
   3. or approved equal.

C. Substitutions: See Section 01 60 00 - Product Requirements.

D. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

E. Source Limitations: Furnish transfer switches and accessories produced by a single manufacturer and obtained from a single supplier.

2.02 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. Utilize open transition transfer unless otherwise indicated or required.

D. Construction Type: Either "contactor type" (open contact) or "breaker type" (enclosed contact) transfer switches complying with specified requirements are acceptable.

E. Automatic Transfer Switch:
   1. Basis of Design: ASCO 7000 series - 4 poles.
   2. Transfer Switch Type: Automatic transfer switch.
   3. Transition Configuration: Open-transition (no neutral position).
   4. Voltage: As indicated on the drawings.
   5. Ampere Rating: As indicated on the drawings.
   6. Neutral Configuration: As indicated on the drawings.
   7. Load Served: As indicated on the drawings.
   8. Primary Source: Utility (fed from transformer).
   9. Alternate Source: Engine generator (fed from on site generator).

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:

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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.

2. Obtain control power for transfer operation from line side of source to which the load is to be transferred.

J. 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.
b. Outdoor Locations: Type 3R or Type 4.
2. Provide lockable door(s) for outdoor locations.
3. Finish: Manufacturer's standard unless otherwise indicated.
4. Construction: Free standing, floor mounted, code gauge formed steel construction.
5. Features: Accessories or screen to prevent entry of bird/rodent.

K. 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 indicated on the drawings.

L. 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.
4. Other Features:

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a. Event log.
b. Communications Capability: Compatible with system indicated. Provide all accessories necessary for proper interface.
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.

M. Service Entrance Rated Transfer Switches:
   1. Furnished with integral disconnecting and overcurrent protective device on the primary/normal source and with ground-fault protection where indicated.
   2. Listed and labeled as suitable for use as service equipment according to UL 869A.

N. Remote Annunciators:
   1. Remote Annunciator Mounting: Wall-mounted; Provide flush-mounted annunciator for finished areas and surface-mounted annunciator for non-finished areas unless otherwise indicated.
   2. Transfer Switch Status Indications:
      a. Connected to alternate/emergency source.
      b. Connected to primary/normal source.
      c. Alternate/emergency source available.

O. Reset switch for manual retransfer to normal with automatic over ride upon emergency source failure.

P. Interface with Other Work:
   1. Interface with engine generators as specified in Section 26 32 13 - Engine Generators.
   2. Interface with building automation system.

2.03 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Perform production tests on transfer switches at factory to verify operation and performance characteristics prior to shipment. Include certified test report with submittals.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

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 a neat and workmanlike manner in accordance with NECA 1.

B. Install transfer switches 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 26 05 29 - Hangers and Supports For Electrical Systems.

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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 03 30 00 - Cast In-Place Concrete.

G. Provide grounding and bonding in accordance with Section 26 05 26 - Grounding and Bonding For Electrical Systems.

H. Identify transfer switches and associated system wiring in accordance with Section 26 05 53 - Identification For Electrical Systems.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, 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 control wiring insulation-resistance tests listed as optional are not required.

E. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

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. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of transfer switches to Owner, and correct deficiencies or make adjustments as directed.

D. 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.

E. Coordinate with related generator demonstration and training as specified in Section 26 32 13 - Engine Generators.

3.06 PROTECTION

A. Protect installed transfer switches from subsequent construction operations.

3.07 MAINTENANCE

A. See Section 01 70 00 - Execution Requirements, for additional requirements relating to maintenance service.

B. Provide to Owner a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of transfer switches for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, inspection, and testing, with a detailed schedule.

NOT FOR BIDDING

C. Conduct site visit at least once every three months to perform inspection, testing, and preventive maintenance. Submit report to Owner indicating maintenance performed along with evaluations and recommendations.

D. Provide trouble call-back service upon notification by Owner:
   1. Provide on-site response within 4 hours of notification.
   2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
   3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

E. Maintain an on-site log listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced.

END OF SECTION

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SECTION 26 41 13
LIGHTNING PROTECTION

ALTERNATE NO. 1

PART 1 GENERAL

2.01 SECTION INCLUDES

A. Strike (air) terminals and interconnecting conductors.

B. Grounding and bonding for lightning protection.

2.02 REFERENCE STANDARDS

A. NFPA 780 - Standard for the Installation of Lightning Protection Systems; 2014.

B. UL 96 - Lightning Protection Components; Current Edition, Including All Revisions.

2.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination with Roofing Work: Ensure adequate attachment of strike terminals and conductors without damage to roofing.

B. 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.

2.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

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. Include engineering analysis of equalization of potential to metal bodies within the structure.

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. 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.

F. Project Record Documents: Record actual locations of air terminals, grounding electrodes, bonding connections, and routing of system conductors in project record documents.

2.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in lightning protection equipment with minimum three years documented experience.

B. Designer Qualifications: Person or entity, employed by installer, who specializes in lightning protection system design with minimum three years documented experience.

C. 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.

D. Products: Listed, classified, and labeled as suitable for the purpose intended.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

NOT FOR BIDDING

PART 2 PRODUCTS

3.01 MANUFACTURERS

A. Lightning Protection Components:
   1. Thompson Lightning Protection: www.tlpinc.com.
   2. Advanced Lightning Technology (ALT): www.altfab.com.
   3. National Lightning Protection Corporation: www.theprotectionsource.com.
   4. Approved Equal.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

3.02 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.
      b. Open air areas within 100 feet of exterior walls at grade level.
      c. Open air areas within building footprint.
      d. Trees identified on site plan.
   2. The lightning protection system shall be Class 1.
   3. Coordinate with other grounding and bonding systems specified.
   4. Provide aluminum, bronze, or stainless steel components, as applicable.

B. Strike Terminals: Provide strike (air) terminals on the following:
   1. Roofs.
   2. Parapets.

3.03 COMPONENTS

A. All Components: Complying with applicable requirements of UL 96.

B. Strike (Air) Terminals: Aluminum, solid, with adhesive bases for single-ply roof installations. Minimum diameter shall be 3/ 8 inch. and minimum height shall be 10 inches. See drawings for details.

C. Grounding Rods: Copper clad Stainless steel, 3/4 inch dia, 10 ft long.

D. Conductors: Aluminum cable with braided smooth twist; 192,000 circular mils; Thompson Lightning Protection Inc. A37 or approved equal.

E. Connectors and Splicers: Bronze.

PART 3 EXECUTION

4.01 EXAMINATION

A. Verify that field measurements are as indicated on shop drawings.

B. Coordinate work with installation of roofing and exterior and interior finishes.

4.02 INSTALLATION

A. Install in accordance with referenced system standards and as required for specified certification.

B. Air terminals shall be secured against overrunning by attachment to the object to be proteced or by means of braces that shall be permnently and rigidly attached to the building.

4.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

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.

END OF SECTION

NOT FOR BIDDING

SECTION 26 43 00
SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surge protective devices for service entrance 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; 2010.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.

C. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

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 of any conflicts or deviations from the contract documents to obtain direction prior to ordering equipment.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

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.
   1. SPDs with EMI/RFI filter: Include noise attenuation performance.

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.
   2. UL 1283 (for Type 2 SPDs).

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 information on status indicators and recommended maintenance procedures and intervals.

G. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

H. Project Record Documents: Record actual connections and locations of surge protective devices.

1.06 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

NOT FOR BIDDING

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

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. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer's Warranty: Provide minimum five year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Schneider Electric; Square D Brand Surgelogic Products as indicated under product article(s) below; www.surgelogic.com.

B. Surge Protective Devices (SPD) as manufactured by Siemens Industry, Inc. are a permitted substitution with the inclusion of a Surge Counter and an External Operable Disconnect.

C. Surge Protective Devices (SPD) as manufactured by Advanced Protection Technologies, Inc. are a permitted substitution with inclusion of an externally operable switch / breaker.

D. Factory-installed, Internally Mounted Surge Protective Devices:
1. Same as manufacturer of equipment containing surge protective device, to provide a complete listed assembly including SPD.

E. Source Limitations: Furnish surge protective devices produced by a single manufacturer and obtained from a single supplier.

2.02 ALL SURGE PROTECTIVE DEVICES

A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service, listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated; system voltage as indicated on the drawings.

B. Protected Modes:
1. Wye Systems: L-N, L-G, N-G, L-L.

C. UL 1449 Voltage Protection Ratings (VPRs):
1. Equivalent to basis of design.
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.

D. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.

E. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
1. Indoor clean, dry locations: Type 1.

F. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.
1. Switchboards: See Section 26 24 13.
2. Panelboards: See Section 26 24 16.

NOT FOR BIDDING

2.03 SURGE PROTECTIVE DEVICES FOR SERVICE ENTRANCE LOCATIONS

A. Unless otherwise indicated, provide field-installed, externally mounted or factory-installed, internally mounted SPDs.

B. 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.

C. Provide SPDs utilizing field-replaceable modular or non-modular protection circuits.

D. Surge Current Rating: Not less than 120 kA per mode/240 kA per phase.

E. Repetitive Surge Current Capacity: Not less than 5,000 impulses.

F. UL 1449 Nominal Discharge Current (I-n): 20 kA.

G. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.

H. Diagnostics:
   1. Protection Status Monitoring: Provide indicator lights to report the protection for each phase.
   2. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.

I. Basis of Design: Schneider Electric; Square D Brand Surgelogic Products; www.surgelogic.com.
   1. Field-installed, Externally Mounted Surge Protective Devices:
      a. EMA Series: Replaceable modules; 200 kA SCCR; individually fused MOVs, thermal fusing; dry contacts; EMI/RFI filtering; surge counter; duty cycle tested for 20,000 impulses; 10 year warranty.
   2. Factory-installed, Internally Mounted Surge Protective Devices:
      a. IMA Series: Replaceable modules; 200 kA SCCR; individually fused MOVs, thermal fusing; dry contacts; EMI/RFI filtering; surge counter; duty cycle tested for 20,000 impulses; 10 year warranty.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

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 26 05 26, 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 a neat and workmanlike manner in accordance with NECA 1.

B. Install SPD in accordance with manufacturer's instructions.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide conductors with minimum ampacity as required by NFPA 70 and not less than manufacturer's recommended minimum conductor size.

E. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations

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may be reasonably be rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.

F. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 26 05 26 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.

3.03 FIELD QUALITY CONTROL

A. Perform inspection, testing, and adjusting in accordance with Section 01 40 00.

B. Inspect and test in accordance with NETA STD ATS, except Section 4.

C. Perform inspections and tests listed in NETA STD 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

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SECTION 26 51 00
INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.

B. Exit signs.

C. Accessories.

1.02 REFERENCE STANDARDS

A. ANSI C78.379 - American National Standard for Electric Lamps -- Reflector Lamps -- Classification of Beam Patterns; 2006.

B. ANSI C82.1 - American National Standard for Lamp Ballast - Line Frequency Fluorescent Lamp Ballast; 2004.

C. ANSI C82.4 - American National Standard for Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type); 2002.

D. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; 2008.

E. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; Illuminating Engineering Society; 2008.

F. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; Illuminating Engineering Society; 2015.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

H. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2006.

I. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

J. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012.

K. NEMA WD 6 - Wiring Devices - Dimensional Requirements; National Electrical Manufacturers Association; 2002.

L. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

O. UL 935 - Fluorescent-Lamp Ballasts; Current Edition, Including All Revisions.

P. UL 1598 - Luminaires; Current Edition, Including All Revisions.

Q. 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.

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4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

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 upon request.

C. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

D. 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.

E. Sustainable Design Documentation: Submit manufacturer's product data on lamp mercury content and rated lamp life, showing compliance with specified requirements.

F. Field quality control reports.

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, and installation of product.

H. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

J. 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. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Conform to requirements of NFPA 70 and NFPA 101.

D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial 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. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

NOT FOR BIDDING

PART 2 PRODUCTS

2.01 LUMINAIRES

A. Manufacturers:
   1. Acuity Brands, Inc; : www.acuitybrands.com/#sle.
   2. Cooper Lighting, a division of Cooper Industries; : www.cooperindustries.com/#sle.
   3. Hubbell Lighting, Inc; : www.hubbelllighting.com/#sle.
   4. NLS
   5. ILP
   6. Elite
   7. Visioneering
   8. Penn Globe
   9. Precision Architectural Lighting
   10. Leviton
   11. Substitutions: See Section 01 60 00 - Product Requirements.

B. Provide products that comply with requirements of NFPA 70.

C. Provide products that are listed and labeled as complying with UL 1598, where applicable.

D. Provide products listed, classified, and labeled as suitable for the purpose intended.

E. 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.

F. 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.

G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

H. 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.

I. 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 lumen maintenance greater than or equal to that of the specified light fixture, calculated based on IES LM-80 test data.

J. LED Luminaires: Listed and labeled as complying with UL 8750.

K. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

2.02 LUMINAIRES

A. Furnish products as indicated in Schedule included on the Drawings.

B. Substitutions: See Section 01 60 00 - Product Requirements.
   1. Input Voltage: 120 or 277 volts.

2.03 EXIT SIGNS

A. Manufacturers - Powered and Self-Luminous Signs:
   1. Acuity Brands, Inc; : www.acuitybrands.com/#sle.
   2. Cooper Lighting, a division of Cooper Industries; : www.cooperindustries.com/#sle.
   3. Hubbell Lighting, Inc; : www.hubbelllighting.com/#sle.
   4. Evenlite
   5. Substitutions: See Section 01 60 00 - Product Requirements.

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B. Description: Internally illuminated exit signs with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
   1. Number of Faces: Single or double as indicated or as required for the installed location.
   2. Directional Arrows: As indicated or as required for the installed location.

C. Self-Powered Exit Signs:
   1. 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.
   2. Battery: Sealed maintenance-free nickel cadmium unless otherwise indicated.
   3. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
   4. Provide low-voltage disconnect to prevent battery damage from deep discharge.
   5. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

D. Accessories:
   1. Provide compatible accessory high impact polycarbonate vandal shields where indicated.
   2. Provide compatible accessory wire guards where indicated.

E. Manufacturers: As indicated on lighting fixture schedule.
   1. Substitutions: See Section 01 60 00 - Product Requirements.

F. Exit Signs: Exit sign fixture .
   1. Housing: die cast aluminum.
   2. Face: polycarbonate face with red letters.
   3. Directional Arrows: Universal type for field adjustment.
   4. Mounting: Universal, for field selection.
   5. Lamps: Manufacturer's standard.
   6. Input Voltage: 120/277 volts.

2.04 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. Tube Guards for Linear Fluorescent Lamps: Provide clear virgin polycarbonate sleeves with endcaps where indicated.

E. Product: As indicated in lighting fixture schedule.
   1. Substitutions: See Section 01 60 00 - Product Requirements.

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.

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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 26 05 33.16 - Boxes for Electrical Systems, 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) and NECA 502 (industrial lighting).

E. Provide required support and attachment in accordance with Section 26 05 29 - Hangers and Supports for Electrical Systems.

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 pendant-mounted luminaires to building structure.
   4. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
   5. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gage, connected from opposing corners of each recessed luminaire to building structure.
   6. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

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.
   3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

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. Install canopies tight to mounting surface.

J. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

K. Install fixtures securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting).

L. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.

