PROJECT MANUAL

TRAP POND SPLASH PARK DESIGN
at
TRAP POND STATE PARK
33587 Bald Cypress Lane
Laurel, DE 19956

STATE OF DELAWARE
Department of Natural Resources and Environmental Control
Division of Parks and Recreation
89 Kings Highway
Dover, DE 19901

DNREC Contract No.: NAT24825-TPSPSPLASH

NOT FOR BIDDING PURPOSES

Prepared by

Architect/Engineer
GWWO Architects
1215 East Fort Avenue, Suite 24
Baltimore, MD 21230

Bid Set
March 28, 2025

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Specifications for this project are arranged in accordance with the Construction Specification Institute numbering system and format. Section numbering is discontinuous and all numbers not appearing in the Table of Contents are not used for this Project.

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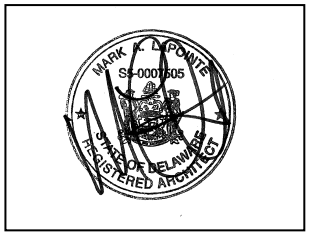
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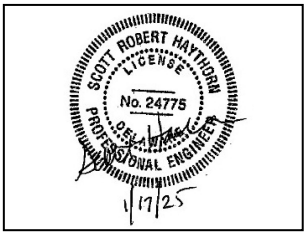
A. ARCHITECT
Seal's Name
GWWO Architects
1215 E. Fort Ave., Suite 24
Baltimore, MD 21211



B. CIVIL ENGINEER
Seal's Name
Vandemark and Lynch
4305 Miller Rd.
Wilmington, DE 19802



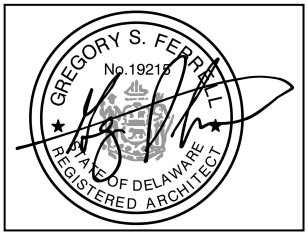
C. MECAHNICAL/ELECTRICAL ENGINEER
Seal's Name
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Baltimore, MD 21204



D. STRUCTURAL ENGINEER
Seal's Name
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Upper Darby, PA 19082

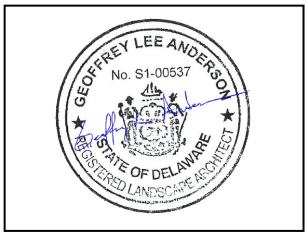


E. AQUATICS ENGINEER
Seal's Name
Aquatic Design Group
2226 Faraday Ave.
Carlsbad, CA 92008



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F. LANDSCAPE ARCHITECT
Seal's Name
RAS
28 W. State St.
Media, PA 19063



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SECTION 00 11 16

INVITATION TO BID

Sealed bids for **DNREC Contract No. NAT24825-TPSPSPLASH**, will be received by the State of Delaware, DNREC, Division of Parks and Recreation at 89 Kings Highway, Dover DE 19901 until 1:00 PM local time on **Thursday, May 15, 2025**. The bids will be opened and read aloud live at 1:00 PM local time on **Thursday, May 15, 2025**, via an online video conference with an option to call in using a telephone. The bid opening will not be held in-person. To attend the bid opening, the public may join via Microsoft Teams enabled computer or mobile app, using Teams Meeting ID: **272 831 382 32** and Passcode: "**pM2kt9Tb**". Audio-only, conference call type of participation is available by calling 1-302-504-8986 and using ID: "**865 320 106#**".

Project involves the construction of a splash park area in Trap Pond State Park including installation of prefabricated buildings, splash pads and fixtures, sitework, and utilities.

A MANDATORY Pre-Bid Meeting will be held on **Wednesday, April 30, 2025**, at 1:00 PM at Trap Pond State Park – 33587 Bald Cypress Lane, Laurel, DE 19956 (Follow Loblolly Road to the last parking lot) for the purpose of establishing the listing of subcontractors and to answer questions. Representatives of each party to any Joint Venture must attend this meeting. **ATTENDANCE OF THIS MEETING IS A PREREQUISITE FOR BIDDING ON THIS CONTRACT**.

Sealed bids shall be addressed to the DNREC - Division of Parks and Recreation, 89 Kings Highway, Dover, DE 19901. The outer envelope should clearly indicate: "**DNREC CONTRACT NO. NAT24825-TPSPSPLASH - SEALED BID - DO NOT OPEN**." We are also accepting, and prefer, emailed bids. They must be emailed to Shawn.Heacock@delaware.gov and Kevin.Rychlicki@delaware.gov prior to the bid deadline. Bidder bears the risk of late delivery regardless of submission method. Any bids received after the deadline will be rejected.

Contract documents shall be obtained by using the online form located at https://bit.ly/2TVIu2z and filling in the required fields. Once the information is provided, bid documents will be sent by email using Egress Switch (State's secure email drop-box type of system). The documents will be e-mailed at no cost.

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 e-mail to those bidders receiving plans.

Gregory Patterson, Secretary

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INSTRUCTIONS TO BIDDERS

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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.

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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.

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.

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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:

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.

2.3 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

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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.

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.

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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.

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.

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4.1.3 Execute all blanks on the Bid Form in a non-erasable medium (typewriter or manually in ink).

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 Interlineations, alterations or erasures must be initialed by the signer of the Bid.

4.1.6 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.

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

4.1.8 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.

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

4.1.10 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.

4.1.11 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).

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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.

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.

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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."

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

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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 in a sealed opaque envelope. Address the envelope to the party receiving the Bids. Identify with the project name, project number, and the Bidder's name and address. If the Bid is sent by mail, enclose the sealed envelope in a separate mailing envelope with the notation "BID ENCLOSED" on the face thereof. The State is not responsible for the opening of bids prior to bid opening date and time that are not properly marked.

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 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.

4.9 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 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.

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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 day 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).

5.3 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:

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

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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.

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.

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

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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.

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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.

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.

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.

NOT FOR BIDDING PURPOSES

END OF SECTION

TRAP POND STATE PARK SPLASH PARK
TRAP POND STATE PARK
33587 BALD CYPRESS LANE, LAUREL, DE 19956
DIVISION OF PARKS AND RECREATION CONTRACT No. NAT24825-TPSPSPLASH

BID FORM

For Bids Due: May 15, 2025 at 1:00pm To: Dept. of Natural Resources and Environmental Control
Division of Parks and Recreation
Office of Design and Development
89 Kings Highway, 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:

$_____

($_____)

NOT FOR BIDDING PURPOSES

Contingency Allowance Twenty Thousand Dollars and Zero Cents ($20,000.00)

Total Bid

$_____

($_____)

TRAP POND STATE PARK SPLASH PARK
TRAP POND STATE PARK
33587 BALD CYPRESS LANE, LAUREL, DE 19956
DIVISION OF PARKS AND RECREATION CONTRACT No. NAT24825-TPSPSPLASH

BID FORM

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: The two (2) additional splash pads, associated equipment, additional pool deck, and additional storm water management trenches.

Add/Deduct: _____

($)

No. of Days to Complete Alternate 1: _____

NOT FOR BIDDING PURPOSES

TRAP POND STATE PARK SPLASH PARK
TRAP POND STATE PARK
33587 BALD CYPRESS LANE, LAUREL, DE 19956
DIVISION OF PARKS AND RECREATION CONTRACT No. NAT24825-TPSPSPLASH

BID FORM

UNIT PRICES

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

NOT FOR BIDDING PURPOSES

		DEDUCT	ADD
UNIT PRICE No. 1:	Additional Excavation	$ _____	$ _____
UNIT PRICE No. 2	Additional Tree and Brush Removal	$ _____	$ _____
UNIT PRICE No. 3	Additional Concrete Paving	$ _____	$ _____
UNIT PRICE No. 4	Additional Installation of Asphalt Roadway, Mill, and Overlay	$ _____	$ _____
UNIT PRICE No. 5	Additional Silt Fence	$ _____	$ _____
UNIT PRICE No. 6	Additional Composite Filter Log	$ _____	$ _____

TRAP POND STATE PARK SPLASH PARK
TRAP POND STATE PARK
33587 BALD CYPRESS LANE, LAUREL, DE 19956
DIVISION OF PARKS AND RECREATION CONTRACT No. NAT24825-TPSPSPLASH

BID FORM

NOT FOR BIDDING PURPOSES

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: _____
_____
_____

TRAP POND STATE PARK SPLASH PARK
TRAP POND STATE PARK
33587 BALD CYPRESS LANE, LAUREL, DE 19956
DIVISION OF PARKS AND RECREATION CONTRACT No. NAT24825-TPSPSPLASH

BID FORM

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)

NOT FOR BIDDING PURPOSES

TRAP POND STATE PARK SPLASH PARK
TRAP POND STATE PARK
33587 BALD CYPRESS LANE, LAUREL, DE 19956
DIVISION OF PARKS AND RECREATION CONTRACT No. NAT24825-TPSPSPLASH

BID FORM

SUBCONTRACTOR LIST

NOT FOR BIDDING PURPOSES

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.	Sitework-A			
	Sitework-B			
	Sitework-C			
2.	Paving -A			
	Paving -B			
	Paving -C			
4.	Landscape-A			
	Landscape-B			
	Landscape-C			
8.	Concrete-A			

	Concrete-B			
	Concrete-C			
10.	Mechanical-A			
	Mechanical-B			
	Mechanical-C			
11.	Plumbing-A			
	Plumbing-B			
	Plumbing-C			
12.	Electric-A			
	Electric-B			
	Electric-C			
13.	Site Utilities-A			
	Site Utilities-B			
	Site Utilities-C			
15.	Electric-A			
	Electric-B			
	Electric-C			
16.	Fencing-A			
	Fencing-B			
	Fencing-C			

NOT FOR BIDDING PURPOSES

TRAP POND STATE PARK SPLASH PARK
TRAP POND STATE PARK
33587 BALD CYPRESS LANE, LAUREL, DE 19956
DIVISION OF PARKS AND RECREATION CONTRACT No. NAT24825-TPSPSPLASH

BID FORM
NON-COLLUSION STATEMENT

NOT FOR BIDDING PURPOSES

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 Division of Natural Resources and Environmental Control.

All the terms and conditions of Trap Pond State Park Splash Park – Contract No. NAT24825-TPSPSPLASH 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.

TRAP POND STATE PARK SPLASH PARK
TRAP POND STATE PARK
33587 BALD CYPRESS LANE, LAUREL, DE 19956
DIVISION OF PARKS AND RECREATION CONTRACT No. NAT24825-TPSPSPLASH

AFFIDAVIT
OF
EMPLOYEE DRUG TESTING PROGRAM

NOT FOR BIDDING PURPOSES

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 _____.

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

TRAP POND STATE PARK SPLASH PARK
TRAP POND STATE PARK
33587 BALD CYPRESS LANE, LAUREL, DE 19956
DIVISION OF PARKS AND RECREATION CONTRACT No. NAT24825-TPSPSPLASH

AFFIDAVIT
OF
CONTRACTOR QUALIFICATIONS

NOT FOR BIDDING PURPOSES

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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NOT FOR BIDDING PURPOSES

STATE OF DELAWARE
DEPARMTENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL

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. NAT24825-TPSPSPLASH, to be paid to the **State** for the use and benefit of _____ (***Delaware Department of Natural Resources and Environmental Control***) 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 _____ (***Delaware Department of Natural Resources and Environmental Control***) 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 _____ (***Delaware Department of Natural Resources and Environmental Control***) 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

NOT FOR BIDDING PURPOSES

_____
Name of Bidder (Organization)

Corporate Seal

By: _____
Authorized Signature

Attest _____

_____
Title

_____
Name of Surety

Witness:_____ By: _____

_____

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NOT FOR BIDDING PURPOSES

STATE OF DELAWARE

DIVISION OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL

AIA 101-2017 AGREEMENT BETWEEN OWNER AND CONTRACTOR

NOT FOR BIDDING PURPOSES

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.

NOT FOR BIDDING PURPOSES

Init.
/

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TABLE OF ARTICLES

1 THE CONTRACT DOCUMENTS

2 THE WORK OF THIS CONTRACT

3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

4 CONTRACT SUM

5 PAYMENTS

6 DISPUTE RESOLUTION

7 TERMINATION OR SUSPENSION

8 MISCELLANEOUS PROVISIONS

9 ENUMERATION OF CONTRACT DOCUMENTS

EXHIBIT A INSURANCE AND BONDS

NOT FOR BIDDING PURPOSES

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.

[ ] 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:

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(Check one of the following boxes and complete the necessary information.)

[ ] 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

§ 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

§ 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)

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

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

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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:

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the day of the 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 ( ) days after the Architect receives the 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.)

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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.)

§ 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.)

§ 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.)

§ 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:

§ 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.)

%

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

[ ] Other *(Specify)*

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.)

§ 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.)

§ 8.7 Other provisions:

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.)

.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.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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User Notes: (3B9ADA4C)

[ ] 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

[ ] 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.)

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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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

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.

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.

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

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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.

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§ 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, 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.)*

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[ ] **§ 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.

§ 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:

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.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.

§ 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.

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§ 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

§ 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.)

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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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STATE OF DELAWARE

DIVISION OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL

AIA 201-2017 SUPPLEMENT TO AGREEMENT BETWEEN OWNER AND CONTRACTOR A101-2017

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AIA® Document A201™ – 2017

General Conditions of the Contract for Construction

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

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

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consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 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.

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§ 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 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,

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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.

§ 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.

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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.

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§ 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.

§ 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.

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§ 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.

§ 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.

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§ 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.

§ 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

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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 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.

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§ 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 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.

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§ 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.

§ 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

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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.

§ 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

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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.

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,

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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.

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,

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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.

§ 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:

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.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:

.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

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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.

§ 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.

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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

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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.

§ 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.

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§ 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;
- .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.

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§ 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.

§ 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.

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§ 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.

§ 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.

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§ 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

.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.

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§ 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 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.

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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 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.

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§ 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.

§ 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

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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 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.

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§ 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.

§ 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.

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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.

§ 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,

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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;
- **.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.

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§ 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.

§ 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

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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.

§ 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.

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§ 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.

§ 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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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.

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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 Other – and add the following sentence:

"Any remedies available in law or in equity."

ARTICLE 7: TERMINATION or SUSPENSION

7.1.1 Delete paragraph 7.1.1 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 SUPPLEMENT TO AGREEMENT BETWEEN OWNER AND CONTRACTOR

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NOT FOR BIDDING PURPOSES

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.

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A.3.2.6 Insert "$500,000.00" in the blank for each accident.
Insert "$500,000.00" in the blank for each employee.
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 PURPOSES

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 **Department of Natural Resources and Environmental Control** ("**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. _____ 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

NOT FOR BIDDING PURPOSES

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, 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)

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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 **Department Natural Resources and of Environmental Control** ("**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. _____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**.

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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.

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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SECTION 00 72 13

GENERAL CONDITIONS TO THE CONTRACT
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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SECTION 00 73 13

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.

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TABLE OF ARTICLES

1. GENERAL PROVISIONS
2. OWNER
3. CONTRACTOR
4. ADMINISTRATION OF THE CONTRACT
5. SUBCONTRACTORS
6. CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS
7. CHANGES IN THE WORK
8. TIME
9. PAYMENTS AND COMPLETION
10. PROTECTION OF PERSONS AND PROPERTY
11. INSURANCE AND BONDS
12. UNCOVERING AND CORRECTION OF WORK
13. MISCELLANEOUS PROVISIONS
14. TERMINATION OR SUSPENSION OF THE CONTRACT
15. CLAIMS AND DISPUTES

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 Section 14.2.2."

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."

"1.2.5The 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."

"1.2.6The 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.

NOT FOR BIDDING PURPOSES

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 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:

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"2.3.6The 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.

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."

"3.3.4The 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."

"3.3.5When 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:

"3.4.4Before 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."

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"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, 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 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:

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"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 redline 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."

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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. 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:

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"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 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:

"8.2.4If 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."

NOT FOR BIDDING PURPOSES

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."

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:

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"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.

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:

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"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

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.

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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

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”.

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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."

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."

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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".

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.

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15.4 ARBITRATION

Strike Section 15.4 and its Subsections in their entirety.

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END OF SECTION

NOT FOR BIDDING PURPOSES

STATE OF DELAWARE

DIVISION OF FACILITIES MANAGEMENT

DELAWARE SEPARTMENT OF LABOR PREVAILING WAGE RATES

NOT FOR BIDDING PURPOSES

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NOT FOR BIDDING PURPOSES

STATE OF DELAWARE
DEPARTMENT OF LABOR
DIVISION OF INDUSTRIAL AFFAIRS
OFFICE OF LABOR LAW ENFORCEMENT
PHONE: (302) 318-2769

Mailing Address:
252 Chapman Road
Suite 210
Newark, DE 19702

Located at:
252 Chapman Road
Suite 210
Newark, DE 19702

PREVAILING WAGES FOR HEAVY CONSTRUCTION EFFECTIVE MARCH 14, 2025

CLASSIFICATION	NEW CASTLE	KENT	SUSSEX
ASBESTOS WORKERS	28.89	25.41	55.24
BOILERMAKERS	90.82	41.9[illegible]	77.00
BRICKLAYERS	90.12	7[illegible].39	32.55
CARPENTERS	62.56	6[illegible].56	50.80
CEMENT FINISHERS	56.98	31.82	23.71
DIVER	103.26	-	-
DIVER TENDER	116.61	-	-
ELECTRICAL LINE WORKERS	96.29	96.29	96.29
ELECTRICIANS	83.92	83.92	83.92
GLAZIERS	[illegible].67	23.17	15.70
INSULATORS	69.1[illegible]	69.12	69.12
IRON WORKERS	78.58	79.67	78.58
LABORERS	57.65	57.65	57.65
MILLWRIGHTS	88.35	88.35	70.97
PAINTERS	95.76	95.76	95.76
PILEDRIVERS	91.12	51.44	40.03
PLASTERERS	25.12	21.85	15.00
PLUMBERS/PIPEFITTERS/STEAMFITTERS	99.88	101.73	25.47
POWER EQUIPMENT OPERATORS	83.29	89.93	83.29
SHEET METAL WORKERS	40.16	24.92	23.41
SPRINKLER FITTERS	43.29	16.39	15.00
TRUCK DRIVERS	44.73	26.88	29.10

NOT FOR BIDDING PURPOSES

CERTIFIED: 3/10/2025 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 OR CLASSIFICATIONS, PHONE (302) 318-2769.

NON-REGISTERED APPRENTICES MUST BE PAID THE MECHANIC'S RATE.

PROJECT: Trap Pond State Park New Splash Park- Splash Pad, Sussex County

STATE OF DELAWARE
DEPARTMENT OF LABOR
DIVISION OF INDUSTRIAL AFFAIRS
OFFICE OF LABOR LAW ENFORCEMENT
PHONE: (302) 318-2769

Mailing Address:
252 Chapman Road
Suite 210
Newark, DE 19702

Located at:
252 Chapman Road
Suite 210
Newark, DE 19702

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

NOT FOR BIDDING PURPOSES

CERTIFIED: 3/18/2025

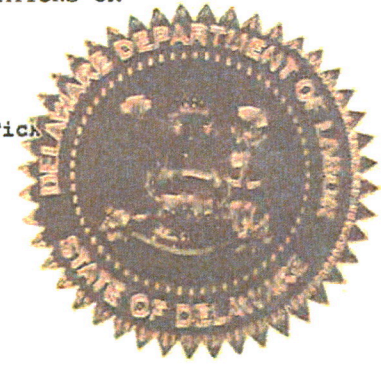
BY: For Fran Chudzik
ADMINISTRATOR, OFFICE OF LABOR LAW ENFORCEMENT

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NON-REGISTERED APPRENTICES MUST BE PAID THE MECHANIC'S RATE.

PROJECT: Trap Pond State Park New Splash Park- Maintenance Building,Tick
Lifeguard office, Sussex County



PREVAILING WAGE DEBARMENT LIST

The following contractors have been debarred for violations of the prevailing wage law 29Del.C. §6960 or other applicable State statutes.

Therefore, no public construction contract in this State shall be bid on, awarded to, or received by contractors and individuals on this list for a period of (3) three years from the date of the judgment or as deemed by a court of competent jurisdiction.

NOT FOR BIDDING PURPOSES

Contractor	Address	Date of Debarment
Mullen Brothers, Inc. and Daniel Mullen, individually	3375 Garnett Road, Boothwyn, PA 19060	Indefinite/ Civil Contempt
State Contractors Corporation, and Jose Oscar Rivera, individually	13004 Hathaway Drive Silver Spring, MD 20906	Indefinite/ 19 Del.C. 2374(f)
Green Granite and Jason Green, individually	604 Heatherbrooke Court Avondale, PA 19311	Indefinite/ Civil Contempt
Pro Image Landscaping, Inc. and Owner(s) individually	23 Commerce Street Wilmington, DE 19801 and/or 2 Cameo Road Claymont, DE 19703	Indefinite/19 Del.C. §108 & 10 Del.C. 542(c)
Liberty Mechanical, LLC and Owner(s), individually	2032 Duncan Road Wilmington, DE 19801	Indefinite/ 19 Del.C. 2374(f)
Integrated Mechanical and Fire Systems Inc. and Allison Sheldon, individually	4601 Governor Printz Boulevard Wilmington, DE 19809	Indefinite/19 Del.C. §108 & 10 Del.C. 542(c)
ACH 1, INC.	873 Salem Church Road Newark, DE 19702	Indefinite/19 Del.C.6960

Updated: July 6, 2022

SECTION 00 81 13

GENERAL REQUIREMENTS

TABLE OF ARTICLES

1. GENERAL
2. OWNER
3. CONTRACTOR
4. ADMINISTRATION OF THE CONTRACT
5. SUBCONTRACTORS
6. CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS
7. CHANGES IN THE WORK
8. TIME
9. PAYMENTS AND COMPLETION
10. PROTECTION OF PERSONS AND PROPERTY
11. INSURANCE AND BONDS
12. UNCOVERING AND CORRECTION OF WORK
13. MISCELLANEOUS PROVISIONS
14. TERMINATION OR SUSPENSION OF THE CONTRACT

NOT FOR BIDDING PURPOSES

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."

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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.

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

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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 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

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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.

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:

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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

   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

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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 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.

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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).

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

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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 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

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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.

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

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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,

9.4.1.6 Instruction Manuals,

9.4.1.7 Consent of Surety to final payment.

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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 existing hazardous material such as lead, 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.

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.

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.