M. Support luminaires independent of ceiling framing.

N. Locate recessed ceiling luminaires as indicated on reflected ceiling plan.

O. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.

P. Exposed Grid Ceilings: Support surface mounted luminaires in grid ceiling directly from building structure.

NOT FOR BIDDING

Q. Exposed Grid Ceilings: Provide auxiliary members spanning ceiling grid members to support surface mounted luminaires.

R. Exposed Grid Ceilings: Fasten surface mounted luminaires to ceiling grid members using bolts, screws, rivets, or suitable clips.

S. Install recessed luminaires to permit removal from below.

T. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

U. Install clips to secure recessed grid-supported luminaires in place.

V. Install wall mounted luminaires, emergency lighting units, and exit signs at height as indicated on Drawings.

W. Install accessories furnished with each luminaire.

X. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

Y. Bond products and metal accessories to branch circuit equipment grounding conductor.

Z. Exit Signs:
   1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Perform field inspection, testing, and adjusting in accordance with Section 01 40 00 - Quality Requirements.

D. Operate each luminaire after installation and connection to verify proper operation.

E. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.

F. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

D. Aim and adjust luminaires as directed.

E. Position exit sign directional arrows as indicated.

3.06 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

B. Clean electrical parts to remove conductive and deleterious materials.

C. Remove dirt and debris from enclosures.

D. Clean photometric control surfaces as recommended by manufacturer.

E. Clean finishes and touch up damage.

NOT FOR BIDDING

3.07 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. Just prior to Substantial Completion, replace all lamps that have failed.

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

3.09 PROTECTION

A. Relamp luminaires that have failed lamps at Substantial Completion.

3.10 SCHEDULE - SEE DRAWINGS

END OF SECTION

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SECTION 26 56 00
EXTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Exterior luminaires.

B. Poles and accessories.

C. Luminaire accessories.

1.02 REFERENCE STANDARDS

A. ANSI O5.1 - American National Standard for Wood Poles -- Specifications and Dimensions; 2015.

B. IEEE C2 - National Electrical Safety Code; 2012.

C. IES LM-63 - IESNA Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).

D. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).

E. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; Illuminating Engineering Society; 2015.

F. IESNA LM-64 - Photometric Measurements of Parking Areas; 2001 (Reaffirmed 2007).

G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

H. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 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. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

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, 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.
   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.
   3. Lamps: Include rated life and initial and mean lumen output.

NOT FOR BIDDING

D. Sustainable Design Documentation: Submit manufacturer's product data on lamp mercury content and rated lamp life, showing compliance with specified requirements.

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.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

H. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

1.05 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

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, 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.

C. Receive, handle, and store wood poles in accordance with ANSI O5.1.

1.07 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acuity Brands, Inc; : www.acuitybrands.com.

B. Hubbell Lighting, Inc; : www.hubbelllighting.com.

C. Penn Globe

D. Elite

E. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 LUMINAIRES

A. Manufacturers:
   1. Acuity Brands, Inc; : www.acuitybrands.com/#sle.
   2. Hubbell Lighting, Inc; : www.hubbelllighting.com/#sle.
   3. Penn Globe
   4. Elite
   5. Or Approved Equal.
   6. Substitutions: See Section 01 60 00 - Product Requirements.

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B. Provide products that comply with requirements of NFPA 70.

C. Provide products that are listed and labeled as complying with UL 1598, where applicable.

D. Provide products listed, classified, and labeled as suitable for the purpose intended.

E. 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.

F. 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.

G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

H. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.

I. LED Luminaires: Listed and labeled as complying with UL 8750.

J. Exposed Hardware: Stainless steel.

2.04 ACCESSORIES

A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.

B. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

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 26 05 33.16 - Boxes for Electrical Systems, 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 in accordance with NECA/IESNA 501.

E. Provide required support and attachment in accordance with Section 26 05 29 - Hangers and Supports for Electrical Systems.

F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

G. Recessed Luminaires:
   1. Install trims tight to mounting surface with no visible light leakage.
   2. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

H. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

NOT FOR BIDDING

I. Pole-Mounted Luminaires:
   1. Maintain the following minimum clearances:
      a. Comply with IEEE C2.
      b. Comply with utility company requirements.
   2. Foundation-Mounted Poles:
      a. Provide cast-in-place concrete foundations for poles as indicated, in accordance with Section 03 30 00.
         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.
   3. Embedded Poles: Install poles plumb as indicated.
   4. Grounding:
      a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
   5. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.

J. Install accessories furnished with each luminaire.

K. Bond products and metal accessories to branch circuit equipment grounding conductor.

L. Install lamps in each luminaire.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

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.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. 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. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.

C. 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

NOT FOR BIDDING

SECTION 27 10 05
STRUCTURED CABLING FOR VOICE AND DATA

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 grounding and bonding.
H. Communications identification.

1.02 REFERENCE STANDARDS

A. EIA/ECA-310 - Cabinets, Racks, Panels, and Associated Equipment; 2005e.
B. ICEA S-83-596 - Indoor Optical Fiber Cable; 2021.
C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
D. TIA-455-21 - FOTP-21 - Mating Durability of Fiber Optic Interconnecting Devices; 1988a (Reaffirmed 2012).
E. TIA-492CAAB - Detail Specification for Class IVa Dispersion-Unshifted Single-Mode Optical Fibers with Low Water Peak; 2000 (Reaffirmed 2005).
F. TIA-526-14 - Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant; IEC 61280-4.1 Edition 3.1, Fiber Optic Communications Subsystem Test Procedures- Part 4-1: Installed Cable Plant- Multimode Attenuation Measurement; 2023d.
G. TIA-568.3 - Optical Fiber Cabling and Components Standard; 2022e.
H. TIA-598 - Optical Fiber Cable Color Coding; 2014d, with Addendum (2018).
I. TIA-568-C.3 - Optical Fiber Cabling Components Standard; 2016.
J. TIA-598-D - Optical Fiber Cable Color Coding; 2014d.
K. TIA-606 - Administration Standard for Telecommunications Infrastructure; 2021d.
L. TIA-607-C - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises; 2015c, with Addendum (2017).
M. UL 444 - Communications Cables; Current Edition, Including All Revisions.
N. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.
O. UL 1651 - Fiber Optic Cable; Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for communications equipment.
   2. Coordinate arrangement of communications equipment with the dimensions and clearance requirements of the actual equipment to be installed.
   3. Notify Architect/Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
   4. Coordinate requirements of this section with Owner.

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1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements and Section 01 33 00 - Submittal Procedures, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

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'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. Field Test Reports.

F. 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 contract drawings.

1.05 QUALITY ASSURANCE

A. Products: Listed, classified, and labeled as suitable for the purpose intended.

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. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a 2 year period after Date of Substantial Completion.

C. Provide warranty as called out in applicable referenced State of Delaware standards/specifications

PART 2 PRODUCTS

2.01 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.

B. **IMPORTANT!! PLEASE NOTE THAT this specification references the Delaware State-Wide Information And Architecture Standards, Standard ID: NE=Cabling-002, Title: Structured Cabling System Standards and Specifications for State-Managed Facilities, Domain: Network and Storage, Discipline: Cabling, Revision Date: 2/20/2019, Revision no.: 8, Original date: 7/21/2008 Reviewed: 1/29/2021. As such this document shall be considered as part of this specification. Unless otherwise shown in the project drawings and or specified in the project specifications, all work, materials, standards, etc. called for in the above mentioned document shall be provided. NOTE: At the end of the above mentioned document is a link to the certified contractors list for the work covered under this specification and the above mentioned document. Only contractors listed on this link are permitted to perform the work covered under this specification and the above mentioned document as indicated.**

2.02 PATHWAYS

A. Refer to above mentioned Delaware State-Wide Information And Architecture Standards as well as other project specifications and drawings.

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B. Cable Trays: Type 304L Stainless Steel 4" deep x 12" wide Hubbell M/N HBT0412S04 or approved equal. Provide associated manufacturer supplied accessories and mounting hardware.

C. Ladder Rack: 16 Guage Tubular Steel 12" wide Hubbell M/N HLS1012B. Provide associated manufacturer supplied accessories and mounting hardware.

2.03 COPPER CABLE AND TERMINATIONS

A. Refer to above mentioned Delaware State-Wide Information And Architecture Standards as well as other project specifications and drawings.

B. Copper Patch Cords:
   1. Refer to above mentioned Delaware State-Wide Information And Architecture Standards as well as other project specifications and drawings.

2.04 FIBER OPTIC CABLE AND INTERCONNECTING DEVICES

A. 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, 8.3/125 um (OS2) complying with TIA-492CAAB.
   3. Cable Capacity: 12-fiber.
   4. Cable Applications:
      a. Plenum Applications: Use listed NFPA 70 Type OFNP plenum cable.
   5. Cable Jacket Color:
      a. Single-Mode Fiber (OS1/OS2): Yellow.
   6. Product(s):
      a. Hubbell M/N HFCD19012PSBK 12-strand OS2 SM Indoor/Outdoor Tight Buffer Plenum Armored Fiber Cable or approved equal.

B. Fiber Optic Interconnecting Devices:
   1. Connector Type: Type LC.
   2. Connector Performance: 500 mating cycles, when tested in accordance with TIA-455-21.
   3. Maximum Attenuation/Insertion Loss: 0.3 dB.
   4. Product(s):
      a. Hubbell M/N FSPLCDS12Y or approved equal. Provide 1 of these per fiber patch panel box.

2.05 COMMUNICATIONS EQUIPMENT ROOM FITTINGS

A. Refer to above mentioned Delaware State-Wide Information And Architecture Standards as well as other project specifications and drawings.

B. Copper Cross-Connection Equipment:
   1. Patch Panels for Copper Cabling: Sized to fit EIA/ECA-310 standard 19 inch wide equipment racks; 0.09 inch thick aluminum; cabling terminated on Type 110 insulation displacement connectors; printed circuit board interface.
      a. Jacks: Non-keyed RJ-45, suitable for and complying with same standard as cable to be terminated; maximum 48 ports per standard width panel.
      b. Capacity: Provide ports sufficient for cables to be terminated plus 25 percent spare.
      c. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA-606.
      d. Provide incoming cable strain relief and routing guides on back of panel.
      e. Provide Hubbell M/N HP648 or approved equal for category 6 (CAT6) applications.
      f. Provide Hubbell M/N HPJ6A48 or appproved equal for category 6A (CAT6A) applications.

C. Equipment Racks and Cabinets: EIA/ECA-310 standard 19 inch wide component racks.
   1. Floor Mounted Racks: Aluminum or steel construction with corrosion resistant finish; vertical and horizontal cable management channels, top and bottom cable troughs, and grounding lug.

NOT FOR BIDDING

a. Load Rating: 2500 pounds bolted to the floor and 500 lb unsecured.
b. Provide Hubbell M/N HHR45U10 or approved equal. Provide manufacturer provided horizonal cable management where indicated.

2.06 COMMUNICATIONS OUTLETS

A. Refer to above mentioned Delaware State-Wide Information And Architecture Standards as well as other project specifications and drawings.

B. Outlet Boxes: Comply with Section 26 05 33.16.
1. Provide depth as required to accommodate cable manufacturer's recommended minimum conductor bend radius.

C. Wall Plates:
1. Comply with system design standards and UL 514C.
2. Accepts modular jacks/inserts.
3. Capacity:
4. Wall Plate Material/Finish - Flush-Mounted Outlets: Type 302 stainless steel. Hubbell M/N SS2XX or approved equal.

2.07 GROUNDING AND BONDING COMPONENTS

A. Refer to above mentioned Delaware State-Wide Information And Architecture Standards as well as other project specifications and drawings.

B. Comply with TIA-607-C.

2.08 IDENTIFICATION PRODUCTS

A. Refer to above mentioned Delaware State-Wide Information And Architecture Standards as well as other project specifications and drawings.

B. Comply with TIA-606.

C. Identification shall be as specified and directed by Owner at no additional cost to the Owner

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Refer to above mentioned Delaware State-Wide Information And Architecture Standards as well as other project specifications and drawings.

B. Comply with Communication Service Provider requirements.

C. Grounding and Bonding: Perform in accordance with TIA-607-C and NFPA 70.

D. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

E. Refer to above mentioned Delaware State-Wide Information And Architecture Standards as well as other project specifications and drawings.

3.02 INSTALLATION OF PATHWAYS

A. Install pathways cable trays and ladder racks in accordance with manufacturer installation instructions. Cut to fit. Install in a clean and workmanlike manner.

B. 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. 5 inches from fluorescent and high frequency lighting fixtures.
4. 6 inches from flues, hot water pipes, and steam pipes.

C. Conduit, in Addition to Requirements of Section 26 05 33.13:
1. Arrange conduit to provide no more than the equivalent of two 90 degree bend(s) between pull points.
2. Conduit Bends: Inside radius not less than 10 times conduit internal diameter.
3. Arrange conduit to provide no more than 100 feet between pull points.

NOT FOR BIDDING

D. Outlet Boxes:
   1. Coordinate locations of outlet boxes provided under Section 26 05 33.16 as required for installation of telecommunications outlets provided under this section.
      a. Mounting Heights: Unless otherwise indicated, as follows:
         1) Telephone and Data Outlets: 18 inches above finished floor.
         2) Telephone Outlets for Side-Reach Wall-Mounted Telephones: 48 inches above finished floor to top of telephone.
         3) Telephone Outlets for Forward-Reach Wall-Mounted Telephones: 48 inches above finished floor to top of telephone.
      b. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
      c. Unless otherwise indicated, provide separate outlet boxes for line voltage and low voltage devices.
      d. Locate outlet boxes so that wall plate does not span different building finishes.
      e. Locate outlet boxes so that wall plate does not cross masonry joints.

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. Copper Cabling:
   1. For 4-pair cables in conduit, do not exceed 25 pounds pull tension.
   2. Use T568B wiring configuration.

C. Floor-Mounted Racks and Enclosures: Permanently anchor to floor in accordance with manufacturer's recommendations.

D. 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. Identify components as directed by Owner at no additional cost to Owner.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, 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. Test backbone cables after termination but before cross-connection.
   2. Test backbone cables for DC loop resistance, shorts, opens, intermittent faults, and polarity between connectors and between conductors and shield, if cable has overall shield.
   3. Test operation of shorting bars in connection blocks.
   4. Category 3 Backbone: Perform attenuation test.
   5. Category 3 Links: Test each pair for short circuit continuity, short to ground, crosses, reversed polarity, operational and ring-back, and dial tone.

NOT FOR BIDDING

6. Category 5e and Above Backbone: Perform near end cross talk (NEXT) and attenuation tests.
7. Category 5e and Above Links: Perform tests for wire map, length, attenuation, NEXT, and propagation delay.
8. Refer to above mentioned Delaware State-Wide Information And Architecture Standards as well as other project specifications and drawings.

E. Testing - Fiber Optic Cabling:
1. Backbone: Perform optical fiber end-to-end attenuation test using an optical time domain reflectometer (OTDR) and manufacturer's recommended test procedures; perform verification acceptance tests and factory reel tests.
2. Multimode Backbone: Perform tests in accordance with TIA-526-14.
3. Links: Perform optical fiber end-to-end attenuation tests and field reel tests.
4. Refer to above mentioned Delaware State-Wide Information And Architecture Standards as well as other project specifications and drawings.