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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 Contractor's Contractual Liability Insurance

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 Contractor's Protective Liability Insurance

Minimum coverage to be:

Bodily Injury	$1,000,000	for each occurrence
	$3,000,000	aggregate

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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.

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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.

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.

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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 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

NOT FOR BIDDING PURPOSES

STATE OF DELAWARE

DIVISION OF FACILITIES MANAGEMENT

DRUG TESTING FORMS

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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: _____

NOT FOR BIDDING PURPOSES

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).

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: _____

NOT FOR BIDDING PURPOSES

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.

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 is defined as "an apprenticeship program approved by and registered with any State apprenticeship agency or the United States Department of Labor."[1] 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://det.delawareworks.com/apprenticeship/documents/Apprenticeship Occupation List for 29Del6962 Compliance.pdf

If you have questions regarding craft training programs, please submit them in writing to the Delaware Department of Labor at: apprenticeship@delaware.gov . The Craft Training Compliance Affidavit must be submitted prior to contract execution. In addition to this Affidavit, all information pertaining to craft training for subcontractors must also be submitted prior to contract execution. Information to be provided is the craft, company name, registration number (indicate DE, US DOL or identify other state) or that craft training requirements do not apply and the reason.

In accordance with Title 29, Chapter 69, Section 6962(d)(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(d)(13) of the Delaware Code.

Craft(s) _____

Contractor Name: _____

Contractor Address: _____

_____

_____

Contractor Program Registration Number _____
On this line also indicate whether DE, Other State (identify) or US Registration Number

Or

☐ **Craft Training requirements are not applicable because:** _____

Authorized Representative (typed or printed): _____

Authorized Representative (signature): _____

[1] Title 29, Chapter 69, Section 6902(7) of the Delaware Code.

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Title: _____

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

My Commission expires _____. NOTARY PUBLIC _____.

THIS PAGE MUST BE SIGNED AND NOTARIZED TO BE CONSIDERED.

NOT FOR BIDDING PURPOSES

SECTION 01 10 00

SUMMARY

PART 1 - GENERAL

1.1 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.

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Work under separate contract.
4. Allowances.
5. Alternates.
6. Unit Prices.
7. Applications for Payment.
8. Owner Supplied Construction Documents.
9. Coordination.
10. Phased construction.
11. Access to site.
12. Coordination with occupants.
13. Work restrictions.
14. Specification and drawing conventions.
15. Field Engineering.
16. References and Standards.
17. Miscellaneous provisions.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

A. Project Identification: Trap Pond State Park Splash Park

1. Project Location: 33587 Bald Cypress Lane, Laurel, DE 19956

NOT FOR BIDDING PURPOSES

B. Owner: State of Delaware, Department of Natural Resources and Environmental Control, Parks and Recreation, 89 Kings Highway, Dover DE 19901.

C. Architect/Engineer's Identification: The Contract Documents, dated 03/28/2025, were prepared for this Project by GWWO Architects 1215 East Fort Avenue, Suite 24, Baltimore, MD 21230.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:

1. Site utility work to bring power, water, and sanitary to the site. Site improvements include stormwater management facilities, landscaping, concrete paving, and fencing. The installation of concrete pool deck, splash pads, and associated equipment. The interior fit-out of a concrete building to be used for office space.

   The purchase and installation of three (3) prefabricated, concrete buildings inclusive of subbase and utilities.

B. Type of Contract:

1. Project will be constructed under a single, lump sum prime contract.

1.5 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts as it will have an impact on the General Contractor's scope of work. The General Contractor shall allow the separate contractors access to scaffolding and/or high reaches.

1. Installation of a well and septic system.
2. Items noted "NIC" (Not in Contract) will be furnished and installed by others.

1.6 ALTERNATES

A. Alternates quoted in the Bid Form will be exercised as Owner option. Accepted alternates will be listed in the Owner-Contractor agreement.

B. Coordinate related work and modify surrounding work affected by accepted alternates as required to complete the Work.

C. Schedule of Alternates: Refer to Section 012300 Alternates.

1.7 UNIT PRICES

A. Unit Prices quoted on the Bid form will be exercised as Owner option.

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B. Coordinate related work and modify surrounding work affected by accepted unit prices as required to complete the Work.

C. Schedule of Unit Prices: Refer to Section 012200 Unit Prices.

1.8 APLICATIONS FOR PAYMENT

A. Submit three (3) originals of each application under procedures of Section 012900 Payment Procedures.

B. Content and Format: Use the Project Manual table of contents to develop the Schedule of Values.

1.9 OWNER SUPPLIED CONSTRUCTION DOCUMENTS

A. The Contractor will be furnished, free of charge one electronic PDF file drawings and Project Manuals that are conformed to include all drawings and specification revised during the bid process. Paper sets will be furnished at the cost of reproduction, postage and handling.

1.10 COORDINATION

A. Coordinate Work of the various sections of Specifications to assure efficient and orderly sequence of installation of construction elements, with provisions for accommodating items installed later.

B. Verify characteristics of elements of interrelated operating equipment are compatible; coordinate Work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

C. Coordinate space requirements and installation of mechanical, electrical and plumbing work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduits, as closely as practicable; make runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

D. In finished areas (except as otherwise shown), conceal pipes, ducts, and wiring in the construction. Coordinate locations of fixtures and outlets with finish elements.

E. Execute cutting and patching to integrate elements of Work, uncover ill-timed defective and non-conforming work, provide openings for penetrations of existing surfaces, and provide samples for testing. Seal penetrations through floors, walls, and ceilings.

F. Before commencing Work of each phase, submit an updated copy of Contractor's construction schedule showing the sequence, commencement and completion dates for all phases of the Work.

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1.11 ACCESS TO SITE

A. General: Contractor shall have full use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Use of Site: Limit use of Project site to areas within the Contract limits. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Limits: Confine construction operations to the areas as indicated on the drawings.
2. Driveways, Walkways and Entrances: Keep public roads, public parking, driveways and entrances outside of the work area serving premises clear and available to Owner, Owner's employees, emergency vehicles and general public at all times. Do not use these areas for parking or storage of materials.

    a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
    b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

3. The adjacent building areas, site and properties are occupied and shall not be disturbed.

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weather tight condition throughout construction period. Repair damage caused by construction operations.

1.12 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
2. Refer to Section 011400 “Work Restrictions” for additional requirements.

B. On-Site Work Hours: Limit work to the site and/or existing building to normal business working hours of 7:00 a.m. to 5:00 p.m., Monday through Friday, unless otherwise indicated.

1. Weekend Hours: Weekend work shall not be allowed unless preapproved by the Owner.
2. Early Morning Hours: Early morning hours are not allowed unless required for utility shut downs.

C. Noise, Vibration, and Odors: Coordinate operations that may result in any level of noise and vibration, odors, or other disruption to the occupancy or use of adjacent occupied areas, the buildings and adjacent properties with the Owner.

1. Notify Architect and Owner not less than seven (7) days in advance of proposed disruptive operations.
2. Obtain Architect's and/or Owner's written permission before proceeding with disruptive operations.

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D. Nonsmoking Campus and Building: Smoking is prohibited within the boundaries of all state workplaces including all buildings, facilities, indoor and outdoor spaces and all the surrounding grounds owned by the State. This policy also includes but is not limited to parking lots, walkways, State vehicles and private vehicles parked or operated on State workplace property.

1.13 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

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1.14 FIELD ENGINEERING

A. Provide field engineering services; establish grades, lines, and levels, by use of recognized engineering survey practices.

B. Control datum for survey is that shown on drawings. Locate and protect control and reference points.

1.15 REFERENCES AND STANDARDS

A. For products specified by association or trade standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. The date of the standard is that in effect as of the Bid date, except when a specific date is specified.

C. Obtain copies of standards when required by Contract Documents. Maintain copy at job site during progress of the specific work.

1.16 MISCELLANEOUS PROVISIONS

A. SCHEDULE

1. The following is the required schedule for this work:

a. Bids Due: Thursday, May 15, 2025 at 1:00pm.
b. Notice of Building Contract Award: Within thirty (30) days of receipt and acceptance of qualified low bid.
c. Purchase Order Issuance: The issuance of a State of Delaware purchase order is contingent upon the successful Contractor submitting bonds on State-approved forms, signed contracts and insurance certificates to the State of Delaware within 20 days of Notice of Award. A purchase order will be issued in approximately thirty days after these items have been submitted to the State of Delaware.
d. On-Site Mobilization: Upon receipt of State of Delaware purchase order.
e. Substantial Completion: It is the State of Delaware's preference that the work shall be completed 8 months from on-site start of work.
f. Completion of Punch List: 21 days from date of substantial completion.

1) Refer to the General Requirements for additional details.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

NOT FOR BIDDING PURPOSES

SECTION 01 14 00 - WORK RESTRICTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 USE OF PREMISES

A. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of site beyond areas in which the Work is indicated.

1. Limits: Confine construction operations to the limits indicated on the drawings. Do not disturb areas to remain occupied during the renovations.
2. Owner Occupancy: The Trap Pond State Park is currently occupied, however, the site within the Park is unoccupied. The surrounding occupied areas, site, buildings, roadways, access into the buildings, etc. beyond the work area shall remain accessible to the Owner.
3. Parking: The existing parking lot can be used for parking, dumpster and laydown.
4. Dumpster: The dumpster shall be covered to avoid windblown debris. Debris shall be removed on a regular basis in order to avoid an overflowing dumpster. Restoration of grounds disturbed by the dumpster will be required upon completion of the Project. “No Trespassing” signs shall be placed on the dumpster.
5. Access: Access shall be through the Park’s main entrance and along Loblolly Road.
6. Storage: Storage areas available in the lay down area of the parking lot. Storage structures shall be provided by the contractor and shall be lockable.
7. Public Roadways, Driveways, Entrances and Public Sidewalks: Keep public roadways, driveways, entrances and public sidewalks serving premises clear and available to the Public, Owner, Owner's employees and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

    a. Schedule deliveries to minimize use of roadways, driveways, sidewalks and entrances.
    b. The Owner will not sign for any deliveries at any time.
    c. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

8. Contractor and subcontractor promotional signage will not be allowed at the project site or within the Park unless approved by the Owner.

B. Use of Existing Building: Not Applicable.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 14 00

NOT FOR BIDDING PURPOSES

SECTION 01 21 00 - ALLOWANCES

PART 1 - GENERAL

1.1 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.

1.2 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

B. Selected materials and equipment are specified in the Contract Documents by Allowances. In some cases, these Allowances include installation. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by Proposal Request.

C. Types of allowances include the following:

1. Lump-sum allowances.
2. Unit-cost Allowances.
3. Contingency Allowances.

D. Related Requirements:

1. Section 012200 "Unit Prices" for procedures for using unit prices.

1.3 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Owner of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Owner's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected in writing by Owner from the designated supplier.

1.4 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

NOT FOR BIDDING PURPOSES

1.5 INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.6 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.7 LUMP-SUM ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight**,** and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.8 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

1. Include installation costs in purchase amount only where indicated as part of the allowance.
2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.

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4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.

1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

1.9 Contingency Allowances:

A. Use the Contingency Allowance only as directed for the Owner's purposes and only by Change Orders that indicate amounts to be charged to the Allowance.

B. Change Orders authorizing use of funds from the Contingency Allowance, for purchase of products and equipment, will include Contractor's related costs and reasonable overhead and profit margins. These related costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.

C. At Project Closeout, credit unused amounts remaining in the Contingency Allowance to the Owner by Change Order.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

NOT FOR BIDDING PURPOSES

3.3 SCHEDULE OF ALLOWANCES

A. Allowance No. 1 – Contingency Allowance: Include, in the Bid, a Contingency Allowance of $20,000.00 for use according to the Owner's instructions.

1. This allowance includes material cost, receiving, handling, installation and Contractor overhead and profit.

END OF SECTION 01 21 00

NOT FOR BIDDING PURPOSES

SECTION 01 22 00 - UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for unit prices.

B. Related Sections include the following:

1. Division 1 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders.

1.3 DEFINITIONS

A. Unit price is an amount proposed by bidders, stated on the Bid Form, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A list of unit prices is included at the end of this Section. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

NOT FOR BIDDING PURPOSES

PART 3 - EXECUTION

3.1 LIST OF UNIT PRICES

A. Unit Price No. 1 – Additional Excavation

1. Description: Excavation of material, where authorized or directed, below or in addition to the levels required for the Work, and backfilling with acceptable fill material, compacted, all in accordance with Section 312000. Dispose of unacceptable excavated material in a legal manner off-site. Quantity verification shall be performed by the Owner's Authorized Representative or Owner's Testing Agency.
2. Unit of Measurement: Cubic yard of material excavated.

B. Unit Price No. 2 – Additional Tree and Brush Removal

1. Description: Removal of trees, brush, weeds, roots, or similar material, where authorized or directed, in accordance with Section 311000. Dispose of material in a legal manner off-site. Additions to or deductions from the Contract Sum for actual quantities removed and replaced, based on volume of material cut, shall be made in accordance with the Unit Prices contained in the Bid Form. Quantity verification shall be performed by the Owner's Authorized Representative or Owner's Testing Agency.
2. Unit of Measurement: Square footage of material excavated.

C. Unit Price No. 3 – Additional Concrete Paving

1. Description: Provide and install 6" concrete paving, where authorized or directed, in addition to that required for the Work. Provide all graded aggregate base course, wire mesh fabric, joints, and turn downs.
2. Unit of Measurement: Square footage of paving.

D. Unit Price No. 4 – Additional Installation of Asphalt Roadway, Mill, and Overlay

1. Description: Provide and install asphalt roadway, mill, and overlay, where authorized or directed, in addition to that required by the Work.
2. Unit of Measurement: Square yard of asphalt.

E. Unit Price No. 5 – Additional Silt Fence

1. Description: Provide and install silt fence, where authorized or directed, in addition to that required for the Work.
2. Unit of Measurement: Linear foot of silt fence.

F. Unit Price No. 6 – Additional Composite Filter Log

1. Description: Provide and install composite filter log, where authorized or directed, in addition to that required for the Work.
2. Unit of Measurement: Linear foot of composite filter log.

NOT FOR BIDDING PURPOSES

END OF SECTION 01 27 00

NOT FOR BIDDING PURPOSES

SECTION 01 23 00 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

NOT FOR BIDDING PURPOSES

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate 1: Additional Splash Pads and Restrooms

1. Install (2) two additional splash pads, associated equipment, pool decking, fencing, and stormwater management trenches. Provide and install prefabricated restroom building with (2) two additional restrooms for a total of (6) restrooms.
   a. See Drawings for additional information.
2. Base Bid will remain (2) two total splash pads, associated equipment, pool decking, fencing, and stormwater management trenches as indicated on drawings. Prefabricated restroom building will remain (4) total restrooms.

END OF SECTION 01 23 00

NOT FOR BIDDING PURPOSES

SECTION 01 24 00 - PERMITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes permits that have been issued for this Project as well as permits-in-progress initiated by the Owner and those required Contractor application.

1.3 DEFINITIONS

A. Permits: A document issued by the Authorities having jurisdiction approving specific construction. Permits may approve the documents as submitted or contain caveats that are to be followed.

1. Preconstruction Permits: Permits issued prior to the bidding and award and which are required prior to proceeding to this stage.
2. Post Bid Permits: Permits required to by applied for by the successful contractor. These include demolition permits, building permits and sub-permits such as mechanical, electrical, fire suppression and plumbing.
3. Post Construction Permits: Permits issued by the authorities having jurisdiction stating that a structure or portion of the structure has been approved as complying with applicable laws, regulations and codes and may be occupied and put to its intended you.

1.4 RESPONSIBILITIES

A. The Contractor shall abide by the approved permits which are to include the notations provided by the entity/person approving the permit.

B. The Contractor is responsible for obtaining and paying for all construction permits unless stated otherwise in the construction documents.

1. The Contractor shall conform to all of the regulations and requirements, and shall be responsible for costs associated therewith, of all permits required of the Work.
2. The Contractor shall be responsible for scheduling all inspections as required by the permits.

PART 2 - PRODUCTS (Not Used)

NOT FOR BIDDING PURPOSES

PART 3 - EXECUTION

3.1 SCHEDULE OF ISSUED PERMITS

A. Department of Natural Resources and Environmental Control (DNREC).

1. Sediment and Stormwater Plan Approval.

B. State of Delaware Architectural Accessibility Board.

C. State of Delaware Fire Marshal.

D. State of Delaware Division of Public Health.

3.2 PERMITS BY GENERAL CONTRACT.

A. Sussex County permits.

END OF SECTION 01 24 00

NOT FOR BIDDING PURPOSES

SECTION 01 25 00 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.

B. Related Sections include the following:

1. Division 1 Section “Submittal Procedures for” administrative procedures for handling requests for substitutions made after Contract award.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
c. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

NOT FOR BIDDING PURPOSES

B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
5. Comply with requirements in Division 1 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.

1.5 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 25 00

NOT FOR BIDDING PURPOSES

SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Contractor's Construction Schedule.
2. Field condition reports.
3. Special reports.

B. Related Sections include the following:

1. Division 1 Section "Payment Procedures" for submitting the Schedule of Values.
2. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.

1.3 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.

B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

D. Event: The starting or ending point of an activity.

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.

NOT FOR BIDDING PURPOSES

1.4 SUBMITTALS

A. Preliminary Construction Schedule: Submit two opaque copies.

B. Contractor's Construction Schedule: Submit two opaque copies of initial schedule, large enough to show entire schedule for entire construction period.

C. Field Condition Reports: Submit two copies at time of discovery of differing conditions.

D. Special Reports: Submit two copies at time of unusual event.

1.5 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.

NOT FOR BIDDING PURPOSES

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."

B. Time Frame: Extend schedule from date established for commencement of the Work to date of Substantial Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Activities: Treat each separate area as a separate numbered activity for each principal element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Submittal Review Time: Include review and resubmittal times indicated in Division 1 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.

3. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.

D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Work Restrictions: Show the effect of the following items on the schedule:

a. Coordination with existing construction.
b. Use of premises restrictions.
c. Provisions for future construction.
d. Seasonal variations.
e. Environmental control.

2. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

a. Mockups.
b. Fabrication.
c. Deliveries.
d. Installation.

E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion**.**

F. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragnets to demonstrate the effect of the proposed change on the overall project schedule.

NOT FOR BIDDING PURPOSES

2.2 CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit horizontal bar-chart-type construction schedule within five days of date established for commencement of the Work.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities.

2.3 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.

5. Material deliveries.
6. High and low temperatures and general weather conditions.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (refer to special reports).
10. Stoppages, delays, shortages, and losses.
11. Emergency procedures.
12. Orders and requests of authorities having jurisdiction.
13. Change Orders received and implemented.
14. Construction Change Directives received and implemented.
15. Substantial Completions authorized.

B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.4 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At bi-weekly intervals, update schedule to reflect actual construction progress and activities. Issue schedule at each regularly scheduled progress meeting.

1. 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.
2. As the Work progresses, indicate Actual Completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, and other parties identified by Contractor with a need-to-know schedule responsibility.

END OF SECTION 01 32 00

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SECTION 01 32 33 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 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.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Periodic construction photographs.
3. Final Completion construction photographs.

B. Related Sections include the following:

1. Division 01 Section "Submittal Procedures" for submitting photographic documentation.
2. Division 01 Section "Closeout Procedures" for submitting digital media as Project Record Documents at Project closeout.
3. Division 01 Section "Selective Demolition" for photographic documentation before selective demolition operations commence.

1.3 SUBMITTALS

A. Construction Digital Images: Submit a complete set of digital image electronic files as part of the Project closeout on CD-ROM, DVD or flash drive. Identify electronic media with date photographs were taken. Submit images that have same aspect ratio as the sensor, uncropped.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in uncompressed TIFF or JPEG format, produced by a digital camera with minimum sensor size of 12.0 megapixels, and at an image resolution of not less than 4000 by 3000 pixels.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

1. Photographs are to be taken weekly at a minimum during normal construction and daily during small duration projects or significant activities.

2. Photographs are to be taken prior to the start of the work to record existing conditions.
3. Photographs are to be taken when areas are opened prior to the start of the new work.
4. Photographs are to be taken during demolition operations.
5. Provide temporary lighting when required to produce clear, well-lit photographs without obscuring shadows.

B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

1. Date and Time: Include date and time in filename for each image.
2. Field Office Images: Maintain one set of images on CD-ROM in the field office at Project site, available at all times for reference. Identify images same as for those submitted to Architect.

C. Preconstruction Photographs: Before commencement of excavation and/or demolition, and starting of construction take color, digital photographs of Project building interior and exterior, site and surrounding properties, including existing items to remain during construction, from different vantage points, or as directed by Architect.

1. Flag excavation areas and construction limits before taking construction photographs.
2. Take a minimum of eight photographs to show existing conditions adjacent to building before starting the Work.
3. Take a minimum of eight photographs of existing buildings adjacent to the building to accurately record physical conditions at start of construction.
4. Take a minimum of four photographs of each existing room even if renovations are not planned in that space.
5. Take as many photographs as necessary to document the exterior of the existing building.
6. Take additional photographs as required to record settlement or cracking of adjacent pavements, and other improvements.

D. Architect-Directed Construction Photographs: From time to time, Architect will instruct the Contractor about number and frequency of color, digital photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.

E. Final Completion Construction Photographs: Take a minimum of four color photographs of each room and eight color photographs of the exterior after date of Substantial Completion for submission as Project Record Documents. Architect will direct photographer for desired vantage points.

1. Do not include date stamp.

END OF SECTION 01 32 33

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SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Sections include the following:

1. Division 1 Section "Payment Procedures" for submitting Applications for Payment and the Schedule of Values.
2. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes and for submitting Coordination Drawings.
3. Division 1 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule.
4. Division 1 Section "Quality Requirements" for submitting test and inspection reports and for mockup requirements.
5. Division 1 Section "Closeout Procedures" for submitting warranties.
6. Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
7. Division 1 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.

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1.3 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Architect's responsive action.

B. Informational Submittals: Written information that does not require Architect’s responsive action. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL PROCEDURES

A. General: Electronic copies of CAD Drawings of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals. The Contractor will be responsible for field verifying existing conditions.

B. 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. 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.

C. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. 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.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.

D. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches (150 by 200 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
3. Include the following information on label for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name and address of Architect.
    d. Name and address of Contractor.
    e. Name and address of subcontractor.
    f. Name and address of supplier.
    g. Name of manufacturer.
    h. Submittal number or other unique identifier, including revision identifier.