END OF SECTION

NOT FOR BIDDING

SECTION 28 31 00
FIRE DETECTION AND ALARM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire alarm system design and installation, including all components, wiring, and conduit.

B. Transmitters for communication with supervising station.

C. Circuits from protected premises to supervising station, including conduit.

D. Maintenance of fire alarm system under contract for specified warranty period.

1.02 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Cor 1, 2012).

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.

E. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 268 - Standard for Smoke Detectors for Fire Alarm Systems; Current Edition, Including All Revisions.

1.03 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Drawings must be prepared using AutoCAD Release 2021.
   1. Owner will provide floor plan drawings for Contractor's use; verify all dimensions on Owner-provided drawings.

C. Evidence of designer qualifications.

D. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
   1. Copy (if any) of list of data required by authority having jurisdiction.
   2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
   3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
   4. System zone boundaries and interfaces to fire safety systems.
   5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
   6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
   7. List of all devices on each signaling line circuit, with spare capacity indicated.
   8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
   9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
   10. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
   11. Certification by the manufacturer of the control unit that the system design complies with the contract documents.

NOT FOR BIDDING

12. Certification by Contractor that the system design complies with the contract documents.

E. Evidence of installer qualifications.

F. Evidence of instructor qualifications; training lesson plan outline.

G. Evidence of maintenance contractor qualifications, if different from installer.

H. Inspection and Test Reports:
   1. Submit inspection and test plan prior to closeout demonstration.
   2. Submit documentation of satisfactory inspections and tests.
   3. Submit NFPA 72 "Inspection and Test Form," filled out.

I. Operating and Maintenance Data: See Section 01 78 00 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
   1. Complete set of specified design documents, as approved by authority having jurisdiction.
   2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
   3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
   4. List of recommended spare parts, tools, and instruments for testing.
   5. Replacement parts list with current prices, and source of supply.
   6. Detailed troubleshooting guide and large scale input/output matrix.
   7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
   8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

J. Project Record Documents: See Section 01 78 00 for additional requirements; have one set available during closeout demonstration:
   1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
   2. "As installed" wiring and schematic diagrams, with final terminal identifications.
   3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.

K. Closeout Documents:
   1. Certification by manufacturer that the system has been installed in compliance with his installation requirements, is complete, and is in satisfactory operating condition.
   2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
   3. Certificate of Occupancy.
   4. Maintenance contract.

L. Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.
   1. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data .
   2. In addition to the items in quantities indicated in PART 2, furnish the following:
      a. All tools, software, and documentation necessary to modify the fire alarm system using Owner's personnel; minimum modification capability to include addition and deletion of devices, circuits, and zones, and changes to system description, operation, and evacuation and instructional messages.
      b. One copy, on CD-ROM, of all software not resident in read-only-memory.

1.04 QUALITY ASSURANCE

A. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer, with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.

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B. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
   1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
   2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
   3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.

C. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

D. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.05 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.

C. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Alarm Control Units - Basis of Design: Simplex Remote Command Center .

B. Fire Alarm Control Units - Other Acceptable Manufacturers: Provided their products meet or exceed the performance of the basis of design product, products of the following are acceptable:
   1. Honeywell Security & Fire Solutions/Fire-Lite: www.firelite.com/#sle.
   2. Honeywell Security & Fire Solutions/Silent Knight: www.silentknight.com/#sle.
   3. Provide all control units made by the same manufacturer.

C. Initiating Devices, and Notification Appliances:
   1. Honeywell Security & Fire Solutions/Fire-Lite: www.firelite.com/#sle.
   2. Honeywell Security & Fire Solutions/Silent Knight: www.silentknight.com/#sle.
   3. Same manufacturer as control units.
   4. Provide all initiating devices and notification appliances made by the same manufacturer.

D. Substitutions: See Section 01 60 00 - Product Requirements.
   1. For other acceptable manufacturers of control units specified, submit product data showing equivalent features and compliance with contract documents.
   2. For substitution of products by manufacturers not listed, submit product data showing features and certification by Contractor that the design will comply with contract documents.

2.02 FIRE ALARM SYSTEM

A. Fire Alarm System: Provide a new automatic fire detection and alarm system:
   1. Provide all components necessary, regardless of whether shown in the contract documents or not.
   2. Protected Premises: stairwell, elevator lobbies, security office.
   3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
      a. ADA Standards for Accessible Design.

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b. The requirements of the State Fire Marshal.
c. The requirements of the local authority having jurisdiction, which is State Of Delaware Fire Marshall's office.
d. Applicable local codes.
e. The contract documents (drawings and specifications).
f. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.

4. Master Control Unit (Panel): New, located at the security office.

B. Supervising Stations and Fire Department Connections:
1. Public Fire Department Notification: By on-premises supervising station.
2. Means of Transmission to Remote Supervising Station: Remote Dialer.

C. Circuits:
1. Initiating Device Circuits (IDC): Class A, Style D.
2. Signaling Line Circuits (SLC) Within Single Building: Class A, Style 7.

D. Spare Capacity:
1. Initiating Device Circuits: Minimum 25 percent spare capacity.
2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
3. Speaker Amplifiers: Minimum 25 percent spare capacity.
4. Master Control Unit: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.

E. Power Sources:
1. Primary: Dedicated branch circuits of the facility power distribution system.
2. Secondary: Storage batteries.
3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
4. Each Computer System: Provide uninterruptible power supply (UPS).

2.03 FIRE SAFETY SYSTEMS INTERFACES

A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
1. Elevator shut-down control circuits.

B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
1. Elevator lobby, elevator hoistway, and elevator machine room smoke detectors.

C. Elevators:
1. Elevator lobby, hoistway, and machine room smoke detectors: Elevator recall for fire fighters' service.
2. Elevator Machine Room Heat Detector: Shut down elevator power prior to hoistway sprinkler activation.

2.04 COMPONENTS

A. General:
1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Fire Alarm Control Units, Initiating Devices, and Notification Appliances: Analog, addressable type; listed by Underwriters Laboratories as suitable for the purpose intended.

C. Master Control Unit: As specified for Basis of Design above, or equivalent.

D. Remote Annunciators: Fire Lite.

E. Addressable Modules:
1. Provide addressable modules suitable for connection to fire alarm control unit signaling line circuits.

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2. Unless otherwise indicated, use addressable modules only in clean, dry, indoor, nonhazardous locations.
3. Monitor Modules: Unless devices are explicitly permitted to be connected together as zone, provide separate addressable monitor module for each conventional dry-contact input device in order to be individually identifiable by addressable fire alarm control unit.
4. Control Modules: Provide as indicated or as required for selective control of notification appliances.

F. Initiating Devices:
1. Addressable Systems:
   a. Addressable Devices: Individually identifiable by addressable fire alarm control unit.
   b. Provide suitable addressable interface modules as indicated or as required for connection to conventional (non-addressable) devices and other components that provide a dry closure output.
2. Manual Pull Stations: Simplex.
   a. Provide 1 extra.
3. Smoke Detectors: Simplex.
   a. Provide 1 extra.
4. Heat Detectors: Simplex.
   a. Provide 1 extra.
5. Addressable Interface Devices: Simplex.
   a. Provide 1 extra.

G. Notification Appliances:
1. Bells: Simplex.
2. Speakers: Simplex.
   a. Provide 1 extra.
3. Strobes: Simplex.
   a. Provide 1 extra.

H. Circuit Conductors: Copper or optical fiber; provide 200 feet extra; color code and label.

I. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.

J. Locks and Keys: Deliver keys to Owner.

K. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
2. Provide one for each control unit where operations are to be performed.
3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
4. Provide extra copy with operation and maintenance data submittal.

L. Storage Cabinet for Spare Parts and Tools: Steel with baked enamel finish, size appropriate to quantity of parts and tools.
1. Padlock eye and hasp for lock furnished by Owner.
2. Locate as directed by Owner.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and the contract documents.

B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.

C. Obtain Owner's approval of locations of devices, before installation.

D. Install instruction cards and labels.

3.02 INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner 7 days prior to beginning completion inspections and tests.

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B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

E. Provide all tools, software, and supplies required to accomplish inspection and testing.

F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.

G. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

3.03 OWNER PERSONNEL INSTRUCTION

A. Provide the following instruction to designated Owner personnel:
   1. Hands-On Instruction: On-site, using operational system.
   2. Classroom Instruction: Owner furnished classroom, on-site or at other local facility.

B. Administrative: One-hour session(s) covering issues necessary for non-technical administrative staff; classroom:
   1. Initial Training: 1 session pre-closeout.

C. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
   1. Initial Training: 1 session pre-closeout.

D. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.

3.04 CLOSEOUT

A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
   1. Be prepared to conduct any of the required tests.
   2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
   3. Have authorized technical representative of control unit manufacturer present during demonstration.
   4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
   5. Repeat demonstration until successful.

B. Occupancy of the project will not occur prior to Substantial Completion.

C. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:
   1. Approved operating and maintenance data has been delivered.
   2. Spare parts, extra materials, and tools have been delivered.
   3. All aspects of operation have been demonstrated to Owner.
   4. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
   5. Occupancy permit has been granted.
   6. Specified pre-closeout instruction is complete.

3.05 MAINTENANCE

A. See Section 01 70 00 - Execution Requirements, for additional requirements relating to maintenance service.

B. Provide to Owner, at no extra cost, a written maintenance contract for entire manufacturer's warranty period, to include the work described below.

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C. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
   1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
   2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
   3. Record keeping required by NFPA 72 and authorities having jurisdiction.

D. Provide trouble call-back service upon notification by Owner:
   1. Provide on-site response within 2 hours of notification.
   2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
   3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

E. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

F. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.

G. Comply with Owner's requirements for access to facility and security.

END OF SECTION

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SECTION 31 10 00

SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping, or sealing site utilities.
7. Temporary erosion and sedimentation control.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Hold Erosion and Sediment Control Preconstruction Meeting on-site prior to beginning site clearing.

1.3 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

B. Should any question arise as to ownership the Contractor shall immediately discuss with Owner prior to removal from site.

1.4 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction (AHJ).

B. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

C. Do not commence clearing or installation of ESC measures prior to completion of Utility Location markings.

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D. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 31 20 00 "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

2. Material obtained from off-site must come from a site with an open grading permit and functioning Erosion and Sediment Control measures.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to the construction plans and requirements of authorities having jurisdiction (AHJ).

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones. Similarly, ensure that diverted or redirected water/runoff does not create erosion or sedimentation on adjoining properties. The Contractor is liable for any damage done to adjoining properties and related fine/penalties. These costs are not subject to reimbursement by the Owner.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. The Contractor shall comply with all ESC notes and specifications shown on the plans approved by the AHJ.

E. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal in accordance with the plans approved by the AHJ.

F. Coordinate with the Owner and attend site inspections as required by the Owner.

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G. Inspect all ESC measures as outlined on the plans approved by the AHJ, but not less than daily and after any rainfall. Any measures deficient will be repaired immediately.

3.3 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

1. Arrange with utility companies to shut off indicated utilities.

B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner not less than 72 hours in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owners written permission.

3.4 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Grind down stumps and remove roots larger than 3 inches in diameter, obstructions, and debris to a depth of 18 inches below exposed subgrade.
2. Use only hand methods or air spade for grubbing within protection zones.
3. An ISA (International Society of Arboriculture) licensed arborist shall be employed to conduct an evaluation of the trees to be trimmed. The contractor shall follow recommendations made by the arborist to selectively trim limbs as needed to minimize the potential impact to trees within the project limits.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches and compact each layer to a density equal to adjacent original ground. Consult with ISA licensed arborist with regard to compaction over existing tree roots.

3.5 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

D. Provide appropriate sediment control measures for stockpiled material.

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3.6 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated on the approved plans and necessary to facilitate new construction.

3.7 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property. Soil shall be disposed of at a spoil site with an open grading permit and functioning ESC measures.

B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials, and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 31 10 00

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SECTION 31 20 00

EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for slabs-on-grade walks pavements turf and grasses and plants.
3. Excavating and backfilling for buildings and structures.
4. Drainage course for concrete slabs-on-grade.
5. Subbase course for concrete walks and pavements.
6. Subbase course and base course for asphalt paving.
7. Excavating and backfilling trenches for utilities and pits for buried utility structures.

1.2 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside, including haunches to support sides of pipe and over pipe in a trench.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

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H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

L. Non-Frost Susceptible, Free Draining Fill Material: Non-frost susceptible, free-draining fill refers to materials like well-graded granular mixtures (sand, gravel, and crushed stone) that are not prone to frost heave and allow water to drain quickly through them. These materials have a low percentage of fines (typically less than 6% passing a #200 sieve) and do not retain water, preventing the ice lensing that causes frost heave.

1. Frost Susceptibility:
   - Frost susceptibility refers to the tendency of a soil or fill material to heave (lift) due to the freezing of water within it.
   - This heaving can damage structures, pavements, and other infrastructure.
   - Non-frost-susceptible materials are those that do not experience significant frost heave.
2. Free-Draining:
   - Free-draining materials allow water to flow through them easily, preventing water from accumulating and freezing.
   - This is achieved by having a good gradation of particles and minimal fines.
   - Examples include well-graded sand and gravel, and crushed stone.
3. Why These Materials are Used:
   - They are used as fill materials in foundations, pavements, and other areas where frost heave is a concern.
   - They help to prevent or minimize frost heave by allowing water to drain away and by reducing the likelihood of ice lens formation.
   - They are also often used as backfill for retaining walls.
4. Examples of Non-Frost-Susceptible and Free-Draining Fill Materials:
   Well-graded sand and gravel, Crushed stone, Reclaimed Asphalt Pavement (RAP), and Some types of slag and cinders.

NOT FOR BIDDING

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct pre-excavation conference at Project site.

1.4 INFORMATIONAL SUBMITTALS

A. Material test reports.

1.5 FIELD CONDITIONS

A. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth-moving operations. Utilities must be marked before commencing earth moving operations.

B. The Contractor is responsible for confirming to their satisfaction the presence of utilities before commencing grading operations. Damage to existing utilities and monetary loss as a result of necessary repairs or operational ability to those served by the disrupted utility are the responsibility of the Contractor alone.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. All soils are to be confirmed by the on-site geotechnical engineer for suitability before use.

C. The Contractor will refer to the geotechnical report and defer to the on-site geotechnical engineer/inspector with regard to the suitability of soils for use.

D. Satisfactory Soils: Refer to the geotechnical report for suitable soils.

E. Unsatisfactory Soils: Refer to the geotechnical report for unsuitable soils.

F. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

G. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

H. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M 0; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

I. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

NOT FOR BIDDING

J. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

K. Drainage Course: Narrowly graded mixture of washed crushed stone or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and zero to 5 percent passing a No. 8 sieve.

2.2 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored to comply with local practice or requirements of authorities having jurisdiction.

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 earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.3 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work. Include allowance for any granular material to be placed beneath footing or foundation.

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2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces. Include allowance for anchorage to prevent flotation of underground tanks.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

3.4 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.5 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: 12 inches each side of pipe or conduit.

B. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

2. Over excavate as necessary to permit installation of suitable granular base material prevent point loads on pipe after placement.

3.6 SUBGRADE INSPECTION

A. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired dump truck to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades. Appropriate compaction equipment and/or rollers are to be used for material and soil being compacted.

B. Proof-rolling is to be conducted under the observation and supervision of the on-site geotechnical engineer.

C. Un-suitable material not meeting approval by the geotechnical engineer is to be removed and replaced with suitable/acceptable material. Saturated soils are to be appropriately undercut.

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D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.7 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

2. Adequate ESC measures are to be placed to prevent sediment runoff from stockpiled material. Likewise, water is to be diverted around stockpiled materials.

3.8 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice. Unsuitable material is to be removed and replaced with suitable materials, as directed by the geotechnical engineer.

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. Trenches under Roadways: 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 course.

D. Initial Backfill: Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

2. Material should be free of angular stones larger than 1” that might create point loads against conduit or utility during and after compaction.

E. Final Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.

F. Warning Tape: Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.9 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.

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3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

3.10 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent 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 2 percent and is too wet to compact to specified dry unit weight.
3. Material is to be tested and compacted under the direction of the geotechnical engineer.

3.11 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil 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. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

1. Top 8” of existing subgrade and each layer of backfill or fill soil material at 95 percent of maximum dry density. With a moisture content of 2%+/-.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent of maximum dry density. With a moisture content of 2%+/-.
3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent of maximum dry density. With a moisture content of 2%+/-.
4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent of maximum dry density. With a moisture content of 2%+/-.

3.12 GRADING

A. 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.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1 inch.
3. Pavements: Plus or minus 1/2 inch.

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3.13 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:

1. Shape subbase course and base course to required crown elevations and cross-slope grades.
2. Place subbase course 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.
3. Compact subbase course 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 1557.

3.14 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Place drainage 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.
2. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.15 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified and licensed geotechnical inspector to perform inspections:

B. Testing Agency: Owner will engage a qualified and licensed geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

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3.16 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.17 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

3.18 SHORING

A. Contractor shall submit a shoring plan, signed and sealed by a licensed professional engineer in the State of Delaware.

B. Contractor shall submit all necessary computations.

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DEWATERING

PART 1 – SCOPE

The work consists of the removal of surface water and ground water as necessary to perform construction required by the contract and in accordance with the specifications. It shall include: (1) constructing, installing, building and maintaining all necessary temporary water containment facilities, channels and diversions; (2) furnishing, installing and operating all necessary pumps, piping and other facilities and equipment; and (3) removing all such temporary works and equipment after their intended function is no longer required. This scope includes well pointing as required.

PART 2 - DIVERTING SURFACE WATER

The contractor shall install, maintain, and operate all cofferdams, channels, flumes, sumps, and all other temporary diversion and protective works needed to divert streamflow and other surface water through or around the construction site. Control of surface water shall be continuous during the period that damage to construction work could occur. Unless otherwise specified and/or approved, the diversion outlet shall be into the same drainageway that the water would have reached before being diverted.

The contractor shall furnish the engineer, in writing, a proposed plan for diverting surface water before beginning any construction activities for which a diversion is required, unless waived or noted on the design. Acceptance of this plan or the waiving of the plan requirement will not relieve the contractor of the responsibilities related to this activity during the process of completing the work as specified.

PART 3 - DEWATERING THE CONSTRUCTION SITE

Foundations, cutoff trenches, and all other parts of the construction site shall be dewatered and kept free of standing water and muddy conditions as necessary for the proper execution of the work. The contractor shall furnish, install, operate, and maintain all drains, sumps, pumps, casings, well points, and all other equipment required to properly dewater the site as specified. Dewatering systems that cause a loss of soil fines from the foundation areas will not be permitted.

The contractor shall furnish the engineer, in writing, a proposed plan for dewatering before commencing with any construction activity for which dewatering may be required, unless waived or noted on the design. Acceptance of this plan or the waiving of the plan requirement will not relieve the contractor of the responsibilities for completing the specified work.

PART 4 - DEWATERING FOR STREAM WORK

Any work that is conducted near or adjacent to streams and rivers must be conducted in a way that prevents sediment or other pollutants from entering the water body. A written sedimentation and dewatering plan shall be provided to the engineer before starting construction. Work must be conducted during periods of low water and when no significant rainfall is predicted and according to requirements form other state or federal agencies. No water may flow through active work areas. Any water that is pumped from the work area and contains sediment shall be discharged into an approved sediment basin or filtering device.

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PART 5 - DEWATERING BORROW AREAS

The contractor shall maintain all borrow areas free of surface water or otherwise provide for timely and effective removal of surface and subsurface water that accumulates within the borrow area, unless waived or noted on the design. Borrow material shall be processed as necessary to achieve proper and uniform moisture content at the time of placement.

PART 6 - EROSION AND POLLUTION CONTROL

Removal of water from the construction site, including the borrow areas, shall be accomplished so that erosion and the transporting of sediment and other pollutants are minimized. Dewatering activities shall be accomplished in a manner that the water table water quality is not altered.

PART 7 - REMOVAL OF TEMPORARY WORKS

When temporary works are no longer needed, the contractor shall remove and return the area to a condition similar to that which existed before construction. Areas where temporary works were located shall be graded for sightly appearance with no obstruction to natural surface waterflows or the proper functioning and access to the works of improvement installed. The contractor shall exercise extreme care during the removal stages to minimize the loss of soil sediment and debris that was trapped during construction.

Pipes, casings, and any other material used to dewater the site shall be removed from temporary wells. The wells shall be filled to ground level with clean gravel or other suitable material approved by the engineer. The contractor shall exercise extreme care to prevent pollution of the ground water by these actions.

PART 8 - SPECIFIC DETAILS

The contractor is responsible for obtaining and complying with all permits associated with dewatering. All dewatering required is incidental to the contract.

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SHORT AGGREGATE PIER FOUNDATIONS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Work shall consist of designing, furnishing and installing Rammed Aggregate Pier foundations to the lines and grades designated on the project foundation plan and as specified herein. The aggregate piers shall be constructed by either augering a cavity or driving a hollow mandrel to the design depth and vertically ramming lifts of aggregate using the specially designed tamper head and high-energy impact densification equipment to create the compacted aggregate pier. The Rammed Aggregate Pier elements shall be in a closely spaced columnar-type configuration effectively providing the minimum required strength and stiffness improvement of the bearing strata and making it capable of supporting conventional spread footing foundations.

1.2 WORK INCLUDED

1. All equipment, material, labor, and supervision to design and install Rammed Aggregate Piers. Design shall rely on subsurface information presented in the project geotechnical report. Pre-drilling where required and/or use of temporary casings to prevent collapse of the pier excavation, shall be included in the Work.

2. The specialty contractor must layout all Rammed Aggregate Piers based on specific tools used and the required strength and stiffness parameters indicated herein below and on the structural drawings.

3. This work shall include spoil removal (as required). This work shall not include footing excavations and subgrade preparation following aggregate pier installation.

4. The Rammed Aggregate Pier design and installation shall adhere to all methods and standards described in this Specification Section.

5. Drawings and General Provisions of the Contract, including General and Supplemental Conditions, and Division 1 Specifications, apply to the work in this specification

1.3 INSTALLER QUALIFICATIONS

A. Installers of Rammed Aggregate Pier foundation systems shall have a minimum of 5 years of experience with the installation of Rammed Aggregate Pier systems and shall have completed at least 20 projects successfully utilizing one manufacturer's system or that and system(s) of similar nature. The Installer's registered Professional Engineer (see paragraph 1.5.A herein below) shall have an experience of providing calculations, drawings and overseeing similar installations on at least 10 projects of the extent and complexity comparable to this project. The Installer's and his/her registered Professional Engineer's portfolios of projects and appropriate references verifying qualifications and experience, shall be submitted to the Owner's Geotechnical Engineer for review and approval. The Rammed Aggregate Pier Installers shall be approved by the Owner's Geotechnical Engineer prior to bid opening.

B. Installer of Rammed Aggregate Pier foundation system must be approved in writing by the manufacturer of system equipment.

C. Soil Improvement Systems similar in nature to the Rammed Aggregate Piers will be considered following a submittal to the Owner's Geotechnical Engineer a detailed description of the system,

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manufacturer's and installer's qualifications and a written certification of meeting or exceeding the requirements of the improved soil strength and stiffness.

1.4 REFERENCE STANDARDS

A. Design

1. Control of Settlement and Uplift of Structures Using Short Aggregate Piers," by Evert C. Lawton (Assoc. Prof., Dept. of Civil Eng., Univ. of Utah), Nathaniel S. Fox (President, Geopier Foundation Co., Inc.), and Richard L. Handy (Distinguished Prof. Emeritus, Iowa State Univ., Dept. of Civil Eng.), reprinted from *IN-SITU DEEP SOIL IMPROVEMENT, Proceedings of sessions sponsored by the Geotechnical Engineering Division/ASCE in conjunction with the ASCE National Convention held October 9-13, 1994, Atlanta, Georgia*.

2. "Settlement of Structures Supported on Marginal or Inadequate Soils Stiffened with Short Aggregate Piers," by Evert C. Lawton and Nathaniel S. Fox. *Geotechnical Special Publication No. 40: Vertical and Horizontal Deformations of Foundations and Embankments,* ASCE, 2, 962-974.

3. "Behavior of Geopier® -Supported Foundation Systems during Seismic Events," by Kord Wissmann, Evert C. Lawton, and Tom Farrell. Geopier Foundation Company, Inc. Blacksburg, VA ©1999.

B. Modulus Testing

1. ASTM D 1143 – Pile Load Test Procedures
2. ASTM D 1194 – Spring Footing Load Test

C. Materials and Inspection
1. ASTM D 1241 - Aggregate Quality
2. ASTM D 422 -Gradation of Soils

D. Where specifications and reference documents conflict, the Rammed Aggregate Pier Designer shall make the final determination of the applicable document.

1.5 CERTIFICATIONS AND SUBMITTALS

A. Design Calculations. The Rammed Aggregate Pier Installer shall employ a Professional Engineer specializing in design of similar installations and licensed to practice in the State where the Work is located. The Installer shall submit detailed design calculations and construction drawings sealed and signed by the Rammed Aggregate Pier Professional Engineer, and prepared specifically for this project.

B. The design assumptions relative to the strength and stiffness of the Rammed Aggregate Pier shall be verified by field testing as directed by the Installer's Professional Engineer and reviewed and confirmed by the Owner's Geotechnical Engineer. Testing for this purpose shall be performed by the Installer on a non-production Rammed Aggregate Pier set where specifically designated on the installation drawings and approved by the Owner's Geotechnical Engineer, the Construction Manager and the Owner.

C. The Installer shall furnish the Owner's Geotechnical Engineer the description of the method used to verify design parameters based on the test results. This information together with the results of tests and subsequent conclusions, shall be contained in a report prepared under the direction of the Installer's Registered Professional Engineer, and submitted to the Owner's Geotechnical Engineer for review and approval.

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D. Daily Rammed Aggregate Pier Progress Reports. The Installer shall furnish a complete and accurate record of Rammed Aggregate Pier installation to the Construction Manager and the Owner's Geotechnical Engineer. The record shall indicate the pier locations, lengths, respective volume of aggregate used or number of lifts, densification forces during installation, and final elevations or depths of the base and top of piers. The record shall also indicate the type and size of the installation equipment used, and the type of aggregate used. The Installer shall immediately report any unusual conditions encountered during installation to the Installer's Engineer, the Owner's Geotechnical Engineer and the Construction Manager.

E. Any and all unusual conditions and adverse effect they may have on the capacity and/or stiffness of the improved soil via Rammed Aggregate Piers, must be addressed by the Installer and the Installer's Professional Engineer by designing and installing remedial work, at Installer's cost, such that improved bearing capacity of soil and the resulting stiffness are not compromised. Any and all remedial action must be reviewed and approved by the Owner's Geotechnical Engineer.

PART 2 - MATERIALS

2.1 AGGREGATE

A. Aggregate used by the Rammed Aggregate Pier Installer for pier construction shall be pre- approved by the Installer's Professional Engineer and the Owner's Geotechnical Engineer. Suitability of the proposed material shall be confirmed by testing proposed and conducted by the Installer and approved and observed by the Owner's Geotechnical Engineer. Typical aggregate consists of Type 1 Grade B in accordance with ASTM D1241 by gradation, ASTM C33 No. 57 aggregate, recycled concrete or other graded aggregate.

B. Potable water shall be used to increase aggregate moisture content where required. Water other than potable may be used if approved by the Owner's Geotechnical Engineer for this purpose only.

2.2 Steel Casing: Steel Pipe Casings ASTM A252, Grade 2, or ASTM A36.

2.3 RAMMED AGGREGATE PIER DESIGN

A. The design of the Rammed Aggregate Pier system shall be based on the service load bearing pressure and the allowable total and differential settlement criteria of all footings indicated by the design team for support by the Rammed Aggregate Pier system. The Rammed Aggregate Pier system shall be designed in accordance with generally-accepted engineering practice and the methods described in Section 1 of these Specifications. The design life of the structure shall be 50 years.

B. The design shall meet the following criteria.

1. Maximum Allowable Bearing Pressure for Footings supported by Rammed Aggregate Pier Reinforced Soils 4,000 psf.

2. Estimated Total Long-Term Settlement for Footings: ≤ 1-inch

3. Estimated Long-Term Differential Settlement of Adjacent Footings: ≤ ½-inch

C. The Rammed Aggregate Piers shall be designed using a Rammed Aggregate Pier stiffness modulus to be verified by the results of the modulus test described in Section 3.6 of this Specification Section.

2.4 DESIGN SUBMITTAL

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A. The Installer shall submit detailed design calculations, layout drawings, and shop drawings comprising the Design Submittal, to the Architect, for approval at least 3 week(s) prior to the commencement of construction. A detailed explanation of the design parameters for settlement calculations shall be included in the Design Submittal. Additionally, the quality control test program for Aggregate Pier system, meeting these design requirements, shall be submitted. All calculations and drawings shall be prepared by or under the direct supervision of a Professional Engineer, licensed in the State where the piers are to be built, and signed and sealed by that Engineer per the building official requirements of that State or locale.

PART 3 - EXECUTION

3.1 SITE INSPECTION

A. All adjacent buildings, structures and utilities located within minimum of 30 ft and up to 50 ft of the pier work area shall be examined and documented by the Installer on the subject of pre-existing cracks, settlement or other damage, prior to the commencement of the installation of the Rammed Aggregate Piers. The Installer must notify the Construction Manager and the Owner of any and all such findings by issuing a written report.

B. All such buildings, structures and utilities must be monitored during construction of the Work. A monitoring program must be submitted by the Installer to the Construction Manager and the Owner's Geotechnical Engineer, and approved by both prior to implementation and commencement of the Work. Any signs of damage due to specific installation methods by the Installer, must be immediately reported to the Construction Manager and the Owner's Geotechnical Engineer, who will make a decision concerning specific methods of Work related to the potential of damage to the adjacent construction.

3.2 APPROVED INSTALLATION PROCEDURES

A. The following sections provide general criteria for the construction of the Rammed Aggregate Piers. Unless otherwise directed by the Owner's Geotechnical Engineer in writing, the installation method used for Rammed Aggregate Pier construction shall be that used in the construction of the pier which resulted in a successful test confirming minimum requirements for strength and stiffness of the improved soil. The selection of a particular method shall be made by the Installer based on the review of the Geotechnical Report attached to these Specifications, experience and knowledge of the local subsurface conditions.