        1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).

    i. Number and title of appropriate Specification Section.
    j. Drawing number and detail references, as appropriate.
    k. Location(s) where product is to be installed, as appropriate.
    l. Other necessary identification.

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E. Deviations: Highlight or otherwise specifically identify deviations from the Contract Documents on submittals.

F. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.
2. Additional copies submitted for maintenance manuals will be marked with action taken and will be returned.

G. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.

1. Transmittal Form: Provide locations on form for the following information:

a. Project name.
b. Date.
c. Destination (To:).
d. Source (From:).
e. Names of subcontractor, manufacturer, and supplier.
f. Category and type of submittal.
g. Submittal purpose and description.
h. Specification Section number and title.
i. Drawing number and detail references, as appropriate.
j. Submittal and transmittal distribution record.
k. Remarks.
l. Signature of transmitter.

2. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same label information as related submittal.

H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked "Furnish as Submitted".

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

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J. Use for Construction: Use only final submittals with mark indicating "Furnish as Submitted" or “Revise as Noted & Furnish” taken by Architect.

1.5 CONTRACTOR'S USE OF ARCHITECT'S CAD FILES

A. General: At Contractor's written request, copies of Architect's CAD files will be provided to Contractor for Contractor's use in connection with Project, subject to the following conditions:

1. CADD files are limited to those that have been generated for this Project.
2. CADD files for the floor plans and roof plans shall be provided. Files for details, etc. will not be provided.
3. Contractor will be asked to sign Architects waiver of release form before files will be delivered to the contractor.

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PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

a. Manufacturer's written recommendations.
b. Manufacturer's product specifications.
c. Manufacturer's installation instructions.
d. Standard color charts.
e. Manufacturer's catalog cuts.
f. Wiring diagrams showing factory-installed wiring.
g. Printed performance curves.
h. Operational range diagrams.
i. Mill reports.
j. Standard product operation and maintenance manuals.
k. Compliance with specified referenced standards.
l. Testing by recognized testing agency.
m. Application of testing agency labels and seals.
n. Notation of coordination requirements.

4. Submit Product Data before or concurrent with Samples.

5. Number of Copies: Submit six (6) copies of Product Data, unless otherwise indicated. Architect will return three copies. Mark up and retain one returned copy as a Project Record Document.

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.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

   a. Dimensions.
   b. Identification of products.
   c. Fabrication and installation drawings.
   d. Roughing-in and setting diagrams.
   e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
   f. Shopwork manufacturing instructions.
   g. Templates and patterns.
   h. Schedules.
   i. Design calculations.
   j. Compliance with specified standards.
   k. Notation of coordination requirements.
   l. Notation of dimensions established by field measurement.
   m. Relationship to adjoining construction clearly indicated.
   n. Seal and signature of professional engineer if specified.
   o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 40 inches (750 by 1000 mm).
3. Number of Copies: Submit six (6) opaque copies of each submittal, unless copies are required for operation and maintenance manuals. Submit five copies where copies are required for operation and maintenance manuals. Architect will retain three copies; remainder will be returned.

D. 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 appropriate Specification Section.

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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.

    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

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.

    a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return 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 four sets of Samples. Architect will retain three Sample sets; remainder will be returned.

        1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
        2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least four sets of paired units that show approximate limits of variations.

E. Product Schedule or List: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product.
2. Number and name of room or space.
3. Location within room or space.
4. Number of Copies: Submit three copies of product schedule or list, unless otherwise indicated. Architect will return two copies.

    a. Mark up and retain one returned copy as a Project Record Document.

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F. Contractor's Construction Schedule: Comply with requirements specified in Division 1 Section "Construction Progress Documentation" for Construction Manager's action.

G. Submittals Schedule: Comply with requirements specified in Division 1 Section "Construction Progress Documentation."

H. Application for Payment: Comply with requirements specified in Division 1 Section "Payment Procedures."

I. Schedule of Values: Comply with requirements specified in Division 1 Section "Payment Procedures."

J. 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. Drawing number and detail references, as appropriate, covered by subcontract.
4. Number of Copies: Submit three copies of subcontractor list, unless otherwise indicated. Architect will return two copies.

    a. Mark up and retain one returned copy as a Project Record Document.

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

1. Number of Copies: Submit three copies of each submittal, unless otherwise indicated. Architect will not return copies.
2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
3. Test and Inspection Reports: Comply with requirements specified in Division 1 Section "Quality Requirements."

B. Coordination Drawings: Comply with requirements specified in Division 1 Section "Project Management and Coordination."

C. Contractor's Construction Schedule: Comply with requirements specified in Division 1 Section "Construction Progress Documentation."

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, names and addresses of architects and owners, and other information specified.

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E. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

F. Installer Certificates: Prepare 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.

G. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

H. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

I. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

J. Material Test Reports: Prepare 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.

K. Product Test Reports: Prepare written reports indicating 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.

L. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

M. Schedule of Tests and Inspections: Comply with requirements specified in Division 1 Section "Quality Requirements."

N. Preconstruction Test Reports: Prepare 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.

O. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed

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before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

P. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, 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.

Q. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 1 Section "Operation and Maintenance Data."

R. Design Data: Prepare 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.

S. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

T. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

U. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

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V. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Architect.

1. Architect will not review submittals that include MSDSs and will return the entire submittal for resubmittal.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. 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. Mark with approval stamp before submitting to Architect.

B. Approval Stamp: Stamp each submittal with a uniform approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:

1. Furnish as Submitted.
2. Revise as Noted & Furnish.
3. Revise as Noted & Furnish. Submit Revised Copy for Record.
4. Revise & 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. Architect will forward each submittal to appropriate party.

D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 01 33 00

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SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Sections include but are not limited to the following:

1. Division 1 Section "Construction Progress Documentation" for developing a schedule of required tests and inspections.
2. Division 1 Section "Cutting and Patching" for repair and restoration of construction disturbed by testing and inspecting activities.

1.3 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

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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 used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Approved mockups establish the standard by which the Work will be judged.

D. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.

E. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

F. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.

G. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

H. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

I. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

J. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to trades people of the corresponding generic name.

K. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. General: 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

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most stringent requirement. Refer uncertainties and 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.

1.5 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Assurance" Article 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. Description of test and inspection.
3. Identification of applicable standards.
4. Identification of test and inspection methods.
5. Number of tests and inspections required.
6. Time schedule or time span for tests and inspections.
7. Entity responsible for performing tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

C. Reports: Prepare and submit certified written reports that include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
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.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee

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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 specify additional requirements.

B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

C. 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.

D. 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.

E. 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 E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

F. 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.

1. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

G. 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 seven days in advance of dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.

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4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.

    a. Allow seven days for initial review and each re-review of each mockup.

5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed, unless otherwise indicated.

1.7 QUALITY CONTROL

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 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 Contractor and the Contract Sum will be adjusted by Change Order.

B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

    a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 1 Section "Submittal Procedures."

D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

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E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for commencement of the Work.

1. Distribution: Distribute schedule to Owner, Architect testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

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1.8 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 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 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 Architect's reference during normal working hours.

3.2 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 1 Section "Cutting and Patching."

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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.

END SECTION 01 40 00

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SECTION 01 42 00 - REFERENCE STANDARDS AND DEFINITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 DEFINITIONS

A. General: Basic contract definitions are included in the Conditions of the Contract.

B. "Indicated": The term "indicated" refers to graphic representations, notes, or schedules on the Drawings; or to other paragraphs or schedules in the Specifications and similar requirements in the Contract Documents. Terms such as "shown," "noted," "scheduled," and "specified" are used to help the user locate the reference. Location is not limited.

C. "Directed": Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean directed by the Architect, requested by the Architect, and similar phrases.

D. "Approved": The term "approved," when used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the Architect's duties and responsibilities as stated in the Conditions of the Contract.

E. "Regulations": The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": The term "furnish" means to supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": The term "install" describes operations at the Project site including the actual unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": The term "provide" means to furnish and install, complete and ready for the intended use.

I. "Installer": An installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, or similar operations. Installers are required to be experienced in the operations they are engaged to perform.

1. The term "experienced," when used with the term "installer," means having successfully completed a minimum of five previous projects similar in size and scope to this Project;

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being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.

2. Trades: Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.
3. Assigning Specialists: Certain Sections of the Specifications require that specific construction activities shall be performed by specialists who are recognized experts in those operations. The specialists must be engaged for those activities, and their assignments are requirements over which the Contractor has no option. However, the ultimate responsibility for fulfilling contract requirements remains with the Contractor.

    a. This requirement shall not be interpreted to conflict with enforcing building codes and similar regulations governing the Work. It is also not intended to interfere with local trade-union jurisdictional settlements and similar conventions.

J. "Project site" is the space available to the Contractor for performing construction activities, either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.

K. "Testing Agencies": A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.3 SPECIFICATION FORMAT AND CONTENT EXPLANATION

A. Specification Format: These Specifications are organized into Divisions and Sections based on the CSI/CSC's "MasterFormat" numbering system.

B. Specification Content: These Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be interpolated as the sense requires. Singular words shall be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.
2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Section Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor or by others when so noted.

    a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

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1.4 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of the date of the Contract Documents.

C. Conflicting Requirements: Where 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 uncertainties and requirements that are different, but apparently equal, to the Architect for a decision before proceeding.

1. 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 the requirements. Refer uncertainties to the Architect for a decision before proceeding.

D. Copies of Standards: Each entity engaged in construction on the Project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source and make them available on request.

E. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where abbreviations and acronyms are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards-producing organization, authorities having jurisdiction, or other entity applicable to the context of the text provision. Refer to Gale Research's "Encyclopedia of Associations" or Columbia Books' "National Trade & Professional Associations of the U.S.," which are available in most libraries.

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1.5 SUBMITTALS

A. Permits, Licenses, and Certificates: For the 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.

PRODUCTS (Not Applicable)

PART 2 - EXECUTION (Not Applicable)

END OF SECTION 01 42 00

NOT FOR BIDDING PURPOSES

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

1.3 USE CHARGES

A. General: Cost or use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to testing agencies and authorities having jurisdiction.

B. Sewer Service: Use of the Owner's existing sanitary sewer system will not be available for use. Provide temporary services as required for construction operations.

C. Water Service: Water from Owner's existing water system will not be available for use. Provide temporary services as required for construction operations.

D. Electric Power Service: Electric power from Owner's existing system will not be available for use. Provide temporary services as required for construction operations.

E. Telephone Service: Use of Owner's existing telephone service will not be available for use. Provide temporary services as required for construction operations.

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1.4 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

D. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.

1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

E. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:

1. Locations of dust-control partitions at each phase of work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air-filtration system discharge.
4. Waste handling procedures.
5. Other dust-control measures.

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1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Comply with Federal, State and local codes and regulations as well as utility company requirements.

C. Coordinate work with Owner’s requirements.

D. Materials: Materials must be new and adequate in capacity for the required usage. Materials must not create unsafe conditions nor violate requirements of applicable codes and standards.

E. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

B. Maintain excavations free of water. Provide and operate pumping equipment. Grade site to drain water away from buildings and excavations.

C. Provide temporary protection for installed products. Control traffic in immediate area to minimize damage.

D. Prohibit traffic and storage on waterproofed and roofed surfaces, on lawns and landscaped areas.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top rails.

B. Portable Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top and bottom rails. Provide concrete bases for supporting posts.

C. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil (0.25-mm) minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

D. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches (914 by 1624 mm).

E. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

F. Lumber and Plywood: Pressure-treated dimension lumber and plywood suitable for exterior exposure.

G. Paint: Exterior latex primer and matching topcoat.

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2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect/Engineer and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- (1.2-m-) square tack and marker boards.

3. Drinking water and private toilet.
4. Coffee machine and supplies.
5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).
6. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. Heating Equipment: Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

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3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

C. Water Service: Provide potable water for drinking and construction purposes.

1. The Contractor shall make all necessary arrangements for temporary water service for construction purposes, and furnish at his own expense all piping and accessories required.

2. Take positive measures to preclude cross-connections and backflow.
3. The Contractor will assume the cost of water consumed if responsible care and restraint are not exercised by the Contractor in its use.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

E. Construction Aids: The General Contractor and each Subcontractor shall provide construction aids and equipment required by their personnel and to facilitate execution of their Work. Examples are scaffolds, staging, ladders, stairs, ramps, runways, platforms, railings, hoists, cranes, chutes and other such facilities and equipment. Mutual use may be arranged by the Contractor where applicable.

F. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

G. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.

1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.

    a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
    b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

H. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

I. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
1. Provide power service required from utility source.

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J. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
2. Install lighting for Project identification sign.

K. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.

1. Provide additional telephone lines for the following:

a. Provide a dedicated telephone line for each facsimile machine in each field office.

2. At each telephone, post a list of important telephone numbers.

a. Police and fire departments.
b. Ambulance service.
c. Contractor's home office.
d. Contractor's emergency after-hours telephone number.
e. Architect's office.
f. Engineers' offices.
g. Owner's office.
h. Principal subcontractors' field and home offices.

3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

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3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect/Engineer schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Security: Security of persons and property in the areas under control of the Contractor shall be the Contractor’s exclusive responsibility.

1. The Contractor, at his own expense, shall initiate whatever programs that are necessary to execute his responsibility.
2. Control of access to the area under the Contractor’s control shall be maintained. Visitors shall be required to report immediately to the Contractor’s Superintendent and to produce full identification which will be recorded in the Contractor’s Daily Log along with the purpose of the visit.

C. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants and control valves.
3. Provide and maintain uninterrupted vehicular access to site and within to temporary construction facilities and work areas for persons and equipment involved in the construction of Project.
4. Maintain traffic areas free of excavated materials, construction equipment, products, snow, ice and debris.

D. Traffic Regulation: Obtain all necessary permits for access to and use of public roads and streets for construction and hauling purposes. Comply with traffic control regulations applying to permit issuance.

1. Provide markers, signs, lights and barriers on and near the site to safely control construction traffic and public access.

E. Parking: Use designated areas of Owner's existing parking areas for construction personnel's private vehicles and of Contractor's light-weight vehicles.

F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

   a. Provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touchup signs so they are legible at all times.

G. Waste Disposal Facilities: Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

H. Cleaning During Construction: Control accumulation of waste materials and rubbish. Periodically dispose of legally off site.

1. Clean interior areas prior to the start of finish work. Maintain areas free of dust and other contaminants during finishing operations.

I. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

J. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

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1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

K. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

L. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

M. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

N. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings.

1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

O. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

P. Tree and Plant Protection: Comply with requirements specified in Section 015639 "Temporary Tree and Plant Protection."

Q. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

R. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose portion of site determined sufficient to accommodate construction operations and maintain security.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish 10 sets of keys to Owner.

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S. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

T. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

U. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

V. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

W. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.4 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

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1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard, replace, or clean stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use permanent HVAC system to control humidity.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

    a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
    b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
    c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

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1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 01 50 00

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SECTION 01 56 00 - ENVIRONMENTAL PROTECTION

PART 1 - GENERAL

1.1 ENVIRONMENTAL PROTECTION

A. Environmental protection considerations consist of, but are not limited to, the following factors:

1. Natural resources including air, water, and land.
2. Solid waste disposal.
3. Noise.
4. Control of toxic substances and hazardous materials.
5. The presence of chemical, physical, and biological elements and agents that adversely effect and alter ecological balances.

1.2 GENERAL REQUIREMENTS

A. Provide and maintain environmental protection defined herein, other Sections and as indicated in the Drawings.

B. Comply with all Federal, State, and local laws, ordinances and regulations pertaining to environmental protection.

C. Compliance by subcontractors with the provisions of this and various other sections of these specifications is the responsibility of the Contractor.

D. Use of equipment from which factory-installed, anti-pollution and noise control devices are removed or rendered ineffective, either intentionally or through lack of proper maintenance is prohibited.

E. Furnish a certificate that all materials and operating equipment installed as a part of this project, the installation thereof and all equipment used in the construction, are in compliance with all applicable local laws, ordinances, regulations and permits concerning environmental pollution control and abatement.

1.3 PROTECTION OF NATURAL RESOURCES

A. General: It is intended that the natural resources within the project boundaries and outside the limits of permanent work performed be preserved in their existing condition, be restored to an equivalent of the existing condition or improved as indicated, as approved by the Architect/Engineer, upon completion of the work. Confine on-site construction activities to areas defined by the drawings and specifications.

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1.4 TOXIC SUBSTANCES

B. Asbestos and Hazardous Materials Procedure: In the event the Contractor, during the course of the work on the project, encounters the presence of asbestos or any materials containing asbestos, or polychlorinated biphenyl (PCB's) or any other hazardous materials as recognized by local Authorities having jurisdiction, promptly notify the Owner through the Architect/Engineer. Do not perform any work pertinent to the asbestos or hazardous material prior to receipt of special instructions from the Owner through the Architect/Engineer. Any delay in the progress of the work as a result of encountering either asbestos or hazardous materials on the project will be mitigated by the Architect/Engineer. Within 24 hours of this notification to the Owner through the Architect/Engineer of the encountering of the presence of asbestos or hazardous materials, the Contractor will meet with the Architect/Engineer to replan and work around the affected area. The Architect/Engineer will provide the special instructions without delay and upon confirmation by the local Authorities of the actions taken and authorize work to progress.

C. Comply with all applicable provisions of the National Emission Standards for Asbestos (40 CFR 61 Subpart B).

D. Comply with the local regulations of polychlorinated biphenyl (PCB). Since these chemicals are used in some existing insulation, existing fixed and vehicular transformers, assure proper marking, handling, and disposal of any PCB's in accordance with the regulations of 40 CFR 761.

1. Do not use PCB chemical substance, mixture, equipment, container, sealant, coating, or dust-control agent except in accordance with regulations of 40 CFR 761.
2. Immediately report any PCB chemical substance, mixture, equipment, container, sealant, coating or dust control agent found stored within the project area to the Architect in writing and stop work in the area.

E. Lead paint is known to be present in the interior and exterior of the building. Refer to the Batta Environmental Report dated January 15, 2020.

F. Asbestos: Is known to be present to be present in some exterior building caulk, pipe insulation and joint compound. Refer to the Batta Environmental Report dated January 15, 2020.

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1.4 CONTROL AND DISPOSAL OF EXCESS MATERIAL, TRASH AND DEBRIS

A. Dispose of excess excavated material that is approved by the Architect/Engineer as clean fill onsite if an onsite soil disposal area is approved by the Architect/Engineer. If no such site is approved, dispose of the material in accordance with the provision of paragraph 1.5 (C).

B. Pick-up trash and place in containers. Empty containers on a regular schedule. Conduct handling and disposal to prevent contamination of the site and other areas. Do not dispose of in areas of natural vegetation. On completion, leave the area clean and natural looking.

C. Dispose of rubbish and debris as follows:

1. Transport all waste off the site and dispose of it in a manner that complies with State, and local requirements. Secure a permit or license prior to transporting any material off the site. Do not burn or bury waste materials on the site.

1.5 CONTROL AND DISPOSAL OF CHEMICAL AND SANITARY WASTES

A. Store chemical waste in corrosion-resistant containers, remove from the project site, and dispose of as necessary, but not less frequently than monthly. Provide for disposal of chemical waste in accordance with standard established practices as approved by the Architect. Dispose of lubricants to be discarded in accordance with approved procedures meeting state, and local regulations.

1.6 DUST CONTROL

A. Keep dust down at all times including nonworking hours, weekends, and holidays.

B. Secure and cover transport equipment and loose materials in transit to ensure that materials do not become airborne during transit.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 56 00

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SECTION 01 56 39 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 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.

1.2 SUMMARY

A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

B. Related Sections:

1. Section 015000 "Temporary Facilities and Controls" for temporary site fencing.
2. Section 311000 "Site Clearing" for removing existing trees and shrubs.

1.3 DEFINITIONS

A. Caliper: Diameter of a trunk measured by a diameter tape at 6 inches (150 mm) above the ground for trees up to, and including, 4-inch (100-mm) size; and 12 inches (300 mm) above the ground for trees larger than 4-inch (100-mm) size.

B. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

C. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.

D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: For each type of the following:

1. Organic Mulch: 1-pint (0.5-L) volume of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.
2. Protection-Zone Fencing: Assembled Samples of manufacturer's standard size made from full-size components.

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3. Protection-Zone Signage: Full-size Samples of each size and text, ready for installation.

C. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.

1. Species and size of tree.
2. Location on site plan. Include unique identifier for each.
3. Reason for pruning.
4. Description of pruning to be performed.
5. Description of maintenance following pruning.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified arborist and tree service firm.

B. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

C. Maintenance Recommendations: From arborist for care and protection of trees affected by construction during and after completing the Work.

D. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1. Use sufficiently detailed photographs or videotape.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

1.6 QUALITY ASSURANCE

A. Arborist Qualifications: Certified Arborist as certified by ISA.

B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.

C. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:

a. Construction schedule. Verify availability of materials, personnel, and equipment needed to make progress and avoid delays.
b. Enforcing requirements for protection zones.
c. Arborist's responsibilities.

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d. Field quality control.

1.7 PROJECT CONDITIONS

A. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil: Natural or cultivated top layer of the soil profile or manufactured topsoil; containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch (25 mm) in diameter; and free of weeds, roots, and toxic and other nonsoil materials.

1. Obtain topsoil only from well-drained sites where topsoil is 4 inches (100 mm) deep or more; do not obtain from bogs or marshes.

B. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:

1. Type: Shredded hardwood.
2. Size Range: 3 inches (76 mm) maximum, 1/2 inch (13 mm) minimum.
3. Color: Natural.

C. Protection-Zone Fencing: Fencing fixed in position and meeting one of the following requirements.

1. Chain-Link Protection-Zone Fencing: Galvanized-steel fencing fabricated from minimum 2-inch (50-mm) opening, 0.148-inch- (3.76-mm-) diameter wire chain-link fabric; with pipe posts, minimum 2-3/8-inch- (60-mm-) OD line posts, and 2-7/8-inch-

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(73-mm-) OD corner and pull posts**;** with 1-5/8-inch- (42-mm-) OD top rails; with 0.177-inch- (4.5-mm-) diameter top tension wire and 0.177-inch- (4.5-mm-) diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.

a. Height: 4 feet (1.2 m).

2. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch (50-mm) maximum opening in pattern and weighing a minimum of 0.4 lb/ft. (0.6 kg/m); remaining flexible from minus 60 to plus 200 deg F (minus 16 to plus 93 deg C); inert to most chemicals and acids; minimum tensile yield strength of 2000 psi (13.8 MPa) and ultimate tensile strength of 2680 psi (18.5 MPa); secured with plastic bands or galvanized-steel or stainless-steel wire ties; and supported by tubular or T-shape galvanized-steel posts spaced not more than 8 feet (2.4 m) apart.

a. Height: 4 feet (1.2 m).
b. Color: High-visibility orange, nonfading.

D. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering and as follows:

1. Size and Text: DO NOT ENTER. TREE PROTECTION ZONE.
2. Lettering: 3-inch- (75-mm-) high minimum, white characters on red background.

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

B. For the record, prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

A. Locate and clearly identify trees, shrubs, and other vegetation to remain. Flag each tree trunk at 54 inches (1372 mm) above the ground.

B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated.

1. Apply 4-inch (100-mm) average thickness of organic mulch. Do not place mulch within 6 inches (150 mm) of tree trunks.

3.3 TREE- AND PLANT-PROTECTION ZONES

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected area except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.

1. Chain-Link Fencing: Install to comply with ASTM F 567 and with manufacturer's written instructions.
2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.

B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Architect. Install one sign spaced approximately every 20 feet (6 m) on protection-zone fencing, but no fewer than one sign with each facing a different direction.

C. Maintain protection zones free of weeds and trash.

D. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

E. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.

1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 312000 "Earth Moving."

B. Trenching near Trees: Where utility trenches are required within protection zones, hand excavate under or around tree roots or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning.

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C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches (75 mm) back from new construction and as required for root pruning.

D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

A. Prune roots that are affected by temporary and permanent construction. Prune as follows:

1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
2. Cut Ends: Coat cut ends of roots more than 1-1/2 inches (38 mm) in diameter with an emulsified asphalt or other coating formulated for use on damaged plant tissues and that is acceptable to arborist.
3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
4. Cover exposed roots with burlap and water regularly.
5. Backfill as soon as possible according to requirements in Section 312000 "Earth Moving."

B. Root Pruning at Edge of Protection Zone: Prune roots 6 inches (150 mm) inside of the protection zone, by cleanly cutting all roots to the depth of the required excavation.

C. Root Pruning within Protection Zone: Clear and excavate by hand to the depth of the required excavation to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

3.6 CROWN PRUNING

A. Prune branches that are affected by temporary and permanent construction. Prune branches as follows:

1. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.
2. Pruning Standards: Prune trees according to ANSI A300 (Part 1) and the following:

    a. Type of Pruning: Cleaning.

3. Cut branches with sharp pruning instruments; do not break or chop.

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4. Do not apply pruning paint to wounds.

B. Chip removed branches and spread over areas identified by Architect.

3.7 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.

1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.

C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

D. Minor Fill within Protection Zone: Where existing grade is 2 inches (50 mm) or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.

3.8 FIELD QUALITY CONTROL

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.9 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

1. Submit details of proposed root cutting and tree and shrub repairs.
2. Have arborist perform the root cutting, branch pruning, and damage repair of trees and shrubs.
3. Treat damaged trunks, limbs, and roots according to arborist's written instructions.
4. Perform repairs within 24 hours.
5. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by Architect.

B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.

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1. Provide new trees of same size and species as those being replaced for each tree that measures 6 inches (150 mm) or smaller in caliper size.

    a. Species: Match existing tree to be replaced.

C. Soil Aeration: Where directed by Architect, aerate surface soil compacted during construction. Aerate 10 feet (3 m) beyond drip line and no closer than 36 inches (900 mm) to tree trunk. Drill 2-inch- (50-mm-) diameter holes a minimum of 12 inches (300 mm) deep at 24 inches (600 mm) o.c. Backfill holes with an equal mix of augered soil and sand.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 01 56 39

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SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

B. Related Sections include but are not limited to the following:

1. Division 1 Section "References" for applicable industry standards for products specified.
2. Division 1 Section "Closeout Procedures" for submitting warranties for Contract closeout.
3. Other included Sections for specific requirements for warranties on products and installations specified to be warranted.

1.3 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

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C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

1.4 SUBMITTALS

A. Product List: Submit a list, in tabular from, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.

1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
2. Form: Tabulate information for each product under the following column headings:

    a. Specification Section number and title.
    b. Generic name used in the Contract Documents.
    c. Proprietary name, model number, and similar designations.
    d. Manufacturer's name and address.
    e. Supplier's name and address.
    f. Installer's name and address.
    g. Projected delivery date or time span of delivery period.
    h. Identification of items that require early submittal approval for scheduled delivery date.

3. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.

    a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.

4. Completed List: Within 60 days after date of commencement of the Work, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
5. Architect's Action: Architect will respond in writing to Contractor within 15 days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.

B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use CSI Form 13.1A at the end of this section.

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2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

    a. Statement indicating why specified material or product cannot be provided.
    b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
    c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
    d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    e. Samples, where applicable or requested.
    f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
    g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
    h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
    i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
    j. Cost information, including a proposal of change, if any, in the Contract Sum.
    k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
    l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's/Engineer's Action: If necessary, Architect/Engineer will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. Architect/Engineer will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

    a. Form of Acceptance: Change Order.
    b. Use product specified if Architect/Engineer cannot make a decision on use of a proposed substitution within time allocated.

C. Comparable Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Architect's Action: If necessary, Architect/Engineer will request additional information or documentation for evaluation within one week of receipt of a comparable product

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request. Architect/Engineer will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

a. Form of Approval: As specified in Division 1 Section "Submittal Procedures."
b. Use product specified if Architect cannot make a decision on use of a comparable product request within time allocated.

D. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 1 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect/Engineer will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store cementitious products and materials on elevated platforms.

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5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
3. Refer to Divisions 2 through 33 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 1 Section "Closeout Procedures."

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PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.

3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Part 2 "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
8. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.
9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's/Engineer's sample. Architect's decision will be final on whether a proposed product matches.

    a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.

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10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.

    a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
    b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

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2.2 PRODUCT SUBSTITUTIONS

A. Timing: Architect will consider requests for substitution if received within **30** days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.

B. Conditions: Architect/Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
2. Requested substitution does not require extensive revisions to the Contract Documents.
3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
4. Substitution request is fully documented and properly submitted.
5. Requested substitution will not adversely affect Contractor's Construction Schedule.
6. Requested substitution has received necessary approvals of authorities having jurisdiction.
7. Requested substitution is compatible with other portions of the Work.
8. Requested substitution has been coordinated with other portions of the Work.
9. Requested substitution provides specified warranty.
10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

2.3 COMPARABLE PRODUCTS

A. Conditions: Architect/Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require extensive revisions to the Contract Documents that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

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Knowledge for Creating and Sustaining the Built Environment

SUBSTITUTION REQUEST

(After the Bidding/Negotiating Phase)

Project: _____ Substitution Request Number: _____

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Phone: _____

Address: _____

Trade Name: _____ Model No.: _____

Installer: _____ Phone: _____

Address: _____

History: ☐ New product ☐ 1-4 years old ☐ 5-10 years old ☐ More than 10 years old

Differences between proposed substitution and specified product:

☐ Point-by-point comparative data attached — REQUIRED BY A/E

Reason for not providing specified item:

Similar Installation:

Project: _____ Architect: _____

Address: _____ Owner: _____

_____ Date Installed: _____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explain _____

Savings to Owner for accepting substitution: _____ ($ _____)

Proposed substitution changes Contract Time: ☐ No ☐ Yes [Add] [Deduct] _____ days.

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

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SUBSTITUTION REQUEST
(After the Bidding/Negotiating Phase — Continued)

The Undersigned certifies:
- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by this substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____

Attachments: ☐

A/E's REVIEW AND ACTION

☐ Substitution approved - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.
☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.
☐ Substitution rejected - Use specified materials.
☐ Substitution Request received too late - Use specified materials.

Signed by: _____ Date: _____

Additional Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ A/E ☐ Other:

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END OF SECTION 01 60 00

SECTION 01 71 23 – FIELD ENGINEERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative provisions and procedural requirements for Field Engineering services, including, but not necessarily limited to the following:

1. Land Survey Work.
2. Engineering services.

1.3 SUBMITTALS

A. Certificates: Submit a certificate signed by the Land Surveyor certifying that the location and elevation of improvements comply with the Contract Documents.

B. Project Record Documents: Submit a record of Work performed and record survey data as required under provisions of Sections "Submittals" and "Project Closeout".

1.4 QUALITY ASSURANCE

A. Surveyor: Engage a Professional Land Surveyor, licensed in the State of Delaware, to perform required surveying services to ensure that grades, lines, levels, and locations of the Work are in compliance with the Contract Documents.

B. Engineer: Engage a Professional Engineer of the discipline required, registered in the State of Delaware, to perform required engineering services.

1.5 EXAMINATION

A. The Owner will identify existing control points and property line corner stakes.

B. Verify layout information shown on the Drawings, in relation to the property survey and existing benchmarks before proceeding to layout the Work. Locate and protect existing benchmarks and control points. Preserve permanent reference points during construction.

1. Do not change or relocate benchmarks or control points without prior written approval. Promptly report lost or destroyed reference points, or requirements to relocate reference points because of necessary changes in grades or locations.
2. Promptly replace lost or destroyed Project control points. Base replacements on the original survey control points.

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C. Establish and maintain a minimum of two permanent benchmarks on the site, referenced to data established by survey control points.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

D. Existing utilities and equipment: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction.

1.6 PERFORMANCE

A. Working from lines and levels established by the property survey, establish benchmarks and markers to set lines and levels at each story of construction and elsewhere as needed to properly locate each element of the Project. Calculate and measure required dimensions within indicated or recognized tolerances. Do not scale Drawings to determine dimensions.

1. Advise entities engaged in construction activities, of marked lines and levels provided for their use.
2. As construction proceeds, check every major element for line, level and plumb.

B. Surveyor's Log: Maintain a surveyor's log of control and other survey Work. Make this log available for reference.

1. Record deviations from required lines and levels, and advise the Architect when deviations that exceed indicated or recognized tolerances are detected. On Project Record Drawings, record deviations that are accepted and not corrected.
2. On completion of foundation walls, major site improvements, and other Work requiring field engineering services, prepare a certified survey showing dimensions, locations, angles and elevations of construction and sitework.

C. Site Improvements: Locate and lay out site improvements, including pavements, stakes for grading, fill and topsoil placement, utility slopes and invert elevations by instrumentation and similar appropriate means.

D. Building Lines and Levels: Locate and lay out batter boards for structures, building foundations, column grids and locations, floor levels and control lines and levels required for mechanical and electrical work.

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PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 71 23

SECTION 01 73 00 – EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. General installation of products.
3. Coordination of Owner-installed products.
4. Progress cleaning.
5. Starting and adjusting.
6. Protection of installed construction.
7. Correction of the Work.

B. Related Sections include the following:

1. Division 1 Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
2. Division 1 Section "Cutting and Patching" for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.
3. Division 1 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
4. Division 02 Section "Selective Demolition" for demolition and removal of selected portions of the building.

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PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and

verify the existence and location of mechanical and electrical systems and other construction affecting the Work.

1. Before construction, verify the location and points of connection of utility services.

B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

a. Description of the Work.
b. List of detrimental conditions, including substrates.
c. List of unacceptable installation tolerances.
d. Recommended corrections.

2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

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3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before

fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents. Submit requests on CSI Form 13.2A, "Request for Interpretation."

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.

C. Building Lines and Levels: Locate and lay out control lines and levels for foundations including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations from two or more locations.

D. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
4. Maintain minimum headroom clearance of 8 feet (2.4 m) in spaces without a suspended ceiling.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

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D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produces harmful noise levels.

F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect/engineer.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. 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 to Project site in time for installation.

H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.5 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction forces.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction forces.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction forces at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction forces if portions of the Work depend on Owner's construction.

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3.6 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

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3.7 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section "Quality Requirements."

3.8 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.9 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01 73 00

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SECTION 01 73 29 - CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

B. Related Sections include the but are not limited to the following:

1. Division 2 Section "Selective Demolition" for demolition of selected portions of the building for alterations.

1.3 DEFINITIONS

A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.4 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. Operational Elements: Do not cut and patch the following operating elements and related components in a manner that results in reducing their capacity to perform as intended or that result in increased maintenance or decreased operational life or safety.

1. Primary operational systems and equipment.
2. Fire-protection systems.
3. Control systems.
4. Communication systems.
5. Electrical wiring systems.

C. Miscellaneous Elements: Do not cut and patch the following elements or related components in a manner that could change their load-carrying capacity, which results in reducing their capacity to perform as intended, or that result in increased maintenance or decreased operational life or safety.

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1. Water, moisture, or vapor barriers.
2. Membranes and flashings.
3. Piping and ductwork.

D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections of these Specifications.

B. Existing Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

NOT FOR BIDDING PURPOSES

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete & Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
5. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

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2. Exposed Finishes: 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. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

END OF SECTION 01 73 29

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SECTION 01 74 19 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 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.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Recycling nonhazardous demolition and construction waste.
2. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:

1. Section 024119 "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.
2. Section 042000 "Unit Masonry" for disposal requirements for masonry waste.

1.3 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. Construction waste includes packaging.

B. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

C. Recycle: The process of sorting, treating and reconstituting materials for the purpose of using the material in the manufacture of a new product.

D. 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 of mulch.

E. Salvage: Recovery of demolition or construction waste and subsequent sale, reuse in another facility or sale to a third party.

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F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

G. 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.

H. 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.

I. 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.

1.4 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for recycling of 75 percent CDL waste by weight from the landfill by one or a combination of the following activities:

1. Source-Separated CDL Recycling.
2. Co-mingled CDL Recycling.

B. CDL waste materials that can be salvaged, reused or recycled include, but are not limited to, the following:

1. Demolition Waste:

a. Asphalt paving.
b. Concrete.
c. Concrete reinforcing steel.
d. Land clearing debris (vegetation, stumpage, dirt, etc.).
e. Transformers.

2. Construction Waste:

a. Asphalt paving.
b. Concrete.
c. Concrete reinforcing steel.
d. Concrete masonry units.
e. Doors and frames.
f. Door hardware.
g. Field office waste including office paper, cans, plastic and office cardboard.

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h. Gypsum board.
i. Land clearing debris (vegetation, stumpage, dirt, etc.).
j. Metals.
k. Metal studs.
l. Paint (through hazardous waste outlets).
m. Plastic film (sheeting, shrink wrap and packaging),
n. Plywood and oriented strand board.
o. Wood.
p. Piping.
q. Electrical conduit.
r. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

1) Paper.
2) Cardboard.
3) Boxes.
4) Plastic sheet and film.
5) Polystyrene packaging.
6) Wood crates.
7) Plastic pails.

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1.5 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 30 days of date established for the Notice of Award.

B. Waste Management Report: Submit report with each application for payment.

1.6 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons (tonnes).
4. Quantity of waste salvaged, both estimated and actual in tons (tonnes).
5. Quantity of waste recycled, both estimated and actual in tons (tonnes).
6. Total quantity of waste recovered (salvaged plus recycled) in tons (tonnes).
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

C. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

D. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

E. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. Qualification Data: For refrigerant recovery technician.

G. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.7 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. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan including responsibilities of waste management coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.
6. Attendees: Inform the following individuals, whose presence is required, of date and time of meeting.

a. Owner.

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b. Architect/Engineer.
c. Contractor's superintendent.
d. Major subcontractors.
e. Waste Management Coordinator.
f. Other concerned parties.

7. Minutes: Record discussion. Distribute meeting minutes to all participants. Note: If there is an Architectural/Engineering consultant contracted by the State of Delaware, they will perform this role.

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1.8 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing and construction waste generated by the Work. List all assumptions made for the quantities estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. The plan shall include 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.
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 materials, 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.

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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.
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.

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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.

WASTE MANAGEMENT PROGRESS REPORT					
		Disposed in Municipal Solid Waste landfill	**Diverted from Landfill by Recycling, Salvage or Reuse**		
Material Category			Recycled	Salvaged	Reused
1.	Asphalt				
2.	Cardboard Packaging				
3.	Drywall				
4.	Concrete				
5.	Land Clearing Debris (Vegetation, Stumpage & dirt)				

6.	Metals				
7.	Paint (Through Hazardous Waste Outlets)				
8.	Wood				
9.	Plastic Film (Sheeting, Shrink Wrap & Packaging)				
10.	Field Office waste (Office Paper, Aluminum Cans, Glass, Plastic and Coffee Cardboard)				
11.	Other (Insert Description)				
12.	Other (Insert Description)				
	Total (In Weight)		(TOTAL OF ALL ABOVE VALUES – IN WEIGHT)		
Percentage of Waste Diverted			(TOTAL WASTE DIVIDED BY TOTAL DIVERTED)		

END OF SECTION 01 74 19

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SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Inspection procedures.
2. Project Record Documents.
3. Operation and maintenance manuals.
4. Warranties.
5. Instruction of Owner's personnel.
6. Final cleaning.

B. Related Sections include the following:

1. Division 1 Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.
2. Division 1 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
3. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
4. Divisions 02 through 33 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

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1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, damage or settlement surveys, and similar final record information.

6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Complete startup testing of systems.
8. Submit test/adjust/balance records.
9. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
10. Advise Owner of changeover in heat and other utilities.
11. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
12. Complete final cleaning requirements, including touchup painting.
13. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect/Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect/Engineer will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect/Engineer, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

1.4 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."
2. Submit certified copy of Architect's/Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect/Engineer. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training videotapes.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect/Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

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1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect.
    d. Name of Contractor.
    e. Page number.

1.6 PROJECT RECORD DOCUMENTS

A. General: Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

B. Record Drawings: Maintain and submit one original set of blue- or black-line white prints with two copies of Contract Drawings and Shop Drawings.

1. Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

    a. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
    b. Accurately record information in an understandable drawing technique.
    c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
    d. Mark Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on Contract Drawings.

2. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
3. Mark important additional information that was either shown schematically or omitted from original Drawings.

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4. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.
5. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.

C. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications. Mark copy to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Note related Change Orders, Record Drawings**,** and Product Data, where applicable.

D. Record Product Data: Submit three copies of each Product Data submittal. Mark one set to indicate the actual product installation where installation varies substantially from that indicated in Product Data.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, Record Drawings**,** and Record Specifications, where applicable.

E. Miscellaneous Record Submittals: Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

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1.7 OPERATION AND MAINTENANCE MANUALS

A. Assemble two complete sets of operation and maintenance data indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include operation and maintenance data required in individual Specification Sections and as follows:

1. Maintenance Data:

a. Manufacturer's information, including list of spare parts.
b. Name, address, and telephone number of Installer or supplier.
c. Maintenance procedures.
d. Maintenance and service schedules for preventive and routine maintenance.
e. Maintenance record forms.
f. Sources of spare parts and maintenance materials.
g. Copies of maintenance service agreements.
h. Copies of warranties and bonds.

B. Organize operation and maintenance manuals into suitable sets of manageable size. Bind and index data in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, with pocket inside the covers to receive folded oversized sheets. Identify each binder on front and spine with the printed title "OPERATION AND MAINTENANCE MANUAL," Project name, and subject matter of contents.

1.8 WARRANTIES

A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

C. Provide additional copies of each warranty to include in each operation and maintenance manual.

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PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances. Provide a magnetic sweep of all areas around the building to retrieve stray nails, screws and other fasteners or metal shards.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
g. Sweep concrete floors broom clean in unoccupied spaces.
h. Clean transparent materials, including glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
i. Remove labels that are not permanent.
j. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.

1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.

k. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.

C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 01 77 00

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SECTION 01 78 23 – OPERATIONS AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for preparing maintenance manuals, including the following:

1. Maintenance documentation directory.
2. Maintenance manuals for the care and maintenance of products, and materials.

B. Related Sections include but are not limited to the following:

1. Division 1 Section "Submittal Procedures" for submitting copies of submittals for maintenance manuals.
2. Division 1 Section "Closeout Procedures" for submitting maintenance manuals.
3. Division 1 Section "Project Record Documents" for preparing Record Drawings for maintenance manuals.
4. Divisions 02 through 33 Sections for specific maintenance manual requirements for the Work in those Sections.

1.3 SUBMITTALS

A. Final Submittal: Submit 1 copy of each manual in final form at least 15 days before final inspection. Architect will return copy with comments within 15 days after final inspection.

1. Correct or modify each manual to comply with Architect's/Engineer's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Architect's/Engineer's comments.

1.4 COORDINATION

A. Where maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

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PART 2 - PRODUCTS

2.1 MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: Include a section in the directory for each of the following:

1. List of documents.
2. Table of contents.

B. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

2.2 MANUALS, GENERAL

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name, address, and telephone number of Contractor.
6. Name and address of Architect/Engineer.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

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a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
b. Identify each binder on front and spine, with printed title "MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch, 20 lb/sq. ft. white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

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2.3 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.

5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

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PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to operation and maintenance manuals.

B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

C. Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.

1. Do not use original Project Record Documents as part of maintenance manuals.
2. Comply with requirements of newly prepared Record Drawings in Division 1 Section "Project Record Documents."

F. Comply with Division 1 Section "Closeout Procedures" for the schedule for submitting maintenance documentation.

END OF SECTION 01 78 23

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.

B. Related Sections include but are not limited to the following:

1. Division 1 Section "Closeout Procedures" for general closeout procedures and maintenance manual requirements.
2. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Divisions 02 through 33 Sections for specific requirements for project record documents of the Work in those Sections.

1.3 SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit copies of Record Drawings as follows:

a. Final Submittal: Submit three sets of marked-up Record Prints and one set of record transparencies. Print each Drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit three copies of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit three copies of each Product Data submittal.

1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in the manual instead of submittal as Record Product Data.

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PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.

1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an understandable drawing technique.
c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Depths of foundations below first floor.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.
j. Changes made by Change Order or Construction Change Directive.
k. Changes made following Architect's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

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B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Record Transparencies: Organize into unbound sets matching Record Prints. Place transparencies in durable tube-type drawing containers with end caps. Mark end cap of each container with identification. If container does not include a complete set, identify Drawings included.
3. Record CAD Drawings: Organize CAD information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each CAD file.
4. Identification: As follows:

    a. Project name.
    b. Date.
    c. Designation "PROJECT RECORD DRAWINGS."
    d. Name of Architect/Engineer.
    e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of the manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
5. Note related Change Orders, Record Drawings, and Product Data where applicable.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, Record Drawings, and Product Data where applicable.

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2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's/Engineer's reference during normal working hours.

END OF SECTION 01 78 39

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SECTION 01 79 00 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training videotapes.