B. Obstructions encountered during excavation or drilling of piers that will prevent extending aggregate piers to the design depth, or cause the aggregate pier to stray from its specified location during installation, shall be removed. Obstructions include, but are not limited to, boulders, timbers, abandoned foundations, utility lines, etc., which prevent normal advance of pier excavation using typical and customary equipment for such operations. Dense natural rock or weathered rock, if determined to be such as opposed to cobblers or boulders, by the Owner's Geotechnical Engineer, shall not be deemed obstructions, and piers may be terminated short of design lengths on such materials. To the extent the obstructions are shown in the available project data including but not limited to the geotechnical report, removal of obstructions shall be performed at no additional cost to the Owner.

C. Augered Rammed Aggregate Pier systems.
1. Augered Rammed Aggregate Pier system shall be pre-drilled using mechanical drilling or excavation equipment.

2. If cave-ins exceeding 10% of the lift volume occur during excavation such that the sidewalls of the hole are deemed to be unstable, a temporary steel casing shall be used to stabilize the cavity, or a Displacement Rammed Aggregate Pier system described under 3.2.D

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herein below, may be used instead.

3. Aggregate shall be placed in the augered cavity in lift thicknesses as determined by the Installer's Professional Engineer and approved by the Owner's Geo-technical Engineer.

4. A specially-designed densification apparatus shall be employed to densify lifts of aggregate during installation. The apparatus shall apply direct downward impact energy to each lift of aggregate. Compaction equipment that induces horizontal vibratory energy maybe permitted provided its technology and use are not detrimental to the site and surrounding soils and foundations and must be acceptable to the Owner's Geotechnical Engineer.

D. Displacement Rammed Aggregate Pier systems.

1. Displacement Rammed Aggregate Pier systems shall be constructed by advancing a specially designed mandrel with a minimum 15 ton static force augmented by dynamic vertical ramming energy to the full design depth. The hollow-shaft mandrel, filled with aggregate, is incrementally raised, permitting the aggregate to be released into the cavity, and then lowered by vertically advancing and/or ramming to densify the aggregate and force it laterally into the adjacent soil. The cycle of raising and lowering the mandrel is repeated to the top of pier elevation. The cycle vertical increment shall be determined by the Installer's Engineer.

2. Special high-energy impact densification apparatus shall be employed to vertically densify the Rammed Aggregate Pier elements during installation of each constructed lift of aggregate.

3. Densification shall be performed using a mandrel/tamper. The mandrel/tamper foot is required to adequately increase the lateral earth pressure in the matrix soil during installation. Compaction equipment that induces horizontal vibratory energy maybe permitted provided its technology and use are not detrimental to the site and surrounding soils and foundations and must be acceptable to the Owner's Geotechnical Engineer.

4. Downward crowd pressure shall be applied to the mandrel during installation.

3.3 TOLERANCES

A. The as-built center of each pier shall be within 6 inches of the locations indicated on the approved shop drawings. Piers installed outside of the above tolerances and deemed not acceptable shall be rebuilt at no additional expense to the Owner.

B. Top of aggregate pier elevation shall never be lower than the design bottom of the respective footing. Excessive rammed aggregate resulting from placement of piers above the design bottom of respective footing must be locally removed by the Installer without disturbing constructed piers, no additional cost to the Owner.

3.4 REJECTED RAMMED AGGREGATE PIER ELEMENTS

A. Rammed Aggregate Piers installed beyond the maximum allowable tolerances shall be abandoned and replaced with new piers, unless the Installer's Professional Engineer approves the condition or provides other remedial measures and the assessment and/or remedial measures are approved by the Owner's Geotechnical Engineer. All material and labor required to replace rejected piers shall be provided at no additional cost to the Owner, unless the cause of rejection is due to an obstruction not specifically identified or other unforeseen condition.

3.5 CONTROL TECHNICIAN

A. The Installer shall have a full-time, on-site Control Technician to verify and report all installation

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procedures. The Installer shall immediately report any unusual conditions encountered during installation to the Installer's Professional Engineer, the Construction Manager, and to the Owner's Geotechnical Engineer.

3.6 RAMMED AGGREGATE PIER MODULUS TEST

A. As required by the Installer's Professional Engineer, a Rammed Aggregate Pier Modulus Test(s) will be performed at locations agreed upon by the Installer's Professional Engineer, the Construction Manager, the Owner and the Owner's Geotechnical Engineer. The testing shall be used to verify or modify Rammed Aggregate Pier design. Modulus Test Procedures shall utilize appropriate portions of ASTM D 1143 and ASTM D 1194, as outlined in the Rammed Aggregate Pier design submittal.

3.7 BOTTOM STABILIZATION TESTING (BSTs) / CROWD STABILIZATION TESTING (CSTS)

A. Bottom stabilization testing (BSTs) or Crowd stabilization testing (CSTs) shall be performed by the Control Technician during the installation of the modulus test pier. Additional testing as required by the Rammed Aggregate Pier Designer shall be performed on selected production Rammed Aggregate Pier elements to compare results with the modulus test pier.

3.8 OWNER'S GEOTECHNICAL ENGINEER

A. The Rammed Aggregate Pier Installer shall provide full-time Quality Control monitoring of Rammed Aggregate Pier construction activities. See specification Section 01 45 00 for the Owner's Geotechnical Engineer's scope of services.

3.9 SITE PREPARATION AND PROTECTION

A. All known underground and aboveground utilities and other structures either abandoned or to remain in service during or following construction, shall be located and conspicuously marked by others as coordinated by the Construction Manager. The protection program of buildings, structures and utilities from damage during installation of the Rammed Aggregate Piers shall be provided by the Installer and coordinated by the Construction Manager.

B. Site grading shall be provided by others prior to commencement of the installation of the Rammed Aggregate Piers, and coordinated by the Construction Manager. Site grades for Rammed Aggregate Pier installation shall be within 1 foot of the top of footing elevation or finished grade elevation to minimize Rammed Aggregate Pier installation depths. Ground elevations and bottom of footing elevations shall be provided to the Rammed Aggregate Pier Installer in sufficient detail to estimate installation depth elevations to within 3 inches.

C. The Construction Manager will provide site access to the Installer, after earthwork in the area has been completed. A working surface shall be established and maintained by others (coordinated by the Construction Manager) to provide wet weather protection of the subgrade and to provide access for efficient operation of the Rammed Aggregate Pier installation.

D. Prior to, during and following Rammed Aggregate Pier installation, the Construction Manager shall coordinated with others, to provide positive drainage to protect the site from wet weather and surface ponding of water.

E. If spoils are generated by Rammed Aggregate Pier installation, spoil removal from the Rammed Aggregate Pier work area in a timely manner to prevent interruption of Rammed Aggregate Pier installation shall be required. The removal of such spoil shall be responsibility of others and coordinated by the Construction Manager.

F. The Installer shall be responsible for the location of Rammed Aggregate Pier-supported foundations for this project, including layout of individual Rammed Aggregate Piers. Such field layout and

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markings shall be done using survey stakes or similar means at locations shown on the approved shop drawings.

G. The Construction Manager shall coordinate all excavations made subsequent to Rammed Aggregate Pier installations by others, so that excavations do not encroach on the piers as shown in the Rammed Aggregate Pier approved shop drawings. Protection of completed Rammed Aggregate Piers is the responsibility of the Construction Manager. In the event that utility excavations are required in close proximity to the installed Rammed Aggregate Piers, the Construction Manager shall contact the Installer's Professional Engineer immediately to develop construction solutions to minimize impacts on the installed Aggregate Piers. Such solution must be reviewed and approved by the Owner's Geotechnical Engineer.

H. Excavation and surface compaction of all footings shall be the responsibility of others, coordinated by the Construction Manager. Foundation excavations to expose the tops of Rammed Aggregate Pier elements shall be made in a workman-like manner, and shall be protected until concrete placement, with procedures and equipment best suited to (1) avoid exposure to water, (2) prevent softening of the matrix soil between and around the Rammed Aggregate Piers before pouring structural concrete, and (3) achieve direct and firm contact between the dense, undisturbed Rammed Aggregate Piers and the concrete footing.

I. All excavations for footing bottoms supported by Rammed Aggregate Pier foundations shall be prepared in the following manner by the others and coordinated by the Construction Manager. Recommended procedures for achieving these goals are to:

1. Limit over-excavation below the bottom of the footing to 3-inches (including disturbance from the teeth of the excavation equipment).

2. Compaction of surface soil and top of Rammed Aggregate Pier elements shall be prepared using a motorized impact compactor ("Wacker Packer", "Jumping Jack" or similar). Sled-type tamping devices shall only be used in granular soils and when approved by the Installer's Professional Engineer and the Owner's Geotechnical Engineer. Loose or soft surficial soil over the entire footing bottom shall be re-compacted or removed, respectively. The surface of the aggregate pier shall be re-compacted prior to completing footing bottom preparation.

3. Place footing concrete immediately after footing excavation is made and approved, preferably the same day as the excavation. Footing concrete must be placed on the same day if the footing is bearing on moisture-sensitive soils. If same day placement of footing concrete is not possible, open excavations shall be protected from surface water accumulation. A lean concrete mud-mat may be used to accomplish this. Other methods must be pre-approved by the Installer's Professional Engineer and the Owner's Geotechnical Engineer.

J. The following criteria shall apply, and a written inspection report by the Owner's Geotechnical Engineer (or Testing Agency) shall be furnished to the Installer to confirm:

1. That water (which may soften the unconfined matrix soil between and around the Rammed Aggregate Pier elements, and may have detrimental effects on the supporting capability of the Rammed Aggregate Pier reinforced subgrade) has not been allowed to pond in the footing excavation at any time.

2. That all Rammed Aggregate Piers designed for each footing have been exposed in the footing excavation.

3. That immediately before footing construction, the tops of Rammed Aggregate Piers exposed in each footing excavation have been inspected and re-compacted as necessary

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with mechanical compaction equipment.

4. That no excavations or drilled shafts (elevator, etc.) have been made after installation of Aggregate Piers within the excavation limits described in the Rammed Aggregate Pier construction drawings, without the written approval of the Installer.

5. Failure to provide the above inspection and certification by the Owner's Geotechnical Engineer (or Testing Agency), which is beyond the responsibility of the Rammed Aggregate Pier Installer, may void any written or implied warranty on the performance of the Rammed Aggregate Pier system.

END OF SECTION

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SECTION 31 41 16

METAL SHEET PILES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2015; Errata 1 2015; Errata 2 2016) Structural Welding Code - Steel ASTM INTERNATIONAL
	(ASTM)
ASTM A572/A572M	(2018) Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A6/A6M	(2017a) Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling

1.2 SUBMITTALS

SD-01 Shop Drawings

Metal Sheet Piling shop drawings signed and sealed by a Structural Engineer licensed in the State of Delaware.

SD-02 Product Data

Driving;
Pile Driving Equipment; Pulling and Redriving;

SD-03 Test Reports Materials Tests;
Interlocked Joint Strength in Tension Test;

SD-04 Closeout Submittals

Pile Driving Record;

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1.3 QUALITY ASSURANCE

1.3.1 Material Certificates

For each shipment, submit certificates identified with specific lots prior to installing piling. Include in the identification data piling type, dimensions, chemical composition, mechanical properties, section properties, heat number, and mill identification mark.

1.3.2 Interlocked Joint Tension Test

Submit, for approval, the procedure for testing the tension strength of piling interlocks prior to testing sheet piling.

1.4 DELIVERY, STORAGE, AND HANDLING

Materials delivered to the site shall be new and undamaged and shall be accompanied by certified test reports. Provide the manufacturer's logo and mill identification mark on the sheet piling as required by the referenced specifications. Store and handle sheet piling in the manner recommended by the manufacturer to prevent permanent deflection, distortion or damage to the interlocks; as a minimum, support on level blocks or racks spaced not more than 10 feet apart and not more than 2 feet from the ends. Storage of sheet piling should also facilitate required inspection activities and prevent damage to coatings and corrosion prior to installation.

1.5 PERMANENT SHEET PILING

All of the requirements in this specification apply to the permanent sheet piling.

1.6 TEMPORARY SHEET PILING

The specification requirements for the temporary sheet piling is applicable to this specification with the exception of the section modulus and type of steel. This is determined by the Contractor and submitted for review to the Contracting Officer in the submittal METAL SHEET PILING. Any modification to the sheet piling tip elevation shown on the drawings is to be submitted for approval to the Contracting Officer.

PART 2 PRODUCTS

2.1 METAL SHEET PILING

Submit detail drawings for sheet piling, including fabricated sections, showing complete piling dimensions and details, driving sequence and location of installed piling.

a. Include in the drawings details of top protection, special reinforcing tips, tip protection, lagging, splices, fabricated additions to plain piles, cut-off method, corrosion protection, and dimensions of templates and other temporary guide structures for installing piling. Provide details of the method for handling piling to prevent permanent deflection, distortion or damage to piling interlocks.

b. Metal sheet piling shall be hot-rolled steel sections conforming to ASTM A572/A572M, Grade 50, Type PZ, meeting the chemical and mechanical requirements of ASTM A572/A572M, Grade 50, Type PZ.

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2.1.1 Interlocks

The interlocks of sheet piling shall be free-sliding, provide a swing angle suitable for the intended installation but not less than 5 degrees when interlocked, and maintain continuous interlocking when installed.

2.1.2 General Requirements

Sheet piling shall be full-length sections of the dimensions shown. Fabricated tees, wyes and cross pieces shall be fabricated of piling sections with a minimum web thickness of 1/2 inch. Provide sheet piling with standard pulling holes. Metalwork fabrication for sheet piling shall be as specified and in Section 05 50 00 METAL FABRICATIONS.

2.2 APPURTENANT METAL MATERIALS

Provide metal plates, shapes, bolts, nuts, rivets and other appurtenant fabrication and installation materials conforming to manufacturer's standards and to the requirements specified in the respective sheet piling standards and in Section 05 50 00 METAL FABRICATIONS.

2.3 TESTS, INSPECTIONS, AND VERIFICATIONS

Requirements for material tests, workmanship and other measures for quality assurance shall be as specified.

2.3.1 Materials Tests

Submit certified materials tests reports showing that sheet piling and appurtenant metal materials meet the specified requirements, for each shipment and identified with specific lots prior to installing materials. Material test reports shall meet the requirements of ASTM A6/A6M. Perform materials tests conforming to the following requirements. Sheet piling and appurtenant materials shall be tested and certified by the manufacturer to meet the specified chemical, mechanical and section property requirements prior to delivery to the site. Testing of sheet piling for mechanical properties shall be performed after the completion of all rolling and forming operations. Testing of sheet piling shall meet the requirements of ASTM A6/A6M.

2.3.2 Interlocked Joint Strength in Tension Test

Submit the procedure for testing sheet piling interlocked joint strength in tension, prior to testing piling. The interlocked joint strength in tension test shall conform to the piling manufacturer's standard test, include testing at least two 3 inch long coupons taken randomly from different as-produced pilings of each heat and shall be approved. Submit a certified report showing results based on approved testing procedures.