B. See Divisions 2 through 33 Sections for specific requirements for demonstration and training for products in those Sections.

1.2 SUBMITTALS

A. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

B. Demonstration and Training CDs/Flash Drives: Submit two copies within seven days of end of each training module.

1.3 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 1 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

C. Pre-instruction Conference: Conduct conference at Project site. Review methods and procedures related to demonstration and training.

D. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

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PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:

1. Basis of System Design, Operational Requirements, and Criteria: Include system and equipment descriptions, operating standards, regulatory requirements, equipment function, operating characteristics, limiting conditions, and performance curves.
2. Documentation: Review emergency, operations, and maintenance manuals; Project Record Documents; identification systems; warranties and bonds; and maintenance service agreements.
3. Emergencies: Include instructions on stopping; shutdown instructions; operating instructions for conditions outside normal operating limits; instructions on meaning of warnings, trouble indications, and error messages; and required sequences for electric or electronic systems.
4. Operations: Include startup, break-in, control, and safety procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; operating procedures for emergencies and equipment failure; and required sequences for electric or electronic systems.
5. Adjustments: Include alignments and checking, noise, vibration, economy, and efficiency adjustments.
6. Troubleshooting: Include diagnostic instructions and test and inspection procedures.
7. Maintenance: Include inspection procedures, types of cleaning agents, methods of cleaning, procedures for preventive and routine maintenance, and instruction on use of special tools.
8. Repair: Include diagnosis, repair, and disassembly instructions; instructions for identifying parts; and review of spare parts needed for operation and maintenance.

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PART 3 - EXECUTION

3.1 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Owner will describe Owner's operational philosophy.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner, through Architect, with at least seven days' advance notice.

D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

3.2 DEMONSTRATION AND TRAINING RECORD

A. General: Engage a qualified commercial photographer to record demonstration and training sessions. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video Format: Provide high-quality color video saved on CD’s or flash drives. Save in a format acceptable to the Owner.

C. Narration: Describe scenes on video by dubbing audio narration off-site after session is recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.

END OF SECTION 01 79 00

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SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Commissioning is intended to achieve the following specific objectives; this section specifies the Contractor's responsibilities for commissioning:

1. Verify that the work is installed in accordance with Contract Documents and the manufacturer’s recommendations and instructions, and that it receives adequate operational checkout prior to startup: Startup reports and Prefunctional Checklists executed by Contractor are utilized to achieve this.

2. Verify and document that functional performance is in accordance with Contract Documents: Functional Tests executed by Contractor and witnessed by the Commissioning Authority are utilized to achieve this.

3. Verify that operation and maintenance manuals submitted to Engineer are complete: Detailed operation and maintenance (O&M) data submittals by Contractor are utilized to achieve this.

4. Verify that the Engineer's operating personnel are adequately trained: Formal training conducted by Contractor is utilized to achieve this.

B. The Commissioning Authority directs and coordinates all commissioning activities; this section describes some but not all of the Commissioning Authority's responsibilities.

C. The Commissioning Authority is employed by the Contractor on behalf of the Engineer.

1.2 SCOPE OF COMMISSIONING

A. The following are to be commissioned:

B. Plumbing Systems:

1. Water heaters.

2. Booster pumps.

3. Well pumps.

C. HVAC System, including:

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1. Major and minor equipment items.
2. Piping systems and equipment.
3. Ductwork and accessories.
4. Terminal units.
5. Control system.
6. Sound control devices.
7. Vibration control devices.
8. Variable frequency drives.

D. Electrical Systems:

1. Power quality.
2. Uninterruptible power systems.
3. Lighting controls other than manual switches.

E. Aquatic Systems:

1. Major and minor equipment items.
2. Piping systems and equipment
3. Play features.

1.3 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures; except:

1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority, unless they require review by Engineer; in that case, submit to Engineer first.
2. Submit one copy to the Commissioning Authority, not to be returned.
3. Make commissioning submittals on time schedule specified by Commissioning Authority.

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4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of Prefunctional Checklists or Functional Test requirements; submit in editable electronic format, Microsoft Word 2010 preferred.

5. As soon as possible after submittals made to Engineer are approved, submit copy of approved submittal to the Commissioning Authority.

B. Product Data: If submittals to Engineer do not include the following, submit copies as soon as possible:

1. Manufacturer's product data, cut sheets, and shop drawings.

2. Manufacturer's installation instructions.

3. Startup, operating, and troubleshooting procedures.

4. Fan and pump curves.

5. Factory test reports.

6. Warranty information, including details of Engineer's responsibilities in regard to keeping warranties in force.

C. Manufacturers' Instructions: Submit copies of all manufacturer-provided instructions that are shipped with the equipment as soon as the equipment is delivered.

D. Startup Plans and Reports.

E. Completed Prefunctional Checklists.

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PART 2 PRODUCTS

2.1 TEST EQUIPMENT

A. Provide all standard testing equipment required to perform startup and initial checkout and required Functional Testing; unless otherwise noted such testing equipment will NOT become the property of Engineer.

B. Calibration Tolerances: Provide testing equipment of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified. If not otherwise noted, the following minimum requirements apply:

1. Temperature Sensors and Digital Thermometers: Certified calibration within past year to accuracy of 0.5 degree F and resolution of plus/minus 0.1 degree F.

2. Pressure Sensors: Accuracy of plus/minus 2.0 percent of the value range being measured (not full range of meter), calibrated within the last year.

3. Calibration: According to the manufacturer's recommended intervals and when dropped or damaged; affix calibration tags or keep certificates readily available for inspection.

C. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Engineer; such equipment, tools, and instruments are to become the property of Engineer.

D. Dataloggers: Independent equipment and software for monitoring flows, currents, status, pressures, etc. of equipment.

1. Dataloggers required to for Functional Tests will be provided by the Commissioning Authority and will not become the property of Engineer.

PART 3 EXECUTION

3.1 COMMISSIONING PLAN

A. Commissioning Authority has prepared the Commissioning Plan.

1. Attend meetings called by the Commissioning Authority for purposes of completing the commissioning plan.

2. Require attendance and participation of relevant subcontractors, installers, suppliers, and manufacturer representatives.

B. Contractor is responsible for compliance with the Commissioning Plan.

C. Commissioning Plan: The commissioning schedule, procedures, and coordination requirements for all parties in the commissioning process.

D. Commissioning Schedule:

1. Submit anticipated dates of startup of each item of equipment and system to Commissioning Authority within 60 days after award of Contract.

2. Re-submit anticipated startup dates monthly, but not less than 4 weeks prior to startup.

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3. Prefunctional Checklists and Functional Tests are to be performed in sequence from components, to subsystems, to systems.

4. Provide sufficient notice to Commissioning Authority for delivery of relevant Checklists and Functional Test procedures, to avoid delay.

3.2 STARTUP PLANS AND REPORTS

A. Startup Plans: For each item of equipment and system for which the manufacturer provides a startup plan, submit the plan not less than 8 weeks prior to startup.

B. Startup Reports: For each item of equipment and system for which the manufacturer provides a startup checklist (or startup plan or field checkout sheet), document compliance by submitting the completed startup checklist prior to startup, signed and dated by responsible entity.

C. Submit directly to the Commissioning Authority.

3.3 PREFUNCTIONAL CHECKLISTS

A. A Prefunctional Checklist is required to be filled out for each item of equipment or other assembly specified to be commissioned.

1. No sampling of identical or near-identical items is allowed.

2. These checklists do not replace manufacturers' recommended startup checklists, regardless of apparent redundancy.

3. Prefunctional Checklist forms will not be complete until after award of the contract; the following types of information will be gathered via the completed Checklist forms:

a. Certification by installing contractor that the unit is properly installed, started up, and operating and ready for Functional Testing.

b. Confirmation of receipt of each shop drawing and commissioning submittal specified, itemized by unit.

c. Manufacturer, model number, and relevant capacity information; list information "as specified," "as submitted," and "as installed."

d. Serial number of installed unit.

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e. List of inspections to be conducted to document proper installation prior to startup and Functional Testing; these will be primarily static inspections and procedures; for equipment and systems may include normal manufacturer's start-up checklist items and minor testing.

f. Sensor and actuator calibration information.

B. Contractor is responsible for filling out Prefunctional Checklists, after completion of installation and before startup; witnessing by the Commissioning Authority is not required unless otherwise specified.

1. Each line item without deficiency is to be witnessed, initialed, and dated by the actual witness; checklists are not complete until all line items are initialed and dated complete without deficiencies.

2. Checklists with incomplete items may be submitted for approval provided the Contractor attests that incomplete items do not preclude the performance of safe and reliable Functional Testing; re-submission of the Checklist is required upon completion of remaining items.

3. Individual Checklists may contain line items that are the responsibility of more than one installer; Contractor shall assign responsibility to appropriate installers or subcontractors, with identification recorded on the form.

4. If any Checklist line item is not relevant, record reasons on the form.

5. Contractor may independently perform startup inspections and/or tests, at Contractor's option.

6. Regardless of these reporting requirements, Contractor is responsible for correct startup and operation.

7. Submit completed Checklists to Commissioning Authority within two days of completion.

C. Commissioning Authority is responsible for furnishing the Prefunctional Checklists to Contractor.

1. Initial Drafts: Contractor is responsible for initial draft of Prefunctional Checklist where so indicated in Contract Documents.

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2. Provide all additional information requested by Commissioning Authority to aid in preparation of checklists, such as shop drawing submittals, manufacturers' startup checklists, and O&M data.

3. Commissioning Authority may add any relevant items deemed necessary regardless of whether they are explicitly mentioned in Contract Documents or not.

4. When asked to review the proposed Checklists, do so in a timely manner.

D. Commissioning Authority Witnessing: Required for:

1. Each piece of primary equipment, unless sampling of multiple similar units is allowed by the commissioning plan.

2. A sampling of non-primary equipment, as allowed by the commissioning plan.

E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Engineer.

1. If difficulty in correction would delay progress, report deficiency to the Commissioning Authority immediately.

3.4 FUNCTIONAL TESTS

A. A Functional Test is required for each item of equipment, system, or other assembly specified to be commissioned, unless sampling of multiple identical or near-identical units is allowed by the final test procedures.

B. Contractor is responsible for execution of required Functional Tests, after completion of Prefunctional Checklist and before closeout.

C. Commissioning Authority is responsible for witnessing and reporting results of Functional Tests, including preparation and completion of forms for that purpose.

D. Contractor is responsible for correction of deficiencies and re-testing at no extra cost to Engineer; if a deficiency is not corrected and re-tested immediately, the Commissioning Authority will document the deficiency and the Contractor's stated intentions regarding correction.

1. Deficiencies are any condition in the installation or function of a component, piece of equipment or system that is not in compliance with Contract Documents or does not perform properly.

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2. When the deficiency has been corrected, the Contractor completes the form certifying that the item is ready to be re-tested and returns the form to the Commissioning Authority; the Commissioning Authority will reschedule the test and the Contractor shall re-test.

3. Identical or Near-Identical Items: If 10 percent, or three, whichever is greater, of identical or near-identical items fail to perform due to material or manufacturing defect, all items will be considered defective; provide a proposal for correction within 2 weeks after notification of defect, including provision for testing sample installations prior to replacement of all items.

4. Contractor shall bear the cost of Engineer and Commissioning Authority personnel time witnessing re-testing.

5. Contractor shall bear the cost of Engineer and Commissioning Authority personnel time witnessing re-testing if the test failed due to failure to execute the relevant Prefunctional Checklist correctly; if the test failed for reasons that would not have been identified in the Prefunctional Checklist process, Contractor shall bear the cost of the second and subsequent re-tests.

E. Functional Test Procedures:

1. Some test procedures are included in Contract Documents; where Functional Test procedures are not included in Contract Documents, test procedures will be determined by the Commissioning Authority with input by and coordination with Contractor.

2. Examples of Functional Testing:

a. Test the dynamic function and operation of equipment and systems (rather than just components) using manual (direct observation) or monitoring methods under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint).

b. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc.

c. Systems are run through all the HVAC control system's sequences of operation and components are verified to be responding as the sequence's state.

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d. Traditional air or water test and balancing (TAB) is not Functional Testing; spot checking of TAB by demonstration to the Commissioning Authority is Functional Testing.

F. Deferred Functional Tests: Some tests may need to be performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions; performance of these tests remains the Contractor's responsibility regardless of timing.

3.5 SENSOR AND ACTUATOR CALIBRATION

A. Calibrate all field-installed temperature, relative humidity, carbon monoxide, carbon dioxide, and pressure sensors and gauges, and all actuators (dampers and valves) on this piece of equipment shall be calibrated. Sensors installed in the unit at the factory with calibration certification provided need not be field calibrated.

B. Calibrate using the methods described below, alternate methods may be used, if approved by Commissioning Authority and Owner beforehand. See PART 2 for test instrument requirements. Record methods used on the relevant Prefunctional Checklist or other suitable forms, documenting initial, intermediate and final results.

C. All Sensors:

1. Verify that sensor location is appropriate and away from potential causes of erratic operation.

2. Verify that sensors with shielded cable are grounded only at one end.

3. For sensor pairs that are used to determine a temperature or pressure difference, for temperature make sure they are reading within 0.2 degree F of each other, and for pressure, within tolerance equal to 2 percent of the reading, of each other.

4. Tolerances for critical applications may be tighter.

D. Sensors Without Transmitters - Standard Application:

1. Make a reading with a calibrated test instrument within 6 inches of the site sensor.

2. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.

3. If not, install offset, calibrate or replace sensor.

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E. Sensors With Transmitters - Standard Application.

1. Disconnect sensor.
2. Connect a signal generator in place of sensor.
3. Connect ammeter in series between transmitter and building automation system control panel.
4. Using manufacturer's resistance-temperature data, simulate minimum desired temperature.
5. Adjust transmitter potentiometer zero until 4 mA is read by the ammeter.
6. Repeat for the maximum temperature matching 20 mA to the potentiometer span or maximum and verify at the building automation system.
7. Record all values and recalibrate controller as necessary to comply with specified control ramps, reset schedules, proportional relationship, reset relationship and P/I reaction.
8. Reconnect sensor.
9. Make a reading with a calibrated test instrument within 6 inches of the site sensor.
10. Verify that the sensor reading, via the permanent thermostat, gauge or building automation system, is within the tolerances in the table below of the instrument-measured value.
11. If not, replace sensor and repeat.
12. For pressure sensors, perform a similar process with a suitable signal generator.

F. Sensor Tolerances for Standard Applications: Plus/minus the following maximums:

1. Watthour, Voltage, Amperage: 1 percent of design.
2. Pressure, Air, Water, Gas: 3 percent of design.
3. Air Temperatures (Outside Air, Space Air, Duct Air): 0.4 degrees F.
4. Relative Humidity: 4 percent of design.
5. Barometric Pressure: 0.1 inch of Hg.
6. Flow Rate, Air: 10 percent of design.

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7. Flow Rate, Water: 4 percent of design.

8. AHU Wet Bulb and Dew Point: 2.0 degrees F.

G. Critical Applications: For some applications more rigorous calibration techniques may be required for selected sensors. Describe any such methods used on an attached sheet.

H. Valve/Damper Stroke Setup and Check:

1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.

2. Set pump/fan to normal operating mode.

3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.

4. Command valve/damper to open; verify position is full open and adjust output signal as required.

5. Command valve/damper to a few intermediate positions.

6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).

I. Isolation Valve or System Valve Leak Check: For valves not associated with coils.

1. With full pressure in the system, command valve closed.

2. Use an ultrasonic flow meter to detect flow or leakage.

3.6 TEST PROCEDURES - GENERAL

A. Provide skilled technicians to execute starting of equipment and to execute the Functional Tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem-solving.

B. Provide all necessary materials and system modifications required to produce the flows, pressures, temperatures, and conditions necessary to execute the test according to the specified conditions. At completion of the test, return all affected equipment and systems to their pre-test condition.

C. Sampling: Where Functional Testing of fewer than the total number of multiple identical or near-identical items is explicitly permitted, perform sampling as follows:

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1. Identical Units: Defined as units with same application and sequence of operation; only minor size or capacity difference.

2. Sampling is not allowed for:

   a. Major equipment.

   b. Life-safety-critical equipment.

   c. Prefunctional Checklist execution.

3. XX = the percent of the group of identical equipment to be included in each sample; defined for specific type of equipment.

4. YY = the percent of the sample that if failed will require another sample to be tested; defined for specific type of equipment.

5. Randomly test at least XX percent of each group of identical equipment, but not less than three units. This constitutes the "first sample."

6. If YY percent of the units in the first sample fail, test another XX percent of the remaining identical units.

7. If YY percent of the units in the second sample fail, test all remaining identical units.

8. If frequent failures occur, resulting in more troubleshooting than testing, the Commissioning Authority may stop the testing and require Contractor to perform and document a checkout of the remaining units prior to continuing testing.

D. Manual Testing: Use hand-held instruments, immediate control system readouts, or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the “observation”).

E. Simulating Conditions: Artificially create the necessary condition for the purpose of testing the response of a system; for example apply hot air to a space sensor using a hair dryer to see the response in a VAV box.

F. Simulating Signals: Disconnect the sensor and use a signal generator to send an amperage, resistance or pressure to the transducer and control system to simulate the sensor value.

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G. Over-Writing Values: Change the sensor value known to the control system in the control system to see the response of the system; for example, change the outside air temperature value from 50 degrees F to 75 degrees F to verify economizer operation.

H. Indirect Indicators: Remote indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100 percent closed, are considered indirect indicators.

I. Monitoring: Record parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of the relevant control systems; where monitoring of specific points is called for in Functional Test Procedures:

1. All points that are monitored by the relevant control system shall be trended by Contractor; at the Commissioning Authority's request, Contractor shall trend up to 20 percent more points than specified at no extra charge.

2. Other points will be monitored by the Commissioning Authority using dataloggers.

3. At the option of the Commissioning Authority, some control system monitoring may be replaced with datalogger monitoring.

4. Provide hard copies of monitored data in columnar format with time down left column and at least 5 columns of point values on same page.

5. Graphical output is desirable and is required for all output if the system can produce it.

6. Monitoring may be used to augment manual testing.

3.7 OPERATION AND MAINTENANCE MANUALS

A. See Section 01 78 00 - Closeout Submittals for additional requirements.

B. Add design intent documentation furnished by Engineer to manuals prior to submission to Engineer.

C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.

D. Commissioning Authority will add commissioning records to manuals after submission to Engineer.

END OF SECTION 01 91 13

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SECTION 023200 – GEOTECHNICAL INVESTIGATION

PART 1 GENERAL

1.1 SUMMARY

A. A Soils Report dated August 29, 2024, prepared by John D. Hynes & Associates, Inc., is included in the project manual.

B. The Soils Report and additional test information is not part of this Contract but was used during the design phases.

1.2 SITE CONDITIONS

A. Site Information
1. Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings.
2. It is to be expressly understood that the Engineer or Design Engineer will not be responsible for interpretations or conclusions drawing there from by Contractor. Data is made available for convenience of Contractor.
3. The locations of test borings at various points are shown in the report. While it is believed the results of the test boring accurately indicate the existing soil conditions below the surface at points and planes indicated, the Engineer and Design Engineer assume no responsibility for the actual conditions which may be encountered in the execution of the contract.
4. Additional test borings and other exploratory operations may be made by Bidder or Contractor at no cost to Owner or Engineer.

1.3 WARRANTY

A. Neither the Engineer or Design Engineer, represent, warrant or guarantee that the materials actually encountered in the prosecution of the work, or any part thereof, will be of the same character as those indicated as those indicated by the sample or logs of the test borings, and if the Contractor relies, for any purpose, upon the accuracy or completeness of said borings or log information, he does so at his own risk.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

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JOHN D. HYNES & ASSOCIATES, INC.

Geotechnical and Environmental Consultants
Monitoring Well Installation
Construction Inspection and Materials Testing

August 29, 2024

Anthony McAllister
GWWO Architects
1215 E. Fort Avenue Suite 24
Baltimore, Maryland 21230

Re: Report of Subsurface Exploration and Geotechnical Consulting Services
Trap Pond Splash Park
Laurel, Delaware
Project No.: JDH-10/23/338

Dear Mr. McAllister:

John D. Hynes & Associates, Inc. has completed the authorized subsurface exploration and geotechnical consulting services for the proposed Trap Pond Splash Park located at 33587 Bald Cypress Lane in Laurel, Delaware. Our services were performed, generally, in accordance with our proposal dated May 4, 2024.

This report describes the exploration methods employed, exhibits the data obtained and presents our evaluations and recommendations. In summary, we recommend that the precast buildings' mat foundations bear on a bed of crusher run stone. The report includes recommendations regarding subgrade preparation and fill construction at the structure locations. Refer to the corresponding foundation section of this report for specific foundation recommendations.

We appreciate the opportunity to be of service to you. If you have any questions regarding the contents of this report or if we may be of further assistance, please contact our office.

Respectfully,
JOHN D. HYNES & ASSOCIATES, INC.

Kelly Cheeks
for: Evan H. Cross
Staff Geologist

Richard D. Rhoads
Project Geologist

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Professional Certification. I hereby certify that these documents were prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the State of Delaware.

JOHN D. HYNES
REGISTERED
No. 7591
STATE OF DELAWARE
PROFESSIONAL ENGINEER

John D. Hynes, P.E.
License No. 7591

Expiration Date: 06/30/2026

EHC: RDR: JDH/kc

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HYNES

REPORT OF
SUBSURFACE EXPLORATION
AND
GEOTECHNICAL CONSULTING SERVICES

NOT FOR BIDDING PURPOSES

TRAP POND SPLASH PARK
LAUREL, DELAWARE

PREPARED FOR
GWWO ARCHITECTS

AUGUST 29, 2024
PROJECT NO.: JDH-10/23/338

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HYNES

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PURPOSE AND SCOPE

The subsurface exploration study was performed to evaluate the subsurface conditions with respect to the following:

1. General site and subgrade preparation;
2. Fill and backfill construction;
3. Foundation recommendations, including allowable bearing capacity, anticipated settlement, and recommendations for foundation support;
4. Floor slab support;
5. Foundation construction and inspection procedures;
6. Seismic site classification;
7. Pavement subgrade preparation and cross-section design;
8. Infiltration testing;
9. Stormwater management structures;
10. Location of groundwater and applicable construction dewatering control procedures; and
11. Other aspects of the design and construction for the proposed structures indicated by the exploration.