PART 3 EXECUTION

3.1 EARTHWORK

Perform in accordance with Section 31 00 00 EARTHWORK.

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3.2 INSTALLATION

3.2.1 Pile Driving Equipment

Submit complete descriptions of sheet piling driving equipment including hammers, extractors, protection caps and other installation appurtenances, prior to commencement of work. Descriptive information includes manufacturer's name, model numbers, capacity, rated energy, hammer details, cushion material, helmet, and templates. Provide pile driving equipment conforming to the following requirements.

Hammers shall be steam, air, or diesel drop, single-acting, double-acting, differential-acting , or vibratory type. The driving energy of the hammers shall be as recommended by the manufacturer for the piling weights and subsurface materials to be encountered. Repair damage to piling caused by use of a pile hammer with excess delivered force or energy.

3.2.2 Placing and Driving

3.2.2.1 Placing

Any excavation required within the area where sheet pilings are to be installed shall be completed prior to placing sheet pilings. Pilings properly placed and driven shall be interlocked throughout their length with adjacent pilings to form a continuous diaphragm throughout the length or run of piling wall.

a. Pilings shall be carefully located as indicated or directed. Pilings shall be placed plumb with out-of-plumbness not exceeding 1/8 inch per foot of length and true to line. Place the pile so the face will not be more than 6 inches from vertical alignment at any point. Top of pile at elevation of cut-off shall be within 1/2 inch horizontally and 2 inches vertically of the location indicated. Manipulation of piles to force them into position will not be permitted. Check all piles for heave. Redrive all heaved piles to the required tip elevation.

b. Provide temporary wales, templates, or guide structures to ensure that the pilings are placed and driven to the correct alignment. Use a system of structural framing sufficiently rigid to resist lateral and driving forces and to adequately support the sheet piling until design tip elevation is achieved. Use two templates, at least, when placing each piling. Templates shall not move when supporting sheet piling. Fit templates with wood blocking to bear against the web of each alternate sheet pile and hold the sheet pile at the design location alignment. Provide outer template straps or other restraints as necessary to prevent the sheets from warping or wandering from the alignment. Mark template for the location of the leading edge of each alternate sheet pile. If in view, also mark the second level to assure that the piles are vertical and in position. If two guide marks cannot be seen, other means shall be used to keep the sheet pile vertical along its leading edge.

3.2.2.2 Driving

Submit records of the completed sheet piling driving operations, including a system of identification which shows the disposition of approved piling in the work, driving equipment performance data, piling penetration rate data, piling dimensions and top and bottom elevations of installed piling.

Prior to driving pilings in water, paint a horizontal line on both sides of each piling at a fixed distance from the bottom so that it will be visible above the water line after installation. This line shall indicate the profile of the bottom elevation of installed pilings and potential problem areas can be identified by abrupt changes in its elevation. Drive pilings with the proper size hammer and by approved methods so as not to subject the pilings to damage and to ensure proper interlocking throughout their lengths.

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a. Maintain driving hammers in proper alignment during driving operations by use of leads or guides attached to the hammer. Caution shall be taken in the sustained use of vibratory hammers when a hard driving condition is encountered to avoid interlock-melt or damages. Discontinue the use of vibratory hammers and impact hammers employed when the penetration rate due to vibratory loading is one foot or less per minute.

b. Employ a protecting cap in driving when using impact hammers to prevent damage to the tops of pilings. Use cast steel shoe to prevent damage to the tip of the sheet piling. Remove and replace pilings damaged during driving or driven out of interlock at the Contractor's expense.

c. Drive pilings without the aid of a water jet.

d. Take adequate precautions to ensure that pilings are driven plumb. Where possible, drive Z-pile with the ball end leading. If an open socket is leading, a bolt or similar object placed in the bottom of the interlock will minimize packing material into it and ease driving for the next sheet. If at any time the forward or leading edge of the piling wall is found to be out-of-plumb in the plane of the wall the piling being driven shall be driven to the required depth and tapered pilings shall be provided and driven to interlock with the out-of-plumb leading edge or other approved corrective measures shall be taken to insure the plumbness of succeeding pilings. The maximum permissible taper for any tapered piling shall be 1/8 inch per foot of length.

e. Pilings in each run or continuous length of piling wall shall be driven alternately in increments of depth to the required depth or elevation. No piling shall be driven to a lower elevation than those behind it in the same run except when the pilings behind it cannot be driven
deeper. Incrementally sequence driving of individual piles such that the tip of any sheet pile shall not be more than 4 feet below that of any adjacent sheet pile. When the penetration resistance exceeds five blows per inch, the tip of any sheet pile shall not be more than 2 feet below any adjacent sheet pile. If the piling next to the one being driven tends to follow below final elevation it may be pinned to the next adjacent piling.

f. If obstructions restrict driving a piling to the specified penetration, the obstructions shall be removed or penetrated with a chisel beam. If the Contractor demonstrates that removal or penetration is impractical, make changes in the design alignment of the piling structure as directed to ensure the adequacy and stability of the structure. Pilings shall be driven to depths shown and shall extend up to the elevation indicated for the top of pilings. Piling driven to rock shall be seated individually on the rock. A tolerance of 0 inches above the indicated top elevation will be permitted. Pilings shall not be driven within 100 feet of concrete less than 7 days old.

3.2.3 Cutting-Off and Splicing

Pilings driven to refusal or to the point where additional penetration cannot be attained and are extending above the required top elevation in excess of the specified tolerance shall be cut off to the required elevation. Pilings driven below the required top elevation and pilings damaged by driving and cut off to permit further driving shall be extended as required to reach the top elevation by splicing when directed at no additional cost to the Government. If directed, pilings shall be spliced as required to drive them to depths greater than shown and extend them up to the required top elevation.

a. Pilings adjoining spliced pilings shall be full length unless otherwise approved. Splicing of pilings shall be as indicated. Ends of pilings to be spliced shall be squared before splicing to eliminate dips or camber. Pilings shall be spliced together with concentric alignment of the interlocks so that there are no discontinuities, dips or camber at the abutting interlocks. Spliced pilings shall be free sliding and able to obtain the maximum swing with contiguous pilings. Welding of splices shall conform to the requirements of Section 05 50 13 MISCELLANEOUS METAL FABRICATIONS. Shop and field welding, qualification of welding procedures, welders, and welding operators shall be in accordance with AWS D1.1/D1.1M.

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b. The tops of pilings excessively battered during driving shall be trimmed when directed, at no cost to the Government. Piling cut-offs except for Government furnished pilings shall become the property of the Contractor and shall be removed from the site.

c. Cut holes in pilings for bolts, rods, drains or utilities in a neat and workmanlike manner, as shown or as directed. Use a straight edge in cuts made by burning to avoid abrupt nicks. Bolt holes in steel piling shall be drilled or may be burned and reamed by approved methods which will not damage the surrounding metal. Holes other than bolt holes shall be reasonably smooth and the proper size for rods and other items to be inserted. All holes in steel pilings on the wet side of cofferdams shall be made watertight by welding steel plates over the holes after the piling installation is completed. Do not use explosives for cutting.

3.2.4 Inspection of Driven Piling

Perform continuous inspection during pile driving. Inspect all piles for compliance with tolerance requirements. Bring any unusual problems which may occur to the attention of the Contracting Officer. Inspect the interlocked joints of driven pilings extending above ground. Pilings found to be out of interlock shall be removed and replaced at the Contractor's expense.

3.2.5 Pulling and Redriving

Submit the proposed method of pulling sheet piling, prior to pulling any piling. Pull, as directed, selected pilings after driving to determine the condition of the underground portions of pilings. Any piling so pulled and found to be damaged, to the extent that its usefulness in the structure is impaired, shall be removed and replaced at the Contractor's expense. Pilings pulled and found to be in satisfactory condition shall be redriven when directed.

3.3 REMOVAL

The removal of sheet pilings shall consist of pulling, sorting, cleaning the interlocks, inventorying and storing previously installed sheet pilings as shown and directed.

3.3.1 Pulling

The method of pulling piling shall be approved. Provide pulling holes in pilings, as required. Extractors shall be of suitable type and size. Care shall be exercised during pulling of pilings to avoid damaging piling interlocks and adjacent construction. If the Contracting Officer determines that adjacent permanent construction has been damaged during pulling, the Contractor will be required to repair this construction at no cost to the Government. Pull pilings one sheet at a time. Pilings fused together shall be separated prior to pulling, unless the Contractor demonstrates, to the satisfaction of the Contracting Officer, that the pilings cannot be separated. The Contractor will not be paid for the removal of pilings damaged beyond structural use due to proper care not being exercised during pulling.

3.3.2 Sorting, Cleaning, Inventorying and Storing

Pulled pilings shall be sorted, cleaned, inventoried and stored by type into groups as:

a. Piling usable without reconditioning.

b. Piling requiring reconditioning.

c. Piling damaged beyond structural use.

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3.4 INSTALLATION RECORDS

Maintain a pile driving record for each sheet pile driven. Indicate on the installation record: installation dates and times, type and size of hammer, rate of operation, total driving time, dimensions of driving helmet and cap used, blows required per foot for each foot of penetration, final driving resistance in blows for final 6 inches, pile locations, tip elevations, ground elevations, cut-off elevations, and any reheading or cutting of piles. Record any unusual pile driving problems during driving. Submit complete records to the Contracting Officer.

END OF SECTION 31 41 16

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SECTION 31 62 16

VINYL SHEET PILES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section covers all members, aluminum caps and fasteners to be used in the construction of vinyl sheet piles. This specification also covers the installation of vinyl sheet piling, trimming of the sheet pile to the lines and grades shown on the drawings or as required, and installation of the sheet pile aluminum caps.

1.02 INFORMATIONAL SUBMITTALS

A. Qualifications of proposed sheet pile/aluminum cap installer.

1.03 ACTION SUBMITTALS

A. Pile-driving equipment data including; type, make, rated energy range, weight of hammer, weight of drive cap, and properties of hammer cushion. Contractor shall submit verification from the manufacturer that the hammer can deliver the required energy.

B. Shop drawings, product and technical data for all fabricated elements.

C. Sample field quality control reports, including pile driving records.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Sheet piling installer shall have, as a minimum, three (3) successful past installations of vinyl sheet piling of comparable overall heights and sections and comparable penetration into soils similar to those found on the project.

B. Field Quality Control Reports: Contractor shall prepare, maintain, and provide field quality control reports for all piles per Section 3.04 of this specification.

1.05 PAYMENT

A. Lump Sum: All work associated with installing aluminum piles shall be included in the Lump Sum price submitted for the project.

B. Work of this Section is affected as follows:

1. No payment is made for rejected piles, including piles driven out of tolerance, defective piles, or piles damaged during handling or driving. The Contractor shall be responsible for providing additional piles to replace those damaged as noted above.

2. No payment will be made for excess pile lengths cut-off to achieve top of pile elevations shown on the plans.

PART 2 PRODUCTS

2.01 GENERAL

NOT FOR BIDDING

A. All sheet piles (including caps, tieback system, and hardware) shall be provided by the Contractor. Upon delivery, the Contractor and Owner shall jointly inspect and reject, if necessary, the sheet pile materials.

B. All vinyl sheet piling shall be new and unspliced material throughout, unless otherwise reviewed and accepted by engineer.

C. Vinyl sheet piles and special fabricated shapes shall be of a design that ensures continuous interlock throughout the entire length when in place.

2.02 MATERIALS

A. Vinyl sheet piles required for the project shall meet the following properties:

- Allowable Moment (M) 9,920 ft-lb/ft
- Section Modulus (Z) 37.2 in3/ft
- Moment of Inertia (I) 186 in4/ft
- Impact Strength 15,000 in-lbs/in2
- Thickness (t) 0.515 in
- Section Depth 10.0 in
- Section Width 18 in
- Material Weatherable Rigid Vinyl
- Color Clay
- Profile Z Profile, I-Beam Lock

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B. The interlocks between vinyl sheet pile sections shall be configured such that the average width of the annular space between all contact points of the interlocks shall be a maximum of one-eighth (1/8) inch.

C. Vinyl sheet piles and interlocks shall not have excessive kinks, camber or twist that would prevent the pile from reasonably free sliding during installation.

D. Handling Holes:

1. If handling holes are provided, they shall be two (2) standard two and nine-sixteenth (2-9/16) inch diameter handling holes located six (6) inches from one end.

2. Materials and labor to cover handling holes shall be provided by the contractor.

E. Aluminum sheet pile caps required for the project shall meet the following properties:

- Section Modulus (Z) 20.8 in3
- Moment of Inertia (I) 128 in4
- Outside Width 12.3 in
- Inside Width 10.15 in
- Material 6063-T6 Marine Grade Aluminum
- Standard Colors/Surface Treatment Clay

2.03 STORAGE AND HANDLING

1. Do not subject piles to damage by impact bending stresses in storing piles onsite.

2. Contractor shall be responsible for storage and security of the materials.

PART 3 INSTALLATION

3.01 EXAMINATION

A. Notify Architect/Engineer and owner 48 hours prior to installing first sheet pile. Architect/Engineer and owner will provide representatives to observe installation of first sheet pile and approve the methods utilized.

B. Upon completion of installation, Architect/Engineer or Owner will verify select piles for compliance with specified tolerances and for depth driven.

3.02 PREPARATION

A. Pile-Length Markings: Mark each pile with horizontal lines at 12-inch intervals; label the distance from pile tip at 60-inch intervals. Maintain markings on piles until approved by Architect/Engineer or Owner.

3.03 INSTALLATION

A. General:

1. An appropriately sized vibratory hammer shall be used for installation of the vinyl sheet piles.

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2. Virtual Refusal:
   a. Vinyl sheet piling shall be driven to the depths shown on the drawings or to virtual refusal.
   b. Virtual refusal is defined as a rate of penetration below 10 mm/s (~0.39 in/s) with an approved vibratory hammer or per hammer manufacturer recommendations.
   c. The hammer shall be operating at the manufacturer's recommended stroke, frequency and speed when virtual refusal is measured.

B. Sheet Piling Driving:

1. At the discretion of the Contractor, the vinyl sheet piling shall be assembled before driving and then driven as a continuous wall, progressively in stages, to keep the piles aligned correctly and minimize the danger of breaking the interlock between the sheets.

2. Vinyl sheet piling shall be driven to form a tight bulkhead.
   a. A suitable driving head/jaws shall be used and any piling which is damaged in driving or which has broken interlocks between sections shall be repaired or pulled and replaced at the Contractor's expense. Any proposed repairs to damaged sheet piles shall be approved by the Architect/Engineer.

3. The piling shall be driven within the following tolerances:
   a. Alignment:
      i) Sheet pile shall be driven to form a relatively straight line between the termini points shown on the drawings.
      ii) Horizontal deviation of any point from a straight line connecting the two ends of the wall section shall be a maximum of six (6) inches.
   b. Location:
      i) 2 inches from the location indicated on the drawings after initial driving, and 4 inches after driving is completed.
   c. Plumbness:
      i) Each individual sheet pile section shall be driven vertical, within a horizontal tolerance of two percent (2%) of any vertical length measured along the pile.
   d. Elevation:
      i) Tops of sheet pile sections shall be within a tolerance of one (1) inch from plan elevations.

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ii) Contractor shall not be paid for excess sheet pile trimmed off the end of the pile to meet final grade.