An evaluation of the site, with respect to potential construction problems and recommendations dealing with earthwork and inspection during construction, is included. The inspection is considered necessary both to confirm the subsurface conditions and to verify that the soils related construction phases are performed properly.

Hynes & Associates subcontracted the services of a Delaware Licensed Soil Scientist to perform a Site Evaluation Report for an area of the site designated for an on site wastewater treatment and disposal system. The Report completed by Delmarva Environmental, Inc. is included in the Appendix.

EXISTING SITE CONDITIONS

As shown on the Project Location Map (Drawing JDH-10/23/338-A) in the Appendix, the project site is located in Trap Pond State Park located at 33587 Bald Cypress Lane in Laurel, Delaware. At the time of our exploration, the site was in a wooded area. Limited clearing was completed to facilitate access to the boring locations. Topographically, the site is relatively flat.

PROJECT CHARACTERISTICS

The project includes the construction of a new multi-purpose building, a ticketing kiosk, a splash lagoon, and a new maintenance building. The ticketing kiosk canopy was eliminated from the scope of work. Based on the drawing set that you provided, we understand that the maintenance building structure will measure 26 feet by 40 feet in plan dimensions, the multi-use building will measure 26 feet by 30 feet, and the kiosk building will measure 26 feet by 10 feet. The buildings are all approximately 12 feet tall. Each building consists of precast concrete construction and includes a precast concrete floor slab approximately 5 inches in thickness. The kiosk building will be delivered in one section. The multi-use building will be delivered in 3 sections. The maintenance building will be delivered in 4 sections. When installed, post tension cables will be used to tie together each building section. According to CXT, each section weighs approximately 90,000 lbs. Once assembled, the maintenance, multiuse, and kiosk building structures will have dead weights of approximately 360, 270, and 90 kips, respectively. Using these structure weights and dimensions, we estimate a contact pressure for each building of approximately 350 psf. We understand that the building is proposed to rest on bed of crushed stone no less than 6 inches in thickness. No footings or turn-down slabs are proposed at this time.

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The splash park includes an approximately circular splash lagoon that will measure approximately 170 feet in diameter and will be constructed using reinforced concrete. According to GWWO, the concrete will be similar in composition to the reinforced concrete used in driveway and sidewalk construction, and will be installed over a layer of crushed stone.

The project, also, includes the construction of pavements, a pedestrian path, stormwater management areas, and a sewage disposal area. The balance of the site will be landscaped. We have assumed that the primary traffic loading at the site will consist of cars, light trucks, and occasional heavy trucks such as trash trucks and delivery vehicles. Stormwater management facilities are proposed for construction at the project site. A stormwater management infiltration trench is proposed to surround the majority of the splash pond and an infiltration pond is proposed for construction between the maintenance building and multi-use building on the east side of the project site. We performed infiltration testing at the proposed stormwater management locations.

FIELD EXPLORATION AND STUDY

In order to determine the nature of the subsurface conditions at the site, 11 test borings were drilled at the approximate locations shown on the Boring Location Plan (Drawing No. JDH-10/23/338-B) in the Appendix. We note that the scope of work was changed from the original plans. The pre-cast structures now proposed for construction require less subsurface evaluation than the original traditional timber framed structures proposed for construction. As a result, the number of borings was reduced but the boring numbering system remained the same. Structural borings SB-1, SB-2, SB-5, SB-6, SB-10, and SB-12 were omitted from this study. The updated boring locations were selected by GWWO. The test borings were drilled at the following project elements to the noted depths:

Project Structure	Boring No.	Boring Depth (ft.)
Ticketing Kiosk	SB-3	20
Multi-Use Building	SB-4	20
Splash Lagoon	SB-7, SB-8, SB-9	15
Maintenance Building	SB-11, SB-13	20
Pavements	SB-14	5
Stormwater Management Structures	SWM-1 to SWM-7	8 to 10

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All but 1 of the "SB" test borings were drilled with a track mounted Geoprobe 7822 DT drill rig. Soil sampling and testing were carried out in accordance with ASTM Specification D-1586. The "SWM" stormwater borings and the pavement boring SB-14 were drilled using a hand auger. A brief description of our field procedures is included in the Appendix. The results of all boring and sampling operations are shown on the boring logs.

Samples of the subsurface soils were examined by our engineering staff and were visually classified in accordance with the Unified Soil Classification System (USCS) and ASTM Specification D-2488. The test borings drilled in the stormwater management areas were, also, classified in accordance with the United States Department of Agriculture (USDA) classification system. The estimated USCS symbols and USDA descriptions appear on the boring logs (where applicable) and keys to the systems' nomenclature are provided in the Appendix of this report. Also included are reference sheets which define the terms and symbols used on the boring logs and explain the Standard Penetration Test procedures. The Munsell soil color code description is, also, provided for each stratum for the stormwater borings.

We note that the test boring records represent our interpretation of the field data based on visual examination and selected soil classification tests. Indicated interfaces between materials may be gradual.

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The field exploration data was supplemented with laboratory testing data. The laboratory at John D. Hynes & Associates, Inc. performed 5 Sieve Analysis tests and 5 Natural Moisture Content tests. The test results are presented on the boring log sheets in the Appendix.

SUBSURFACE CONDITIONS

At the time of our field exploration, approximately 6 to 14 inches of organic bearing soil were encountered at the ground surface at the test boring locations. Varying thicknesses of organic bearing soils or other surficial materials and material thicknesses may be encountered at other locations on site.

The test borings were all classified in accordance with the USCS, and consisted of interbedded layers of SAND (SP, SP-SM), Silty SAND (SM), and Silty CLAY (CL) to the boring termination depths. The sands were characterized by Standard Penetration Test (SPT) values (N-values) of 4 to 22 blows per foot indicating in place relative densities of very loose to medium dense. A single cohesive soil layer was encountered at a depth of 12 to 17 feet below existing grade at soil test boring location SB-13. The N-value of this layer was 7, indicating an in place consistency of medium stiff.

Referring to stormwater borings SWM-1 through SWM-7, note that these borings were classified in accordance with the USCS and USDA soil classification systems. The soils were visually classified as SAND (SP, SP-SM), and Silty SAND (SM) layers in the test borings. USDA designations are Sand, Sandy loam, and Loamy sand. Refer to the test boring logs in the Appendix for the soil profiles at each boring location.

Based on information available on the NRCS Web Soil Survey website, the site is located in an area that is mapped with two soil types. The soils include the Runclint loamy sand, 0 to 2 percent slopes (RuA) and the Runclint loamy sand, 2 to 5 percent slopes (RuB). The typical profile for RuA and RuB soils are described as Loamy sand from 0 to 9 inches, Sand from 9 to 59 inches, and Loamy coarse sand from 59 to 80 inches. Groundwater is typically found at depths of 40 to 72 inches.

Groundwater was encountered during drilling operations at depths ranging from 7 to 11 feet below existing grade at all of the boring locations except SB-14. Groundwater was not encountered in soil test boring SB-14 to the boring termination depth of 5 feet below existing grade. Groundwater elevations may vary at other times during the year depending upon the amount of local precipitation, and the extent of local surface development.

Water level data from nearby DGS Well Oh51-09 is included in the Appendix for reference. The DGS well is screened from 8 feet to 13 feet below grade and penetrates the Columbia Aquifer. Water levels at the DGS well fluctuate approximately 6 feet during the year. In consideration of this information, and based on subsurface conditions, the seasonal high water table (SHWT) at the project site is estimated to be 2 feet higher than conditions at the time the soil borings were drilled. We note that subsurface conditions at the DGS well site may vary from conditions at the project location.

LOCAL GEOLOGY

The site is located in the Atlantic Coastal Plain Physiographic Region. The Atlantic Coastal Plain is characterized by interbedded layers of unconsolidated sands, silts, clays and gravels. Based on information provided on the Delaware Geological Survey Data Viewer, the site is mapped as the Turtle Branch Formation (Qtb). The Formation is described as a "Fining-upward sequence of a thin (less than 1 foot thick), gravelly sand, to an interlaminated, medium to coarse sand with heavy mineral laminae, to a well-sorted fine to medium, fluffy sand that makes up the bulk of the unit. Near the present stream valleys, 1 to 5 feet thick beds of light-grayish-brown to brown, organic-rich, clayey silt are common. Along the margins of the unit where it is adjacent to the Beaverdam Formation, the unit

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commonly consists of pale-yellow to yellowish-brown, fine to very fine silty sand. The unit is less than 5 feet thick over much of its mapped area but can range up to 20 feet thick near the present stream valleys. The well-sorted sands of the Turtle Branch Formation are differentiated from those of the dune deposits by their slightly coarser texture, better developed soil profile, and common presence of heavy mineral laminae. Interpreted to be a sand-dominated fluvial to tidal and shoreline deposit associated with a high stand of sea level during the middle Pleistocene."

INFILTRATION TESTING

Standard single ring falling head infiltration tests were performed on July 3, 2024 in companion borings adjacent to boring locations SWM-1 through SWM-5 in the areas of the proposed SWM facilities. In accordance with the project requirements, testing was not completed at locations SWM-6 and SWM-7. Testing was completed using the 4 inch diameter cased borehole method. Weather at the time of testing was sunny and the temperature was approximately 90° F. No significant rainfall occurred in the 48 hours prior to performing the infiltration testing. Testing was completed in general accordance with DNREC regulations in accordance with ASTM-D5126. The test locations, depth to groundwater, infiltration test depth, and steady state infiltration rates are summarized in the table below. Soil boring logs at the test locations are included in the Appendix.

Table 1: Summary of Infiltration Test Results

Test Location	Surface Elevation (ft.)	Depth to Groundwater (ft.)	Infiltration Test Depth (ft.)	Infiltration Test Elevation (ft.)	K_m (in./hr.) (Infiltration Rate)
SWM-1	38.0	7.0	3.0	35.0	8.0
SWM-2	39.0	7.0	4.5	34.5	10.6
SWM-3	38.0	7.0	3.0	35.0	3.1
SWM-4	38.0	7.0	5.0	33.0	7.6
SWM-5	38.0	8.0	4.0	34.0	7.2

Based on groundwater level data from DGS Well Oh51-09 and in consideration of subsurface soil and groundwater conditions, seasonal high groundwater levels are estimated to be approximately 2 feet higher than conditions at the time of drilling at the test locations (El. 32 to El. 34). We note that seasonal high groundwater may vary across the site.

We note that redoximorphic features can indicate seasonal high groundwater, "perched water", or a restrictive soil layer. Redoximorphic features were not observed above groundwater in the stormwater borings.

Refer to the "Infiltration Data Table" and "Single Ring Infiltration" test procedures in the Appendix for additional information regarding the infiltration tests. Elevations are based on data provided by Vandemark & Lynch, Inc.

RECOMMENDATIONS

The following recommendations and considerations are based on our understanding of the proposed construction, the data obtained from the exploration, and our previous experience with similar subsurface conditions and projects. If there are any significant changes to the project characteristics, such as revised structural loadings differing significantly from those noted above, structure geometry, structure location, elevations, etc., we request that this office be advised so the recommendations of this report can be re-evaluated.

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A. Site Preparation

Prior to the placement of crushed stone, or the placement of fill in any structural areas, all existing organic materials, frozen or wet soils, excessively soft or loose soils, root mats, tree stumps, miscellaneous debris, and other deleterious materials should be removed and wasted. The existing organic bearing soil should be stripped and can be stockpiled for reuse in landscape areas. If groundwater or perched surface water is encountered during any grading or excavation process, Hynes & Associates should be consulted for additional recommendations regarding the stabilization of the bases of the excavations and backfilling.

After the stripping operations have been completed, the exposed subgrade soils should be inspected. The inspector should verify that organic matter has been removed from structural subgrade areas. The inspector should require the exposed subgrade materials be proofrolled utilizing a heavily-loaded dump truck or other pneumatic tired vehicle of similar size and weight. The purpose of proofrolling would be to provide surficial densification and to locate any isolated areas of soft or loose soils requiring undercutting. Proofrolling is not advised in wet areas which may deteriorate under repeated vehicular loading. Wet areas should be drained and be allowed to dry prior to proofrolling. Precipitation may result in standing water (perched water) at low areas. If the water is allowed to pond, the natural soils may deteriorate and overexcavation or subgrade improvements may be necessary at those areas. The Geotechnical Engineer should be consulted to evaluate poor subgrade conditions during construction.

Care should be exercised during the grading operations at the site. Shallow SP, SP-SM, and SM materials were identified at the boring locations. These materials are slightly (SP, SP-SM) to moderately (SM) sensitive to changes in moisture conditions and should therefore be protected. If earthwork is performed in the presence of moisture, the traffic of heavy equipment, including heavy compaction equipment, may create pumping and a general deterioration of the subgrade soils. Construction traffic should be minimized at structural subgrade areas. The contractor should protect subgrades and fills during the earthwork operations. If subgrade problems arise, the Geotechnical Engineer should be consulted for an evaluation of the conditions. Overexcavated areas resulting from the removal of organic matter, old foundations, rubble, abandoned utilities, or otherwise unacceptable materials should be backfilled with properly compacted materials in accordance with the procedures discussed in the following section.

B. Fill Selection, Placement and Compaction

It is recommended that all materials to be used as structural fill be inspected, tested and approved by the Geotechnical Engineer prior to use. The existing shallow SP, SP-SM, and SM soils that do not contain organics may be re-used for structural fill. Acceptable borrow material should include GW, SM, SW and SP classified in accordance with the USCS. Furthermore, the material to be utilized as structural fill should have a Plasticity Index (PI) less than 20.

The importation of high quality, granular material should be allowed, and acceptable unit rates for importation and placement should be established. Sand, gravel or sand/gravel mixtures would be appropriate for wet weather placement. Otherwise, the materials noted above will be acceptable for use as structural fill. Native or imported SM soils will be sensitive to alteration in moisture content and will become unworkable during and following periods of precipitation. For this reason, if earthwork is attempted in late autumn, winter or early spring, the above mentioned high quality imported granular material should be limited to those soils better than SM. SM materials become unworkable at moisture contents greater than 3 percentage points above optimum. The contractor would have to dry these SM materials or set them aside for use in landscaping areas.

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Structural fill should be placed in lifts which are 8 inches or less in loose thickness and should be compacted to at least 95 percent of the Modified Proctor maximum dry density (ASTM D-1557). Adjustments to the natural moisture content of the soils may be required in order to obtain specified compaction levels. Should utility construction be performed after earthwork, the Contractor should be responsible for achieving 95 percent compaction in all trench backfill. These guidelines should be set for all structural fill at the site including, but not limited to building, ground slab and pavement fills. For the proofrolling and fill compaction operations, fill limits should be extended at least 5 feet beyond the structure exterior walls.

C. Structure Slab Area Preparation

Considering current and proposed grade levels, the in-situ soil conditions and the proposed structural loadings, we recommend that the precast buildings be placed on crushed stone (CR-1 stone or similar) compacted to 95 percent of the Modified Proctor maximum dry density. We recommend that the top of the buildings' slabs be slightly above grade. The precast structure should bear on a layer of well graded crushed stone. The CXT Precast Products drawings (DWG No. S-44). Note 4 indicates that the stone should extend to frost depth. Frost depth is 24 inches in Laurel, Delaware. Prior to the placement of stone base, the subgrade shall be prepped in accordance with Sections A and B above. As discussed above, we anticipate a dead load contact pressure of approximately 350 psf. The actual bearing pressure (dead load plus live loads) will be less than 500 psf. The building subgrade should be inspected for an allowable soil bearing of 1,500 psf. For these loads and bearing pressures, we expect building settlement of less than ½ inch.

All foundation excavations should be inspected by the Geotechnical Engineer or his approved representative prior to the placement of stone. The purpose of the inspection would be to verify that the exposed bearing materials are acceptable for the design soil bearing pressure and that loose, wet, frozen or compressible soils are not present.

Soils exposed at the bases of all satisfactory foundation excavations should be protected against any detrimental change in condition, such as disturbance from rain or frost. Surface runoff should be drained away from the excavations and not be allowed to pond.

For the proofrolling and fill compaction operations, fill limits should be extended at least 5 feet beyond the structure exterior walls, and exterior columns, ground slabs, and pavement boundaries. A sufficient number of in-place density tests should be performed by an engineering technician to verify that the proper degree of compaction is being obtained in all fill soils.

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D. Splash Lagoon Foundation

As indicated by GWWO, we understand that the concrete to be utilized for the splash lagoon will be similar to that of a concrete sidewalk or concrete driveway. The splash lagoon will be approximately circular and will measure approximately 170 feet in diameter. The splash lagoon slab subgrade shall be constructed and inspected as stipulated in Sections A and B. The subgrade for the slab will support nominal loads. Any structural elements within the splash lagoon should be supported on a reinforced structural slab. We recommend that the splash lagoon slab be supported by 4 inches of crusher run type stone (CR-1, CR-6, GAB, etc.) compacted to at least 95 percent of the Modified Proctor maximum dry density (ASTM D-1557).

E. Floor Slab Support

Ground supported slabs may be supported on firm, natural soils or on a layer of controlled, structural fill. The subgrade should be prepared in accordance with the procedures described in Sections A and B of this report. It

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is, also, recommended that a minimum sub-base stone layer be used beneath the floor slabs. As noted above, the CXT Precast products Dwg. No. S-44 calls for sub-base stone to frost depth. This sub-base stone material will require acquisition from off-site sources. Prior to placing the sub-base stone, the slab subgrade should be free of standing water or mud. An acceptable moisture barrier should, also, be provided for the building subgrades. These procedures will help to prevent capillary rise and damp floor slab conditions. For native soil or fill material placed and compacted according to the procedures outlined in this report, we recommend using a value of modulus of subgrade reaction of 200 pounds per cubic inch.

F. **Seismic Site Class**

The soils in the project area are part of the Atlantic Coastal Plains geologic formation. Soils have been deposited on the coastal plain by glaciers and alluvial deltas. Some of the windblown deposits have been reworked by alluvial action.

Hynes & Associates is providing below, the Seismic Site Class in accordance with the International Building Code (IBC) 2021 (DE Edition). The code stipulates that we evaluate the strength of soil to a depth of 100 feet below grade. We used the soil properties indicated in the structure borings, which were drilled to depths of 20.5 feet and our experience with deeper test borings that we have drilled locally. In consideration of the test boring data, it is our opinion that the average properties of the soils in the upper 100 feet of the local subsurface stratigraphy meet Site Class "D" criteria.

We recommend using the following spectral design coefficients for seismic design for the Trap Pond Splash Park project in Laurel, Delaware:

Seismic Design Coefficients for Laurel, Delaware	
F_a=	1.6
F_v=	2.4
S_S=	0.095
S_1=	0.045
S_{DS}=	0.102
S_{D1}=	0.072

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These values were obtained and calculated in accordance with the IBC 2021 and ASCE 7. These are site specific design values and are based on a Site Classification of D.

G. **Pavement Subgrade Preparation and Pavement Cross-Section Design**

One test boring, designated as SB-14, was drilled at the proposed pavement area. Below the surficial organic bearing soils, borings identified SAND (SP, SP-SM) in the upper 5 feet of the subgrade.

All pavement subgrade areas should be inspected and proofrolled in accordance with Section A and B of this report. The pavement subgrade soils will consist of materials having the classifications of SP-SM, SP, or SM in accordance with the USCS. The top 12 inches of the natural subgrades at pavement areas should be compacted to 95 percent of the Modified Proctor maximum dry density (ASTM D-1557) prior to fill or stone placement.

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Refer to sections A and B for recommendations for subgrade preparation and fill construction related to areas that have organics, rubble or demolition debris at the pavement subgrade.

The following recommendations are provided for on-site pavements assuming an improved subgrade (top 12 inches compacted to 95 percent of the Modified Proctor maximum dry density) and organic soils have been removed from pavement subgrade areas.

The following tables summarize the recommended pavement thickness section for the proposed driveway and parking areas:

ASPHALT PAVEMENTS

Asphalt Surface Course (Delaware Superpave, 9.5 mm)	1.5 inches
Asphalt Concrete Base Course (Delaware Superpave, 19 mm)	2.5 inches
Graded Aggregate Sub-base, (Delaware CR-1 or GAB Sub-base)	7 inches

The pavement materials and construction should be in accordance with the Delaware Department of Transportation, State Highway Administration, STANDARD SPECIFICATIONS FOR CONSTRUCTION AND MATERIALS latest edition, and this report. The aggregate sub-base should be compacted to a minimum 95 percent of the Modified Proctor (ASTM D-1557) maximum dry density. All pavement subgrade areas should be inspected, proofrolled and tested by the Geotechnical Engineer.

The pavement subgrade and pavement layers should be graded such that surface water is carried off of the pavement areas and away from building areas. The surface water should not be allowed to pond. Runoff onto adjacent properties should be controlled property.

Hynes & Associates recommends that rigid pavement be designed and installed for use at trash container storage and pick-up locations. These "dumpster pad" locations receive extreme wheel loads during emptying and placement. Also, hydraulic oils usually accumulate at these areas causing a breakdown in asphalt pavement mixtures.

H. Stormwater Management Facilities

Standard single ring falling head infiltration tests were performed on July 3, 2024 in companion borings adjacent to boring locations SWM-1 through SWM-5. The testing was completed in general accordance with DNREC guidelines. The testing was completed using 4 inch diameter cased boreholes. The test depths were coordinated with GWWO. In consideration of the measured infiltration rates, we recommend design infiltration rates as summarized in Table 2. The DNREC required Factor of Safety of 2.5 was applied to the measured infiltration rates for falling head tests completed in 4 inch diameter cased boreholes at locations SWM-1 through SWM-5.

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The test locations, depths, elevations, and recommended infiltration rates for each test are summarized in the table below:

Table 2: Summary of Infiltration Test Results

Test Boring Location	Surface Elevation (ft.)	Depth of Potentially Restrictive Soil Layers	Infiltration Test Depth (ft.)	Infiltration Test Elevation (ft.)	Recommended Design Infiltration Rate (in./hr.)	Approximate Elevation Range
SWM-1	38	NE	3.0	35.0	3.2	31 to 37
SWM-2	39	NE	4.5	34.5	4.2	32 to 37
SWM-3	38	NE	3.0	35.0	3.2	31 to 37
SWM-4	38	NE	5.0	33.0	3.0	31 to 34
SWM-5	38	NE	4.0	34.0	2.9	30 to 35

* Estimated range in which the design infiltration rate is applicable

Hynes & Associates has listed the recommended design infiltration rates in Table 2. It is our opinion that the design rates presented above be considered for the project. The test results are included in the Appendix in the data tables. A description of the test procedures is, also, included in the Appendix.