C. Contractor shall brace and/or provide soil grading as necessary during construction operations in order to provide lateral stability for the sheet pile wall. The sheet pile wall has been designed for the soil loading developed as part of the final configuration denoted on the drawings only. Other temporary loading configurations that exceed these design loads shall not be allowed.

D. Care shall be taken during driving to keep from causing deformations of the top of the piles, splitting of section, or breaking of the interlock between sections. Care shall also be taken during driving to prevent and correct any tendency of sheet piles to twist or lose plumb.

E. Vinyl sheet piling shall be driven with the ball-end leading. Proper care and planning shall be used to allow for this construction procedure in both immediate and possible future walls.

F. Alternate sheet piles shall be reversed end for proper interlocking in the “normal” position. Piles shall also be aligned properly to maintain a “normal” driving width.

G. For sheet piles driven into the native soils, pre-drilled soils, or excavated soils, a vibratory driver shall be used as long as the required depth is obtained.

H. Install aluminum sheet pile caps per the manufacturer’s recommendations.

3.04 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Vinyl piles will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

1. Contractor shall provide to the owner a record of: driven depth of each pile; values for tolerance items; method utilized for checking tolerances; and confirmation that piles are driven within tolerances.
   a. Contractor shall include the following items in the pile driving records: blow counts per foot of penetration, type and size of hammer used, rate of operation of pile driving equipment, plumbness, tip elevation, top elevation (before and after cut-off), compiled and attested to by a qualified professional engineer.

2. Sheet piles shall be left uncut, with depth markings legible, until the Architect/Engineer or Owner can confirm the driven depths provided by visual inspection of the increments marked on the sheet pile.

END OF SECTION 31 62 16

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SECTION 32 31 13
CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manual gates with related hardware.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete anchorage for posts.

B. Section 08 71 00 - Door Hardware: Gate locking device.

1.03 REFERENCE STANDARDS

A. ASTM F567 - Standard Practice for Installation of Chain-Link Fence; 2023.

B. ASTM F668 - Standard Specification for Polyvinyl Chloride (PVC), Polyolefin and Other Polymer-Coated Steel Chain Link Fence Fabric; 2017 (Reapproved 2022).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on fabric, posts, accessories, fittings and hardware.

PART 2 PRODUCTS

2.01 COMPONENTS

A. Line Posts: 1.9 inch diameter.

B. Corner and Terminal Posts: 2.38 inch diameter.

C. Gate Posts: 3-1/2 inch diameter.

D. Top and Brace Rail: 1.66 inch diameter, plain end, sleeve coupled.

E. Gate Frame: 1.66 inch diameter for welded fabrication.

F. Fabric: 2 inch diamond mesh interwoven wire, 9 gauge, 0.1483 inch thick, top selvage knuckle end closed, bottom selvage twisted tight.

G. Tension Wire: 9 gauge, 0.1483 inch thick steel, single strand.

H. Tie Wire: Aluminum alloy steel wire.

2.02 MATERIALS

A. Vinyl Coating Color: Black

B. Posts and rails shall be rolled formed, open seam, self-draining shapes that permit uniform zinc and color applications on all surfaces.

C. Before color is applied, all materials shall be given a 2 ounce coating of zinc. A chemical cleaning and phosphate conversion treatment shall be used to prepare the zinc substrate to receive primer and PVC coating.

D. Color shall be a thermal fusion coating of 10 to 15 mils of polyvinyl chloride applied per manufacturer's specifications.

E. Line Posts: Line posts shall be Schedule 40 Pipe, size as shown on Drawings with minimum bending strength of 316 pounds under a 8 ft. cantilever load. Maximum spacing of line posts to be 6'-0".

F. Top and Brace Rail: Top and brace rails shall be Schedule 40 Pipe, size as shown on Drawings with minimum vertical bending strength of 192 pounds on 6 ft. span. Top rail couplings 6"minimum in length shall be spaced at maximum 21' centers and 9 gauge minimum fabric tie wire shall be spaced at 24" maximum centers.

G. Terminal Posts: All end, corner, and pull posts shall be Schedule 40 Pipe, size as shown on Drawings with minimum bending strength of 486 pounds on 8 ft. cantilever load.

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H. General: Certain components not adaptable to the herein specified coating process may be color coated by other means. All fittings shall be pressed steel or malleable iron. Tie wires shall be minimum 9 gauge PVC coated.

2.03 MANUAL GATES AND RELATED HARDWARE

A. Hardware for Double Swinging Gates: 180 degree hinges, 2 for gates up to 60 inches high, 3 for taller gates; drop bolt on inactive leaf engaging socket stop set in concrete, active leaf latched to inactive leaf preventing raising of drop bolt, padlock hasp; keepers to hold gate in fully open position.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install framework, fabric, accessories and gates in accordance with ASTM F567.

B. Set intermediate posts plumb, in concrete footings with top of footing 6 inches (150 mm) below finish grade.

3.02 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch.

B. Maximum Offset From True Position: 1 inch.

3.03 CLEANING

A. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.

B. Clean fence with mild household detergent and clean water rinse well.

END OF SECTION

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SECTION 32 31 19
DECORATIVE METAL FENCES AND GATES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Decorative steel fences.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 31 23 16 - Excavation.

1.03 REFERENCE STANDARDS

A. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2017.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2017.

C. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus; 2016.

D. ASTM D523 - Standard Test Method for Specular Gloss; 2014 (Reapproved 2018).

E. ASTM D714 - Standard Test Method for Evaluating Degree of Blistering of Paints; 2002 (Reapproved 2017).

F. ASTM D822/D822M - Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings; 2013 (Reapproved 2018).

G. ASTM D1654 - Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments; 2008, with Editorial Revision (2017).

H. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates; 2023.

I. ASTM D2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact); 1993 (Reapproved 2024).

J. ASTM D3359 - Standard Test Methods for Rating Adhesion by Tape Test; 2023.

K. ASTM F2408 - Standard Specification for Ornamental Fences Employing Galvanized Steel Tubular Pickets; 2016 (Reapproved 2023).

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings:
   1. Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.

D. Manufacturer's Warranty.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years documented experience.

B. Installer Qualifications: Experienced with type of construction involved and materials and techniques specified and approved by fence manufacturer.

1.06 WARRANTY

A. Correct defective Work within a TWO year period after Date of Substantial Completion.

B. Provide ten year manufacturer warranty for material finish defects.

NOT FOR BIDDING

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Decorative Metal Fences and Gates:
   1. Ameristar Perimeter Security, USA; Aegis Plus, Majestic (Basis-of-Design): www.ameristarperimeter.com/#sle.
   2. CDH Custom Roll Form, LLC: www.cdhrollform.com/#sle.
   3. Stewart Iron Works, LLC: www.stewartironworks.com/#sle.
   4. Approved Equal.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FENCES

A. Fences: Complete factory-fabricated system of posts and panels, accessories, fittings, and fasteners; finished with electrodeposition coating, and having the following performance characteristics:

B. Electro-Deposition Coating: Multistage pretreatment/wash with zinc phosphate, followed by epoxy primer and polyester powder topcoat.
   1. Color: As selected by Architect from manufacturer's standard range.

C. Steel: ASTM A653/A653M; tensile strength 45,000 psi, minimum.
   1. Hot-dip galvanized; ASTM A653/A653M, G60.

D. Fasteners: ASTM A276/A276M, Type 302 stainless steel; finished to match fence components.

E. Hinges: Finished to match fence components.

F. Latches: Finished to match fence components.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Set fence posts in accordance with the manufacturer recommended spacing.

C. When cutting rails immediately seal the exposed surfaces by:
   1. Removing metal shavings from cut area.
   2. Apply zinc-rich primer to thoroughly cover cut edge and drilled hole; allow to dry.
   3. Apply two coats of custom finish spray paint matching fence color.
   4. Failure to seal exposed surfaces in accordance with manufacturer's instructions will negate manufacturer's warranty.

D. Space gate posts according to the manufacturers' drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware selected.
   1. Base type and quantity of gate hinges on the application, weight, height, and number of gate cycles.

3.02 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

NOT FOR BIDDING

SECTION 32 91 13

SOIL PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes planting soils specified by composition of the mixes.

B. Related Requirements:

1. Section 31 10 00 "Site Clearing" for topsoil stripping and stockpiling.

2. Section 31 20 00 “Earth Moving”.

1.2 DEFINITIONS

A. Duff Layer: A surface layer of soil, typical of forested areas, that is composed of mostly decayed leaves, twigs, and detritus.

B. Imported Soil: Soil that is transported to Project site for use.

C. Manufactured Soil: Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.

D. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

E. 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.

F. 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.

G. 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.

H. USCC: U.S. Composting Council.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at 1200 N. DuPont Highway, Dover, DE, 19901.

NOT FOR BIDDING

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each bulk-supplied material in sealed containers labeled with content, source, and date obtained; providing an accurate representation of composition, color, and texture.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 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.

PART 2 - PRODUCTS

2.1 PLANTING SOILS SPECIFIED BY COMPOSITION

A. Planting-Soil Type: Existing, on-site surface soil, with the duff layer, if any, retained; and stockpiled on-site; modified to produce viable planting soil. Blend existing, on-site surface soil with the following soil amendments and fertilizers in the following quantities to produce planting soil:

1. Ratio of Loose Compost to Soil: 1:2 by volume.
2. Weight of Lime: 1000 lbs per acre per 6 inches of soil depth.

2.2 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.
3. Form: Provide lime in form of ground dolomitic limestone.

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. Perlite: Horticultural perlite, soil amendment grade.

NOT FOR BIDDING

E. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through a No. 50 sieve.

F. Sand: Clean, washed, natural or manufactured, free of toxic materials, and according to ASTM C33/C33M.

2.3 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: 30 to 40 percent of dry weight.
6. Particle Size: Minimum of 98 percent passing through a 1-inch sieve.

2.4 FERTILIZERS

A. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.

C. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.

PART 3 - EXECUTION

3.1 GENERAL

A. Place planting soil and fertilizers according to requirements in other Specification Sections.

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.

NOT FOR BIDDING

3.2 PREPARATION OF UNAMENDED, ON-SITE SOIL BEFORE AMENDING

A. Excavation: Excavate soil from designated area(s) to a minimum depth of 6 inches and stockpile until amended.

B. Unacceptable Materials: Clean soil of 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 that are harmful to plant growth. Remove stones larger than 2” diameter from soil mix.

C. Unsuitable Materials: Clean soil to contain a maximum of 8 percent by dry weight of stones, roots, plants, sod, clay lumps, and pockets of coarse sand.

D. Screening: Pass unamended soil through a 2-inch sieve to remove large materials.

3.3 PLACING AND MIXING PLANTING SOIL OVER EXPOSED SUBGRADE

A. General: Apply and mix unamended soil with amendments on-site to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. Subgrade Preparation: Till subgrade to a minimum depth of 6 inches. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

C. Mixing: Spread unamended soil to total depth of 4 inches, but not less than required to meet finish grades after mixing with amendments and natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.

1. Amendments: Apply soil amendments, except compost, and fertilizer, if required, evenly on surface, and thoroughly blend them with unamended soil to produce planting soil.

    a. Mix lime with dry soil before mixing fertilizer.
    b. Mix fertilizer with planting soil no more than seven days before planting.

2. Lifts: Apply and mix unamended soil and amendments in lifts not exceeding 8 inches in loose depth for material compacted by compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

D. Compaction: Compact each blended lift of planting soil to 75 to 82 percent of maximum dry density. Standard Proctor density according to ASTM D698 and tested in-place.

E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.4 BLENDING PLANTING SOIL IN PLACE

A. General: Mix amendments with in-place, unamended soil to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. Preparation: Till unamended, existing soil in planting areas to a minimum depth of 6 inches. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

NOT FOR BIDDING

C. Mixing: Apply soil amendments, except compost, and fertilizer, if required, evenly on surface, and thoroughly blend them into full depth of unamended, in-place soil to produce planting soil.

1. Mix lime with dry soil before mixing fertilizer.
2. Mix fertilizer with planting soil no more than seven days before planting.

D. Compaction: Compact blended planting soil to 75 to 82 percent of maximum Standard Proctor dry density according to ASTM D698.

E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform the following tests and inspections:

1. Compaction: Test planting-soil compaction after placing each lift and at completion using a densitometer or soil-compaction meter calibrated to a reference test value based on laboratory testing according to ASTM D698. Space tests at no less than one for each 2000 sq. ft. of in-place soil or part thereof.

C. Soil will be considered defective if it does not pass tests and inspections. Defective soil is to be removed and replaced at the Contractor's expense.

D. Prepare test and inspection reports.

E. Label each sample and test report with the date, location keyed to a site plan or other location system, visible conditions when and where sample was taken, and sampling depth.

3.6 PROTECTION AND CLEANING

A. Protection Zone: Identify protection zones according to Section 015639 "Temporary Tree and Plant Protection."

B. Protect areas of in-place soil 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 or other digging unless otherwise indicated.

C. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.

1. Legally dispose of excess subsoil and unsuitable off-site.

NOT FOR BIDDING

END OF SECTION 32 91 13

NOT FOR BIDDING

SECTION 32 93 00

PLANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plant materials.
2. Fertilizers.
3. Weed-control barriers.
4. Mulches.
5. Herbicides and pesticides.
6. Landscape edgings.
7. Tree-watering devices.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product data.

B. Samples of each type of mulch.

1.4 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.

1. Installer's Field Supervision: Maintain an experienced full-time supervisor on Project site when work is in progress.
2. Pesticide Applicator: State licensed, commercial.

NOT FOR BIDDING

B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

1.7 DELIVERY, STORAGE, AND HANDLING

A. 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.

B. Handle planting stock by root ball.

C. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.

D. 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.

1.8 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 planting completion.

   a. Trees, Shrubs, Vines, and Ornamental Grasses: 24 months.
   b. Ground Covers, Biennials, Perennials, and Other Plants: 24 months.
   c. Annuals: Three months.

PART 2 - PRODUCTS

2.1 PLANT MATERIALS

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.

B. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare in accordance with ANSI Z60.1.

NOT FOR BIDDING

C. Annuals and Biennials: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery.

2.2 FERTILIZERS

A. Granular Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition:

a. 0.75 lb/1000 sq. ft., 3 percent of actual nitrogen, 4 percent phosphorous, and 3 percent potassium, by weight.
b. Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.3 WEED-CONTROL BARRIERS

A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. minimum, composed of fibers inert to biological degradation and naturally resistant to chemicals, alkalis, and acids, formed into a stable network so that fibers retain their relative position.

B. Composite Fabric: Woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric, 4.8 oz./sq. yd..

2.4 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Type: Shredded hardwood.
2. Size Range: ½" minimum to 1 ½" maximum.
3. Color: Natural.

2.5 HERBICIDES AND PESTICIDES

A. 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.

2.6 TREE-STABILIZATION MATERIALS

A. Trunk-Stabilization Materials:

1. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal by length indicated, pointed at one end.
2. Guys and Tie Wires: ASTM A641/A641M, Class 1, galvanized-steel wire, two-strand, twisted, 0.106 inch in diameter.
3. Tree-Tie Webbing: UV-resistant polypropylene or nylon webbing with brass grommets.