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I. Groundwater and Drainage

Groundwater was encountered during drilling operations at depths of 7 to 11 feet below the ground surface at all of the soil test borings except for SB-14. Groundwater was not encountered at soil test boring SB-14 to the boring termination depth of 5 feet below existing grade. The Contractor will not likely experience foundation construction problems relating to the groundwater. However, the Contractor may encounter groundwater in deep utility trenches. Therefore, the Contractor should be prepared to dewater the lowest excavations in the event of a rise in groundwater or the infiltration of precipitation. These methods may include sumping and pumping, well point systems, dewatering wells, etc. Efforts should be made to keep exposed subgrade areas dry during construction, primarily, because the soils will be susceptible to deterioration and loss of strength in the presence of moisture. Adequate drainage should be provided at the site to minimize any increase in moisture content of the foundation and pavement subgrade soils. All pavements and site grades should be sloped away from the structures to prevent ponding of water around them. The final site drainage should also be designed such that run-off onto adjacent properties is controlled properly.

ADDITIONAL SERVICES RECOMMENDED

Additional engineering, testing and consulting services recommended for this project are summarized below.

A. Site Preparation and Proofrolling Monitoring

The Geotechnical Engineer or experienced soils inspector should inspect the site after it has been stripped and excavated. The inspector should determine if any undercutting or in-place densification is necessary to prepare a subgrade for fill placement, or slab and pavement support. The inspector should verify that organic soils, organic matter, tree stumps, and demolition debris have been removed from all structural subgrade areas prior to filling operations.

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B. Fill Placement and Compaction Monitoring

The Geotechnical Engineer or experienced soils inspector should witness all fill operations and take sufficient in-place density tests to verify that the specified degree of fill compaction is achieved. The inspector should observe and approve borrow materials used and should determine if their existing moisture contents are acceptable.

C. Foundation Inspections

The Geotechnical Engineer should inspect all foundation excavations for the buildings and splash pond. He should verify that the design bearing pressures are available and that no loose or soft areas exist beneath the bearing surfaces of the foundation excavations.

D. Pavement System Inspection

Pavement subgrade soils should be inspected prior to the placement of pavement materials to verify that proper compaction has been achieved and that project specifications are being followed. A sufficient number of in place density tests should be performed to assure that the specified degree of compaction is achieved in the sub-base stone layer.

REMARKS

This report has been prepared solely and exclusively for GWWO Architects to provide guidance to design professionals in developing facilities plans for the proposed Trap Pond Splash Park project located in Laurel, Delaware. It has not been developed to meet the needs of others, and application of this report for other than its intended purpose could result in substantial difficulties. The Consulting Engineer cannot be held accountable for any problems which occur due to the application of this report to other than its intended purpose. This report in its entirety should be attached to the project specifications.

These analyses and recommendations are, of necessity, based on the concepts made available to us at the time of the writing of this report, and on-site conditions, surface and subsurface that existed at the time the exploratory borings were drilled. Further assumption has been made that the limited exploratory borings, in relation both to the areal extent of the site and to depth, are representative of conditions across the site. It is, also, recommended that we be given the opportunity to review all plans for the project in order to comment on the interaction of soil conditions as described herein and the design requirements.

Our professional services have been performed, our findings obtained and our recommendations prepared in accordance with generally accepted engineering principles and practices.

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APPENDIX

1. Investigative Procedures
2. Project Location Map
3. Boring Location Plan
4. Boring Logs
5. Infiltration Test Results
6. DGS Well Oh51-09 Graph and Data
7. Site Evaluation Report (Septic)
8. Unified Soil Classification Sheet
9. Field Classification Sheet
10. USDA Soil Classification Sheet
11. Important Information Sheet

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INVESTIGATIVE PROCEDURES

SOIL TEST BORINGS

Soil drilling and sampling operations were performed in accordance with ASTM Specification D-1586. The borings were advanced by mechanically turning continuous hollow stem auger flights into the ground. At regular intervals, samples were obtained with a standard 1.4 inch I.D., 2.0 inch O.D. splitspoon sampler. The sampler was first seated 6 inches to penetrate any loose cuttings and then driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot is the "Standard Penetration Resistance". The penetration resistance, when properly evaluated, is an index to the soil's strength, density and behavior under applied loads. The soil descriptions and penetration resistances for each boring are presented on the Test Boring Records in the Appendix.

HAND AUGER SOIL TEST BORINGS

Test borings were performed using a hand auger. The auger is manually advanced by rotating the shaft of the auger. The auger is withdrawn at short intervals for inspection of soils collected in the auger head. Soil samples are taken when soil conditions are noted to change. The soil descriptions for each boring are presented on the boring logs in the Appendix.

SOIL CLASSIFICATION

Soil classifications provide a general guide to the engineering properties of various soil types and enable the engineer to apply his past experience to current problems. In our investigation, jar samples obtained during drilling operations are examined in our laboratory and visually classified by the geotechnical engineer in accordance with ASTM Specification D-2488. The soils are classified according to the Unified Classification System (ASTM D-2487). Each of these classification systems and the in-place physical soil properties provides an index for estimating the soil's behavior.

NATURAL MOISTURE

Portions from representative soil samples obtained during drilling operations were selected for Natural Moisture Content tests. The Natural Moisture Content Test determines the water content of soils by drying into an oven with a standard drying temperature of 110 °C. The loss of mass drying the sample, determines the water content into the soil. The water content of the sample is calculated in percentage. The water content of soils (natural moisture) is determined in accordance with ASTM Specification D-2216.

SIEVE ANALYSIS TEST

Gradational analysis tests were performed to determine the particle size and distribution of the samples tested. The grain size distribution of soils coarser than a No. 200 sieve is determined by passing the sample through a standard set of nested sieves. The percentage of materials passing the No. 200 sieve is determined by washing the material over a No. 200 sieve. These tests are in accordance with ASTM D-421, D-422 and D-1140. The results are presented in the Appendix to our report.

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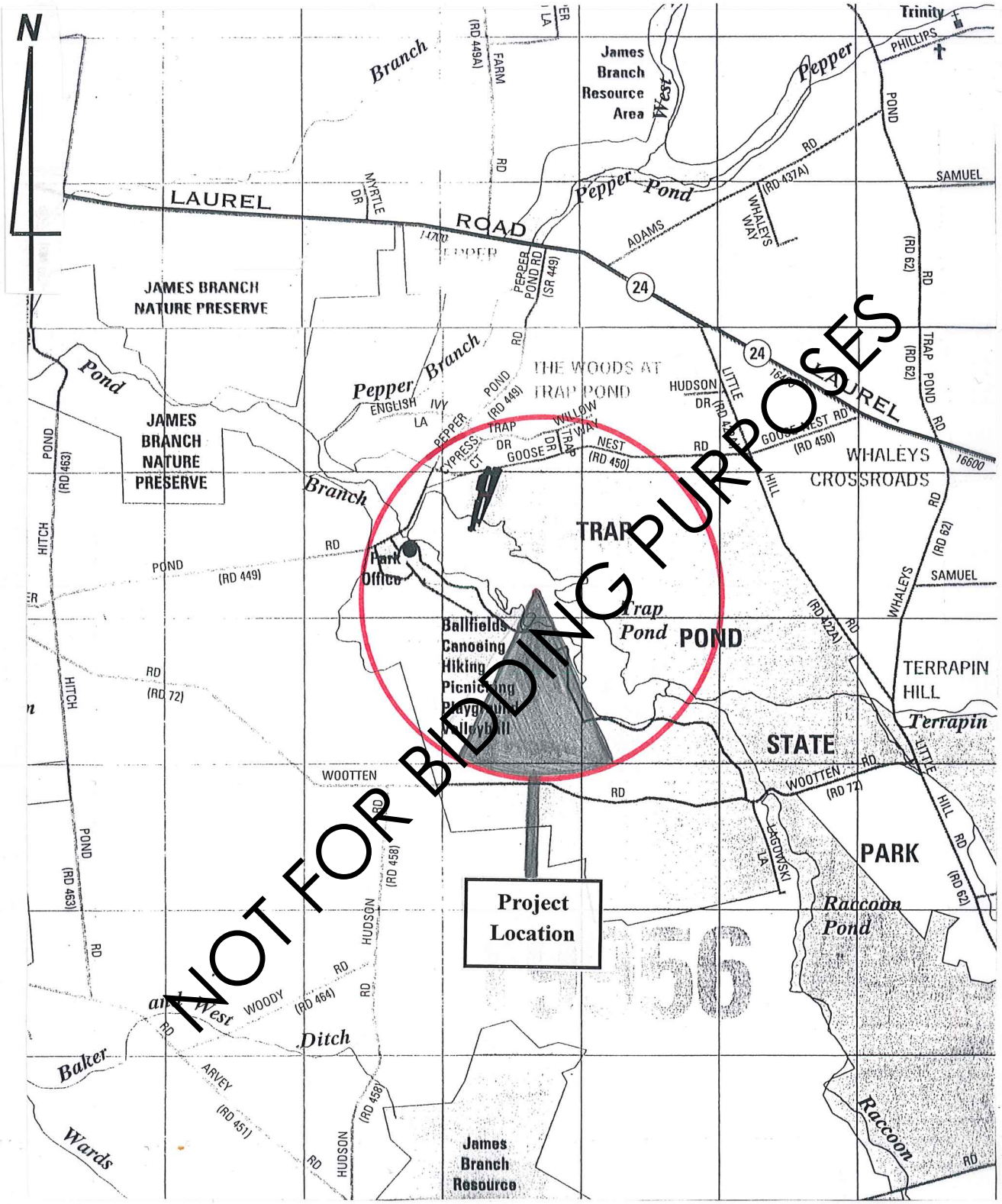
INVESTIGATIVE PROCEDURES
(CONTINUED)

ATTERBERG LIMITS TEST

Portions from representative soil samples obtained during drilling operations were selected for Atterberg Limits tests. The Atterberg Limits are indicative of the soil's plasticity characteristics. The liquid limit is the moisture content at which the soil will flow as a heavy viscous fluid and is determined in accordance with ASTM Specification D-4318. The plastic limit is the moisture content at which the soil begins to lose its plasticity and is determined in accordance with ASTM Specification D-4318.

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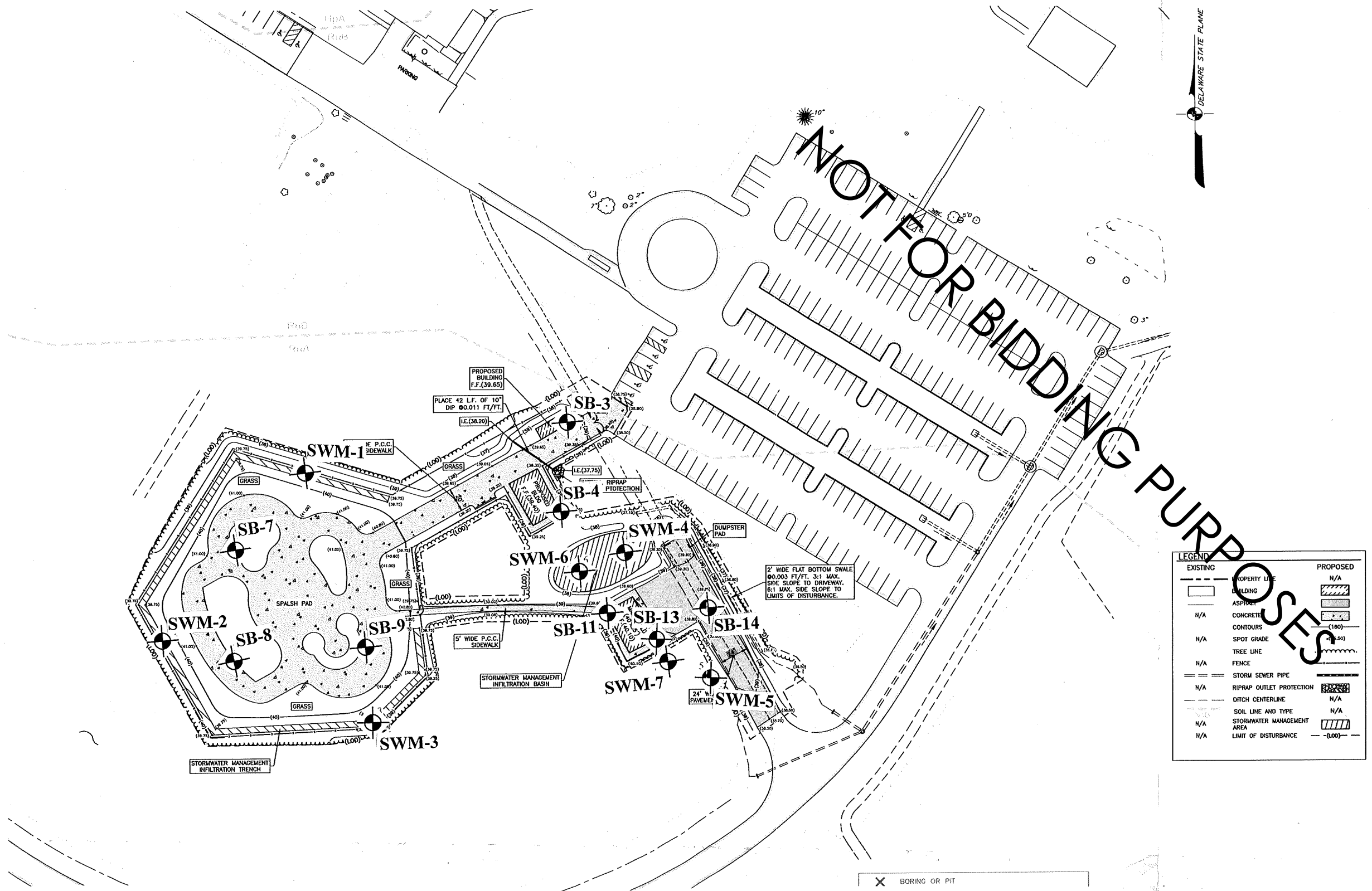
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Date: July 10, 2024	
Scale: 1" = 2,000 ft.	
Drawn: ADC Maps	
Project Location Map Trap Pond Splash Park Sussex County, Delaware	DWG. No. JDH-10/23/338-A



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Boring Location Plan
Trap Pond Splash Park
Sussex County, Delaware

Date: July 10, 2024
Scale: As Shown
Drawn: GWWO
DWG. No. JDH-10/23/338-B

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LOG OF BORING SB-3

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Baltimore, Maryland 21230

Trap Pond Splash Park

Project No.: JDH-10/23/338

Date Completed: : July 2, 2024
Logged By: : E. Cross
Drilled By: : B. Hynes
Drilling Method: : HSA (Geoprobe 7822 DT)
Total Depth: : 20.5 feet

Depth in Feet	Surf. Elev. 37	DESCRIPTION	GRAPHIC	USCS	Sample	Blow Count	REMARKS
0	37	Brown, wet, loose to, fine to medium SAND, with trace to little silt		SP-SM	1	1-1-2-4	Scale 1" ~ 4.5 feet Approximately 8 inches of organic bearing soil was encountered at the ground surface. Groundwater was encountered at 10 feet during drilling operations. Laboratory Test Results Sample No. 3 From 4 to 6 feet Natural Moisture = 6.7% Sample No. 5 From 8 to 10 feet Sieve Analysis Sieve Size / Passing % No. 10 100 No. 20 99.4 No. 40 93.9 No. 60 67.8 No. 100 19.9 No. 200 7.7 Natural Moisture = 21.2%
2	35	Brown to gray, wet, loose to medium dense, fine to medium SAND, with little silt			2	2-2-3-3	
4	33			SM	3	3-3-5-6	
6	31				4	3-4-4-6	
8	29	Brown, saturated, loose to medium dense, fine to medium SAND, with trace to little silt			5	3-5-5-5	
10	27						
12	25			SP-SM			
14	23				6	3-6-8	
16	21						
18	19	Gray, saturated, medium dense, fine to medium SAND, with trace silt		SP			
20	17				7	4-6-6	
		Boring terminated at 20.5 feet.					
22	15						
24	13						
26	11						
28	9						
30							

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LOG OF BORING SB-4

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Trap Pond Splash Park

Project No.: JDH-10/23/338

Date Completed: : July 2, 2024
Logged By: : E. Cross
Drilled By: : B. Hynes
Drilling Method: : HSA (Geoprobe 7822 DT)
Total Depth: : 20.5 feet

Depth in Feet	Surf. Elev. 38	DESCRIPTION	GRAPHIC	USCS	Sample	Blow Count	REMARKS
0	38	Brown, wet, very loose to loose, fine to medium SAND, with trace silt		SP	1	1-2-3-4	Scale 1" ~ 4.5 feet Approximately 8 inches of organic bearing soil was encountered at the ground surface. Groundwater was encountered at 8 feet during drilling operations.
2	36				2	1-2-2-3	
4	34				3	2-3-5-4	
6	32	Gray, saturated, fine to medium SAND, with trace to little silt		SP-SM	4	3-4-6-7	
8	30	Gray to brown, saturated, very loose to medium dense, fine to medium SAND, with little silt, little clay (mottled)		SM	5	3-5-5-8	
10	28						
12	26						
14	24				6	1-2-3	
16	22						
18	20	Brown, saturated, medium dense, fine to medium SAND, with trace silt		SP			
20	18				7	3-5-9	
		Boring terminated at 20.5 feet.					
22	16						
24	14						
26	12						
28	10						
30							

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LOG OF BORING SB-7

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Trap Pond Splash Park

Project No.: JDH-10/23/338

Date Completed: : July 2, 2024
Logged By: : E. Cross
Drilled By: : B. Hynes
Drilling Method: : HSA (Geoprobe 7822 DT)
Total Depth: : 15.5 feet

Depth in Feet	Surf. Elev. 38	DESCRIPTION	GRAPHIC	USCS	Sample	Blow Count	REMARKS
0	38	Brown to gray, wet, very loose to loose, fine to medium SAND, with trace silt		SP	1	1-1-2-3	Scale 1" ~ 4.5 feet Approximately 10 inches of organic bearing soil was encountered at the ground surface. Groundwater was encountered at 10 feet during drilling operations.
2	36				2	2-2-3-5	
4	34				3	2-4-3-4	
6	32	Brown to gray, wet, loose, fine to medium SAND, with trace to little silt		SP-SM	4	3-4-4-5	
8	30	Gray, saturated, medium dense, fine to medium SAND, with trace silt		SP	5	3-6-8-12	
10	28						
12	26	Brown, saturated, loose, fine to medium SAND, with trace to little silt		SP-SM			
14	24				6	2-3-3	
16	22	Boring terminated at 15.5 feet.					
18	20						
20	18						
22	16						
24	14						
26	12						
28	10						
30							

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LOG OF BORING SB-8

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Baltimore, Maryland 21230

Trap Pond Splash Park

Project No.: JDH-10/23/338

Date Completed: : July 2, 2024
Logged By: : E. Cross
Drilled By: : B. Hynes
Drilling Method: : HSA (Geoprobe 7822 DT)
Total Depth: : 15.5 feet

Depth in Feet	Surf. Elev. 39	DESCRIPTION	GRAPHIC	USCS	Sample	Blow Count	REMARKS
0	39	Brown, wet, loose, fine to medium SAND, with trace to little sand		SP-SM	1	1-1-3-3	Scale 1" ~ 4.5 feet Approximately 10 inches of organic bearing soil was encountered at the ground surface. Groundwater was encountered at 10 feet during drilling operations.
2	37				2	2-3-4-3	
4	35	Gray, wet, loose, fine to medium SAND, with trace silt		SP	3	1-3-3-5	
6	33				4	3-4-5-5	
8	31	Orange-brown, saturated, loose, fine to medium SAND, with little silt, trace clay (mottled)		SM	5	3-4-4-6	
10	29						
12	27	Gray, saturated, medium dense, fine to medium SAND, with trace silt, trace clay		SP-SM			
14	25				6	3-5-10	
16	23	Boring terminated at 15.5 feet.					
18	21						
20	19						
22	17						
24	15						
26	13						
28	11						
30							

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LOG OF BORING SB-9

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Trap Pond Splash Park

Project No.: JDH-10/23/338

Date Completed: : July 2, 2024
Logged By: : E. Cross
Drilled By: : B. Hynes
Drilling Method: : HSA (Geoprobe 7822 DT)
Total Depth: : 15.5 feet

Depth in Feet	Surf. Elev. 38.5	DESCRIPTION	GRAPHIC	USCS	Sample	Blow Count	REMARKS
0	38.5	Brown, wet, very loose, fine to medium SAND, with trace to little silt		SP-SM	1	1-1-2-3	Scale 1" ~ 4.5 feet Approximately 12 inches of organic bearing soil was encountered at the ground surface. Groundwater was encountered at 10 feet during drilling operations. Laboratory Test Results Sample No. 2 From 2 to 4 feet Natural Moisture = 6.6% Sample No. 4 From 6 to 8 feet Sieve Analysis Sieve Size / Passing % No. 10 100 No. 20 99.5 No. 40 92.0 No. 60 66.3 No. 100 27.4 No. 200 11.2 Natural Moisture = 18.0%
2	36.5	Brown, wet, loose, fine to medium SAND, with little silt			2	2-2-3-4	
4	34.5			SM	3	3-3-3-4	
6	32.5	Gray, wet to saturated, loose to medium dense, fine to medium SAND, with trace to little silt			4	3-6-8-9	
8	30.5			SP-SM	5	2-3-3-4	
10	28.5						
12	26.5	Gray to brown, saturated, loose, fine to medium SAND, with trace silt		SP			
14	24.5				6	2-4-6	
16	22.5	Boring terminated at 15.5 feet.					
18	20.5						
20	18.5						
22	16.5						
24	14.5						
26	12.5						
28	10.5						
30							

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LOG OF BORING SB-11

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Baltimore, Maryland 21230

Trap Pond Splash Park

Project No.: JDH-10/23/338

Date Completed: : July 2, 2024
Logged By: : E. Cross
Drilled By: : B. Hynes
Drilling Method: : HSA (Geoprobe 7822 DT)
Total Depth: : 20.5 feet