NOT FOR BIDDING

4. Flags: Standard surveyor's plastic flagging tape, white, 6 inches long.

B. Root-Ball Stabilization Materials:

1. Upright Stakes and Horizontal Hold-Down: Rough-sawn, sound, new hardwood or softwood, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal by length indicated; stakes pointed at one end.
2. Wood Screws: ASME B18.6.1.
3. Proprietary Root-Ball Stabilization Devices: Proprietary at- or below-grade stabilization systems to secure each new planting by root ball and that do not encircle the trunk; sized in accordance with manufacturer's written instructions unless otherwise indicated.

2.7 LANDSCAPE EDGINGS

A. Steel Edging: Standard commercial-steel edging, fabricated in sections of standard lengths, with loops stamped from or welded to face of sections to receive stakes.

1. Edging Size: 3/16 inch thick by 4 inches deep.
2. Stakes: Tapered steel, a minimum of 12 inches long.
3. Accessories: Standard tapered ends, corners, and splicers.
4. Finish: Manufacturer's standard paint.

a. Paint Color: Black.

2.8 TREE-WATERING DEVICES

A. Slow-Release Watering Device: Standard product manufactured for drip irrigation of plants and emptying its water contents over two to nine hours two to three weeks; manufactured from UV-light-stabilized nylon-reinforced polyethylene sheet, PVC, or HDPE plastic.

1. http://www.specagent.com/LookUp/?ulid=8984&mf=&src=wd Color: green.

2.9 MISCELLANEOUS PRODUCTS

A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix in accordance with manufacturer's written instructions.

PART 3 - EXECUTION

3.1 PLANTING AREA ESTABLISHMENT

A. General: Prepare planting area for soil placement and mix planting soil in accordance with Section 32 91 13 "Soil Preparation."

B. Placing Planting Soil: Place and mix planting soil in-place over exposed subgrade.

NOT FOR BIDDING

C. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.2 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Trenches: Excavate circular planting pits.

1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
2. Excavate approximately three times as wide as ball diameter for balled and burlapped and container-grown stock.
3. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
4. Do not excavate deeper than depth of root ball, measured from the root flare to the bottom of root ball.

B. Backfill Soil: Subsoil and topsoil removed from excavations may be used as backfill soil unless otherwise indicated.

3.3 TREE, SHRUB, AND VINE PLANTING

A. Inspection: At time of planting, verify that root flare is visible at top of root ball in accordance with ANSI Z60.1. If root flare is not visible, remove soil in a level manner from root ball to where the top-most root emerges from the trunk. After soil removal to expose root flare, verify that root ball still meets size requirements.

B. Roots: 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 above adjacent finish grades.

1. Backfill: Planting soil. For trees, use excavated soil for backfill.
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. Distribute granular fertilizer around each planting pit when pit is approximately one-half filled. Do not place in bottom of the hole.

    a. Quantity: Two per plant.

5. 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 or trench with root flare 1 inch above adjacent finish grades.

NOT FOR BIDDING

1. Backfill: Planting soil. For trees, use excavated soil for backfill.
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. Distribute granular fertilizer around each planting pit when pit is approximately one-half filled. Do not place in bottom of the hole.
5. Continue backfilling process. Water again after placing and tamping final layer of soil.

E. Slopes: When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of root ball.

3.4 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 Architect.

C. Prune, thin, and shape trees, shrubs, and vines in accordance with standard professional horticultural and arboricultural practices. Unless otherwise indicated by 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.

3.5 GROUND COVER AND PLANT PLANTING

A. Set out and space ground cover and plants other than trees, shrubs, and vines 12 inches apart in even rows with triangular spacing.

B. Use planting soil for backfill.

C. Dig holes large enough to allow spreading of roots.

D. Work soil around roots to eliminate air pockets and leave slight saucer indentation around plants to hold water.

E. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

F. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.6 INSTALLATION OF MULCHES

A. Install weed-control barriers before mulching in accordance with manufacturer's written instructions. Completely cover area to be mulched, overlapping edges minimum of 6 inches, and secure seams with galvanized pins.

B. Mulch backfilled surfaces of planting areas and other areas indicated.

NOT FOR BIDDING

1. Trees and Treelike Shrubs in Turf Areas: Apply organic mulch ring of 3-inch average thickness, with 24-inch radius around trunks or stems. Do not create a mulch cone or place mulch within 3 inches of trunks or stems.
2. Organic Mulch in Planting Areas: Apply 3-inch average thickness of organic mulch extending 12 inches beyond edge of individual planting pit or trench and over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches of trunks or stems.

3.7 INSTALLATION OF LANDSCAPE EDGINGS

A. Steel Edging: Install steel edging around specimen trees, and landscape groupings in accordance with manufacturer's written instructions. Anchor with steel stakes spaced approximately 30 inches apart, driven below top elevation of edging.

3.8 INSTALLATION OF TREE-WATERING DEVICES

A. Provide one device for each tree.

3.9 APPLICATION OF HERBICIDES AND PESTICIDES

A. Pre-Emergent Herbicides (Selective and Nonselective): Apply to tree, shrub, and ground-cover areas in accordance with manufacturer's written instructions. Do not apply to seeded areas.

B. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written instructions.

C. Apply pesticides and other chemical products and biological control agents according to authorities having jurisdiction and in accordance with manufacturer's written instructions. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

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.

NOT FOR BIDDING

3.11 CLEANING AND PROTECTION

A. 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.

B. At time of Substantial Completion, verify that tree-watering devices are in good working order and leave them in place. Replace improperly functioning devices.

END OF SECTION 32 93 00

NOT FOR BIDDING

SECTION 33 46 00 - SUBDRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Perforated-wall pipe and fittings.
2. Drainage conduits.
3. Drainage panels.
4. Geotextile filter fabrics.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Drainage conduits, including rated capacities.
2. Drainage panels, including rated capacities.
3. Geotextile filter fabrics.

PART 2 - PRODUCTS

2.1 PERFORATED-WALL PIPES AND FITTINGS

A. Perforated PE Pipe and Fittings:

1. NPS 6 and Smaller: ASTM F405 or AASHTO M 252, Type CP; corrugated, for coupled joints.
2. NPS 8 and Larger: ASTM F667; AASHTO M 252, Type CP; or AASHTO M 294, Type CP; corrugated; for coupled joints.
3. Couplings: Manufacturer's standard, band type.

B. Perforated PVC Sewer Pipe and Fittings: ASTM D2729, bell-and-spigot ends, for loose joints.

2.2 SOIL MATERIALS

A. Soil materials are specified in Section 31 20 00 "Earth Moving."

2.3 WATERPROOFING FELTS

A. Material: Comply with ASTM D226, Type I, asphalt-saturated organic felt. See architectural plans.

NOT FOR BIDDING

2.4 GEOTEXTILE FILTER FABRICS

A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. when tested in accordance with ASTM D4491.

B. Structure Type: Nonwoven, needle-punched continuous filament.

1. Survivability: AASHTO M 288 Class 2.
2. Styles: Flat and sock.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.

B. If subdrainage is required for landscaping, locate and mark existing utilities, underground structures, and aboveground obstructions before beginning installation and avoid disruption and damage of services.

C. Apply waterproofing to foundation walls in accordance with Architectural details.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.3 PIPING INSTALLATION

A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's written instructions and other requirements indicated.

1. Subdrainage: Install piping level and with a minimum cover of 36 inches, unless otherwise indicated.
2. Lay perforated pipe with perforations down.
3. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.

B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.

3.4 PIPE JOINT CONSTRUCTION

A. Join perforated PE pipe and fittings with couplings in accordance with ASTM D3212 with loose banded, coupled, or push-on joints.

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B. Join perforated PVC sewer pipe and fittings in accordance with ASTM D3212 with loose bell-and-spigot, push-on joints.

C. Special Pipe Couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and fit materials and dimensions of both pipes.

3.5 CLEANOUT INSTALLATION

A. Comply with requirements for cleanouts specified in Section 334100 "Storm Utility Drainage Piping."

B. Cleanouts for Foundation Subdrainage:

1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
2. In vehicular-traffic areas, use NPS 4 cast-iron soil pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 18 by 18 by 12 inches deep. Set top of cleanout flush with grade.
3. In nonvehicular-traffic areas, use NPS 4 PVC pipe and fittings for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 12 by 12 by 4 inches deep. Set top of cleanout 1 inch above grade.
4. Comply with requirements for concrete specified in Section 033000 "Cast-in-Place Concrete."

3.6 CONNECTIONS

A. Comply with requirements for piping specified in Section 33 41 00 "Storm Utility Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

3.7 IDENTIFICATION

A. Arrange for installation of green warning tapes directly over piping. Comply with requirements for underground warning tapes specified in specified in Section 31 20 00 "Earth Moving."

1. Install PE warning tape or detectable warning tape over ferrous piping.
2. Install detectable warning tape over nonferrous piping and over edges of underground structures.

3.8 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling.
2. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

B. Drain piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

NOT FOR BIDDING

3.9 CLEANING

A. Clear interior of installed 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. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION 33 46 00

NOT FOR BIDDING

SECTION 33 71 19

ELECTRICAL UNDERGROUND DUCTS, DUCTBANKS, AND MANHOLES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Conduit and duct:
   1. Rigid polyvinyl chloride (PVC) conduit.
   2. High density polyethylene (HDPE) conduit.

B. Accessories:
   1. Underground warning tape.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete.

B. Section 31 23 16 - Excavation.

C. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.

D. Section 31 23 23 - Fill: Bedding and backfilling.

1.03 PRICE AND PAYMENT PROCEDURES

A. See Section 01 22 00 - Unit Prices, for additional unit price requirements.

B. Ductbank:
   1. Basis of Measurement: By the lineal foot (meter), for each configuration.
   2. Basis of Payment: Includes purchase, delivery, and installation of duct, fittings, supports, and accessories, and for trenching, concrete encasement, and backfill.

1.04 REFERENCE STANDARDS

A. ASTM D1002 - Standard Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal); 2010 (Reapproved 2019).

B. IEEE C2 - National Electrical Safety Code; 2012.

C. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2013.

D. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2015.

E. NEMA TC 7 - Smooth-Wall Coilable Electrical Polyethylene Conduit; 2016.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

H. UL 651A - Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit; Current Edition, Including All Revisions.

I. UL 746C - Polymeric Materials – Use in Electrical Equipment Evaluations; Current Edition, Including All Revisions.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide for metallic conduit, nonmetallic conduit, and manhole accessories.

C. Shop Drawings: Indicate dimensions, reinforcement, size and locations of openings, and accessory locations for precast manholes.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

NOT FOR BIDDING

E. Project Record Documents: Record actual routing and elevations of underground conduit and duct, and locations and sizes of manholes.

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 minimum three years documented experience and with service facilities within 100 miles of Project.

C. 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 CONDUIT AND DUCT

A. Rigid Polyvinyl Chloride (PVC) Conduit: NFPA 70, Type PVC; comply with NEMA TC 2 and list and label as complying with UL 651; Schedule 40 unless otherwise indicated; rated for use with conductors rated 90 degrees C.
   1. Manufacturers:
      a. Cantex Inc: www.cantexinc.com/#sle.
      b. Carlon, a brand of Thomas & Betts Corporation: www.carlon.com/#sle.
      c. JM Eagle: www.jmeagle.com/#sle.
      d. Or Approved Equal.
      e. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Fittings: Comply with NEMA TC 3 and list and label as complying with UL 651.
      a. Manufacturer: Same as manufacturer of conduit to be connected.

B. High Density Polyethylene (HDPE) Conduit: NFPA 70, Type HDPE; comply with NEMA TC 7 and list and label as complying with UL 651A; Schedule 40 unless otherwise indicated.
   1. Manufacturers:
      a. Blue Diamond Industries, LLC: www.bdiky.com/#sle.
      b. Carlon, a brand of Thomas & Betts Corporation: www.carlon.com/#sle.
      c. Dura-Line: www.duraline.com/#sle.
      d. Or Approved Equal.
      e. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ACCESSORIES

A. Adhesive for HDPE Conduit and RTRC:
   1. Specifically designed for bonding dissimilar materials in lieu of transition fittings, including but not limited to polyethylene, fiberglass, PVC, aluminum, and steel; UL 746C recognized.
   2. Approved by adhesive manufacturer for use with materials to be joined.
   3. Adhesive Shear Strength: Not less that 100 psi, when tested in accordance with ASTM D1002.
   4. Products:
      a. American Polywater Corporation; Polywater BonDuit Conduit Adhesive: www.polywater.com/#sle.
      b. Or Approved Equal.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

B. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for the conduit/duct arrangement to be installed.
   1. Products:
      a. Advance Products & Systems, LLC; Duct Bank Spacers: www.apsonline.com/#sle.
      b. Or Approved Equal.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

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C. Bore Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for installation within casing; furnished with roller wheels to facilitate installation, openings to facilitate grout flow, and holes for stabilization cable; suitable for the casing and conduit/duct arrangement to be installed.
   1. Products:
      a. Advance Products & Systems, LLC; Bore Spacers: www.apsonline.com/#sle.
      b. Or approved Equal.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

D. Underground Warning Tape: Polyethylene tape suitable for direct burial.
   1. Manufacturers:
      a. Brady Corporation: www.bradyid.com/#sle.
      b. Brimar Industries, Inc: www.brimar.com/#sle.
      c. Seton Identification Products: www.seton.com/#sle.
      d. Or approved Equal.
      e. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Legend: Type of service, continuously repeated over full length of tape.
   3. Color:
      a. Tape for Buried Power Lines: Black text on red background.
      b. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.03 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify routing and termination locations of duct bank prior to excavation for rough-in.

C. Verify locations of manholes prior to excavating for installation.

D. Duct bank routing is shown in approximate locations unless dimensions are indicated. Route as required to complete duct system.

E. Manhole locations are shown in approximate locations unless dimensions are indicated. Locate as required to complete ductbank system.

3.02 DUCT BANK INSTALLATION

A. Install duct to locate top of ductbank at depths as indicated on drawings.

B. Install duct with minimum slope of 4 inches per 100 feet (0.33 percent). Slope duct away from building entrances.

C. Cut duct square using saw or pipe cutter; de-burr cut ends.

D. Insert duct to shoulder of fittings; fasten securely.

E. Join nonmetallic duct using adhesive as recommended by manufacturer.

F. Wipe nonmetallic duct dry and clean before joining. Apply full even coat of adhesive to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

G. Install no more than equivalent of three 90-degree bends between pull points.

H. Provide suitable fittings to accommodate expansion and deflection where required.

I. Stagger duct joints vertically in concrete encasement 6 inches minimum.

J. Use suitable separators and chairs installed not greater than 4 feet on centers.

K. Band ducts together before backfilling.

L. Securely anchor duct to prevent movement during concrete placement.

NOT FOR BIDDING

M. Place concrete under provisions of Section 03 30 00. Use mineral pigment to color concrete red.

N. Provide minimum 3 inch concrete cover at bottom, top, and sides of ductbank.

O. Provide two No. 4 steel reinforcing bars in top of bank under paved areas.

P. Provide suitable pull string in each empty duct except sleeves and nipples.

Q. Swab duct. Use suitable caps to protect installed duct against entrance of dirt and moisture.

END OF SECTION

NOT FOR BIDDING