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Depth in Feet	Surf. Elev. 38	DESCRIPTION	GRAPHIC	USCS	Sample	Blow Count	REMARKS
0	38	Brown, wet, very loose to loose, fine to medium SAND, with trace silt		SP	1	1-1-2-2	Scale 1" ~ 4.5 feet Approximately 8 inches of organic bearing soil was encountered at the ground surface. Groundwater was encountered at 11 feet during drilling operations. Laboratory Test Results Sample No. 2 From 2 to 4 feet Natural Moisture = 2.4% Sample No. 6 From 14 to 15.5 feet Sieve Analysis Sieve Size / Passing % No. 10 100 No. 20 99.6 No. 40 94.0 No. 60 76.8 No. 100 52.6 No. 200 33.4 Natural Moisture = 19.5%
2	36				2	3-3-3-3	
4	34				3	2-3-2-4	
6	32	Brown to gray, wet, loose to medium dense, fine to medium SAND, with little silt		SM	4	2-4-5-6	
8	30				5	2-3-3-6	
10	28						
12	26	Gray, saturated, loose, fine to medium SAND, with little silt, little clay (mottled)		SM	6	3-3-4	
14	24						
16	22						
18	20	Brown, saturated, medium dense, fine to medium SAND, with trace to little silt (mottled)		SP-SM	7	7-10-12	
20	18	Boring terminated at 20.5 feet.					
22	16						
24	14						
26	12						
28	10						
30							

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LOG OF BORING SB-13

(Page 1 of 1)

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Trap Pond Splash Park

Project No.: JDH-10/23/338

Date Completed: : July 2, 2024
Logged By: : E. Cross
Drilled By: : B. Hynes
Drilling Method: : HSA (Geoprobe 7822 DT)
Total Depth: : 20.5 feet

Depth in Feet	Surf. Elev. 38	DESCRIPTION	GRAPHIC	USCS	Sample	Blow Count	REMARKS
0	38	Brown, wet, loose, fine to medium SAND, with trace to little silt		SP-SM	1	3-4-4-4	Scale 1" ~ 4.5 feet Approximately 6 inches of organic bearing soil was encountered at the ground surface. Groundwater was encountered at 10 feet during drilling operations. Laboratory Test Results Sample No. 2 From 2 to 4 feet Natural Moisture = 3.8% Sample No. 4 From 6 to 8 feet Sieve Analysis Sieve Size / Passing % No. 10 100 No. 20 99.1 No. 40 91.4 No. 60 70.3 No. 100 41.5 No. 200 26.4 Natural Moisture = 17.3%
2	36				2	3-4-4-4	
4	34	Brown, wet, loose, fine to medium SAND, with trace to little silt		SP	3	2-3-3-4	
6	32	Brown to gray, wet, loose, fine to medium SAND, with little silt, trace to little clay		SM	4	3-4-5-5	
8	30	Gray, wet to saturated, loose, fine to medium SAND, with little silt		SM	5	2-3-4-4	
10	28						
12	26	Gray, saturated, medium stiff, clayey SILT, with some sand		CL	6	2-3-4	
14	24						
16	22						
18	20	Gray, saturated, medium dense, fine to medium SAND, with trace to little silt		SP-SM	7	6-9-11	
20	18	Boring terminated at 20.5 feet.					
22	16						
24	14						
26	12						
28	10						
30							

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LOG OF BORING SB-14

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1215 East Fort Avenue, Suite 24
Baltimore, Maryland 21230

Trap Pond Splash Park

Project No.: JDH-10/23/338

Date Completed: : July 3, 2024
Logged By: : E. Cross
Drilled By: : B. Brisbane
Drilling Method: : Hand Auger
Total Depth: : 5 feet

Depth in Feet	Surf. Elev. 38	DESCRIPTION	GRAPHIC	USCS	Sample	REMARKS
0	38	Brown, wet, fine to medium SAND, with trace to little silt		SP-SM	1	Scale 1" ~ 4.5 feet
2	36				2	Approximately 12 inches of organic bearing soil was encountered at the ground surface.
4	34				3	Groundwater was not encountered during augering operations.
					4	
6	32	Boring terminated at 5 feet.				Laboratory Test Results
8	30					Sample No. 3 From 3 to 4 feet
10	28					Sieve Analysis
12	26					Sieve Size / Passing % No. 4 100 No. 10 99.9 No. 20 98.4 No. 40 85.4 No. 60 53.0 No. 100 20.2 No. 200 6.8
14	24					Natural Moisture = 4.8%
16	22					Sample No. 4 From 4 to 5 feet
18	20					Natural Moisture = 4.8%
20	18					
22	16					
24	14					
26	12					
28	10					
30						

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LOG OF BORING SWM-1

GWWO Architects
1215 East Fort Avenue, Suite 24
Baltimore, Maryland 21230

Trap Pond Splash Park

Project No.: JDH-10/23/338

Date Completed: : July 2, 2024
Logged By: : E. Cross
Drilled By: : B. Hynes
Drilling Method: : Hand Augered
Total Depth: : 8 feet

Depth in Feet	Surf. Elev. 38	DESCRIPTION	GRAPHIC	USCS	Sample	REMARKS
0	38	Brown, wet, fine to medium SAND, with trace to little silt (10 YR 5/3, Sand)		SP-SM	1	Scale 1" ~ 4.5 feet Approximately 6 inches of organic bearing soil was encountered at the ground surface. Groundwater was encountered at 7 feet during augering operations. Weather: Sunny, 95 There was no significant precipitation within 48 hours prior to drilling.
2	36	Brown, wet, fine to coarse SAND, with little silt (10 YR 6/2, Loamy sand)		SM	2	
		Brown, wet, fine to medium SAND, with little silt, trace clay (10 YR 6/2, Loamy sand)		SM	3	
4	34	Brown, wet, fine to medium SAND, with trace to little silt (10 YR 6/2, Sand)		SP-SM	4	
					5	
6	32	Brown to gray, wet, fine to medium SAND, with trace silt (10 YR 6/2, Sand)		SP	6	
		Gray, saturated, fine to medium SAND, with trace silt (10 YR 7/2, Sand)		SP	7	
8	30	Boring terminated at 8 feet.				
10	28					
12	26					
14	24					
16	22					
18	20					
20	18					
22	16					
24	14					
26	12					
28	10					
30						

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LOG OF BORING SWM-2

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1215 East Fort Avenue, Suite 24
Baltimore, Maryland 21230

Trap Pond Splash Park

Project No.: JDH-10/23/338

Date Completed: : July 3, 2024
Logged By: : E. Cross
Drilled By: : B. Hynes
Drilling Method: : Hand Augered
Total Depth: : 9 feet

Depth in Feet	Surf. Elev. 39	DESCRIPTION	GRAPHIC	USCS	Sample	REMARKS
0	39	Brown, wet, fine to medium SAND, with little silt (10YR 5/3, Loamy sand)		SM	1	Scale 1" ~ 4.5 feet Approximately 14 inches of organic bearing soil was encountered at the ground surface. Groundwater was encountered at 7 feet during augering operations. Weather: Sunny, 95 There was no significant precipitation within 48 hours prior to drilling.
2	37	Brown, wet, fine to medium SAND, with trace to little silt (10YR 5/3, Sand)		SP-SM	2	
					3	
4	35	Brown, wet, fine to medium SAND, with little silt, trace clay (10YR 5/3, Loamy sand)		SM	4	
6	33	Brown, wet, fine to medium SAND, with trace to little silt (10YR 5/3, Sand)		SP-SM	5	
					6	
8	31	Brown, wet, fine to medium SAND, with trace to little silt, trace roots (10YR 5/3, Sand)		SP-SM	7	
		Brown, saturated, fine to medium SAND, with trace silt (10YR 5/3, Sand)		SP	8	
10	29	Boring terminated at 9 feet.				
12	27					
14	25					
16	23					
18	21					
20	19					
22	17					
24	15					
26	13					
28	11					
30						

NOT FOR BIDDING PURPOSES

HYNES & ASSOCIATES

LOG OF BORING SWM-3

GWWO Architects
1215 East Fort Avenue, Suite 24
Baltimore, Maryland 21230

Trap Pond Splash Park

Project No.: JDH-10/23/338

Date Completed: : July 2, 2024
Logged By: : E. Cross
Drilled By: : B. Hynes
Drilling Method: : Hand Augered
Total Depth: : 8 feet

Depth in Feet	Surf. Elev. 38	DESCRIPTION	GRAPHIC	USCS	Sample	REMARKS
0	38	Brown, wet, fine to medium SAND, with trace to little silt (10YR 5/3, Sand)		SP-SM		Scale 1" ~ 4.5 feet
2	36	Brown, wet, fine to medium SAND, with little silt (10YR 5/3, Loamy sand)		SM	2	Approximately 6 inches of organic bearing soil was encountered at the ground surface.
		Brown, wet, fine to medium SAND, with little silt, trace clay (10YR 5/3, Loamy sand)		SM	3	
4	34	Brown, wet, fine to medium SAND, with trace to little silt (10YR 5/3, Sand)		SP-SM	4	Groundwater was encountered at 7 feet during augering operations.
6	32	Brown to gray, wet to saturated, fine to medium SAND, with trace silt (10YR 5/3, 6/2, Sand)		SP	5	Weather: Sunny, 95
		Brown, saturated, fine to medium SAND, with little silt, trace clay (10YR 5/3, Loamy sand, mottled)		SM	6	There was no significant precipitation within 48 hours prior to drilling.
8	30	Boring terminated at 8 feet.			7	
10	28					
12	26					
14	24					
16	22					
18	20					
20	18					
22	16					
24	14					
26	12					
28	10					
30						

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HYNES & ASSOCIATES

LOG OF BORING SWM-4

GWWO Architects
1215 East Fort Avenue, Suite 24
Baltimore, Maryland 21230

Trap Pond Splash Park

Project No.: JDH-10/23/338

Date Completed: : July 2, 2024
Logged By: : E. Cross
Drilled By: : B. Hynes
Drilling Method: : Hand Augered
Total Depth: : 7 feet

Depth in Feet	Surf. Elev. 38	DESCRIPTION	GRAPHIC	USCS	Sample	REMARKS
0	38	Brown, wet, fine to medium SAND, with trace to little silt (10YR 5/3, Sand)		SP-SM	1	Scale 1" ~ 4.5 feet
2	36				2	Approximately 12 inches of organic bearing soil was encountered at the ground surface.
4	34	Brown, wet, fine to medium SAND, with trace silt (10YR 5/3, Sand)		SP	3	
					4	Groundwater was encountered at 7 feet during augering operations.
6	32				5	Weather: Sunny, 95
					6	There was no significant precipitation within 48 hours prior to drilling.
8	30	Brown, wet, fine to medium SAND, with trace to little silt (10YR 5/3, Sand)		SP-SM	7	
		Boring terminated at 8 feet.				
10	28					
12	26					
14	24					
16	22					
18	20					
20	18					
22	16					
24	14					
26	12					
28	10					
30						

NOT FOR BIDDING PURPOSES

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HYNES & ASSOCIATES

LOG OF BORING SWM-5

GWWO Architects
1215 East Fort Avenue, Suite 24
Baltimore, Maryland 21230

Trap Pond Splash Park

Project No.: JDH-10/23/338

Date Completed: : July 2, 2024
Logged By: : E. Cross
Drilled By: : B. Hynes
Drilling Method: : Hand Augered
Total Depth: : 9 feet

Depth in Feet	Surf. Elev. 38	DESCRIPTION	GRAPHIC	USCS	Sample	REMARKS
0	38	Brown, wet, fine to medium SAND, with trace to little silt (10YR 5/3, Sand)		SP-SM		Scale 1" ~ 4.5 feet
2	36	Brown, wet, fine to medium SAND, with little silt, trace clay (10YR 5/3, Loamy sand)		SM	2	Approximately 12 inches of organic bearing soil was encountered at the ground surface.
4	34	Brown, wet, fine to medium SAND, with trace to little silt (10YR 5/3, Sand)		SP-SM	3 4 5	Groundwater was encountered at 8 feet during augering operations.
6	32				6	Weather: Sunny, 95
8	30	Gray, wet to saturated, fine to medium SAND, with trace silt (10YR 5/3, Sand)		SP	7	There was no significant precipitation within 48 hours prior to drilling.
		Brown, saturated, fine to medium SAND, with little silt, trace to little clay (10YR 5/3, Loamy sand, mottled)		SM	8	
10	28	Boring terminated at 9 feet.				
12	26					
14	24					
16	22					
18	20					
20	18					
22	16					
24	14					
26	12					
28	10					
30						

NOT FOR BIDDING PURPOSES

HYNES & ASSOCIATES

LOG OF BORING SWM-6

GWWO Architects
1215 East Fort Avenue, Suite 24
Baltimore, Maryland 21230

Trap Pond Splash Park

Project No.: JDH-10/23/338

Date Completed: : July 2, 2024
Logged By: : E. Cross
Drilled By: : B. Hynes
Drilling Method: : Hand Augered
Total Depth: : 10 feet

Depth in Feet	Surf. Elev. 38	DESCRIPTION	GRAPHIC	USCS	Sample	REMARKS
0	38	Brown, wet, fine to medium SAND, with trace to little silt (10YR 5/3, Sand)		SP-SM	1	Scale 1" ~ 4.5 feet
2	36	Brown, wet, fine to medium SAND, with little silt (10YR 5/3, Loamy sand)		SM	2	Approximately 6 inches of organic bearing soil was encountered at the ground surface.
4	34	Brown, wet, fine to medium SAND, with trace to little silt (10YR 5/3, Sand)		SP-SM	3 4 5	Groundwater was encountered at 9 feet during augering operations. Weather: Sunny, 95
6	32	Brown, wet, fine to medium SAND, with trace silt (10YR 5/3, Sand)		SP	6 7	There was no significant precipitation within 48 hours prior to drilling.
8	30	Brown, wet to saturated, fine to medium SAND, with little silt (10YR 5/3, Loamy sand)		SM	8 9	
10	28	Boring terminated at 10 feet.				
12	26					
14	24					
16	22					
18	20					
20	18					
22	16					
24	14					
26	12					
28	10					
30						

NOT FOR BIDDING PURPOSES

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HYNES & ASSOCIATES

LOG OF BORING SWM-7

GWWO Architects
1215 East Fort Avenue, Suite 24
Baltimore, Maryland 21230

Trap Pond Splash Park

Project No.: JDH-10/23/338

Date Completed: : July 3, 2024
Logged By: : E. Cross
Drilled By: : B. Hynes
Drilling Method: : Hand Augered
Total Depth: : 10 feet

Depth in Feet	Surf. Elev. 38	DESCRIPTION	GRAPHIC	USCS	Sample	REMARKS
0	38	Brown, wet, fine to medium SAND, with trace to little silt (10YR 5/3, Sand)		SP-SM	1	Scale 1" ~ 4.5 feet
2	36	Brown, wet, fine to medium SAND, with little silt (10YR 5/3, Loamy sand)		SM	2	Approximately 8 inches of organic bearing soil was encountered at the ground surface.
4	34	Brown, wet, fine to medium SAND, with trace to little silt (10YR 5/3, Sand)		SP-SM	3	Groundwater was encountered at 8 feet during augering operations.
		Brown, wet, fine to medium SAND, with trace silt (10YR 5/3, Sand)		SP	4	
6	32	Gray, wet, fine to medium SAND, with trace silt (10YR 6/2, Sand)		SP	5	Weather: Sunny, 95
8	30	Gray, wet, fine to medium SAND, with trace to little silt (10YR 6/2, Sand)		SP-SM	6	There was no significant precipitation within 48 hours prior to drilling.
		Brown, saturated, fine to medium SAND, with little silt (10YR 5/3, Loamy sand)		SM	7	
10	28	Brown, saturated, fine to medium SAND, with trace to little silt (10YR 5/3, Sand)		SP-SM	8	
		Boring terminated at 10 feet.			9	
12	26					
14	24					
16	22					
18	20					
20	18					
22	16					
24	14					
26	12					
28	10					
30						

NOT FOR BIDDING PURPOSES

08-23-2024 J:\Mtech 2010\Trap Pond Splash Park-23338\SWM-7.bor

Single Ring
Falling Head Infiltration Test
4 Inch Casing

Project: Trap Pond Splash Park **Date:** 7/3/2024
Project No.: JDH-10/23/338
Test Location: SWM-1

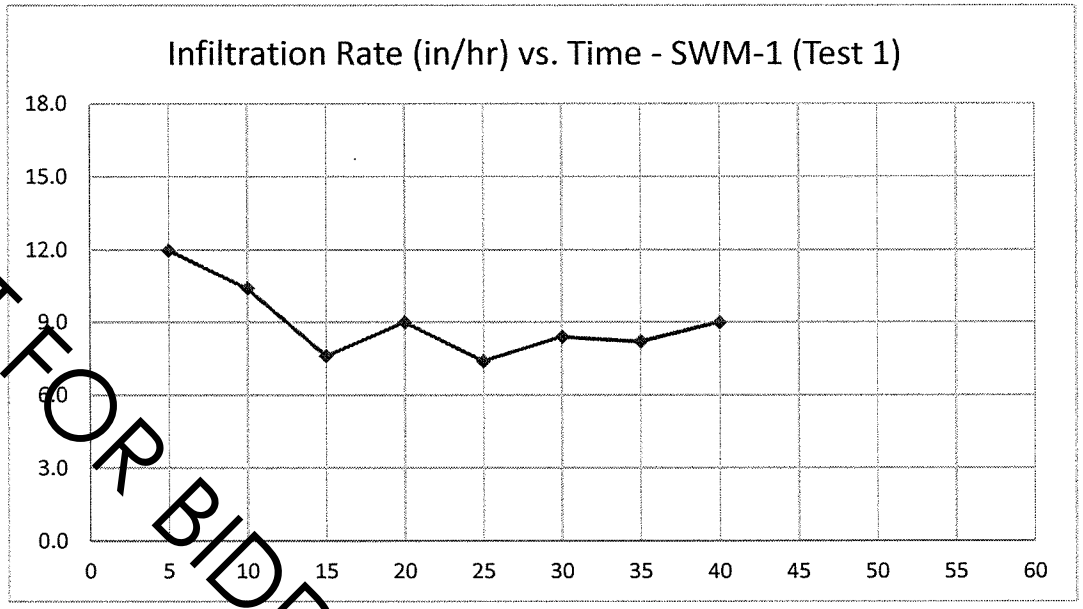
Weather: Sun, 90°
Test Elevation: 35.0 ft.
Casing Embedment: 2.5 in.
Tester/ Technician Performing Test: B. Walters

	Time (t)	Time Elapsed (min)	Hydraulic Head (h) (in)	Change (Δh) (in)	Incremental Inf. Rate (in/hr)
Presoak	0	-	12.00	-	-
	45	45	DRY	12.00	N/A
Test 1	0	-	6.25	-	-
	5	5	5.25	1.00	12.0
	10	5	4.38	0.87	10.4
	15	5	3.75	0.63	7.6
	20	5	3.00	0.75	9.0
	25	5	2.38	0.62	7.4
	30	5	1.68	0.70	8.4
	35	5	1.00	0.68	8.2
	40	5	0.25	0.75	9.0
	45	5	DRY	-	-
	Test 1		Average Infiltration Rate (in./hr.) :		9.0
			Steady State Infiltration Rate (in./hr.) :		9.0
Test 2	0	-	6.00	-	-
	5	5	5.50	0.50	6.0
	10	5	4.75	0.75	9.0
	15	5	4.13	0.62	7.4
	20	5	3.50	0.63	7.6
	25	5	2.88	0.62	7.4
	30	5	2.25	0.63	7.6
	35	5	1.50	0.75	9.0
	40	5	0.75	0.75	9.0
	45	5	0.00	0.75	9.0
	Test 2		Average Infiltration Rate (in./hr.) :		8.0
			Steady State Infiltration Rate (in./hr.) :		8.0

NOT FOR BIDDING PURPOSES

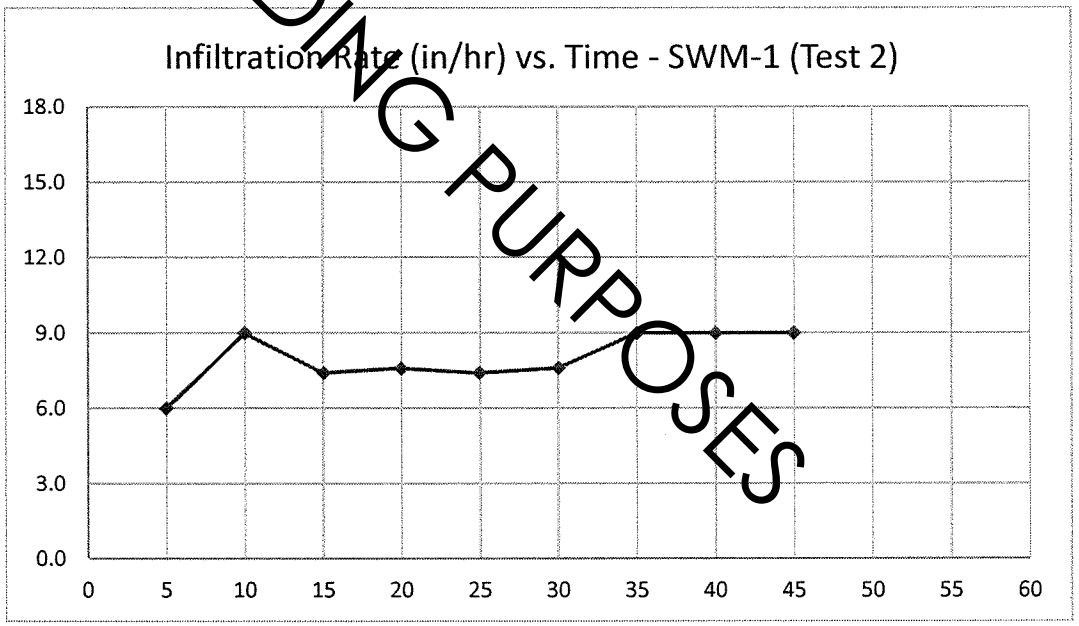
SWM-1 Test 1

Interval #	Interval(min)	Cumulative Time	Rate(in/hr)
1	5	5	12.0
2	5	10	10.4
3	5	15	7.6
4	5	20	9.0
5	5	25	7.4
6	5	30	8.4
7	5	35	8.2
8	5	40	9.0



SWM-1 Test 2

Interval #	Interval(min)	Cumulative Time	Rate(in/hr)
1	5	5	6.0
2	5	10	9.0
3	5	15	7.4
4	5	20	7.6
5	5	25	7.4
6	5	30	7.6
7	5	35	9.0
8	5	40	9.0
9	5	45	9.0



NOT FOR BIDDING PURPOSES

Single Ring
Falling Head Infiltration Test
4 Inch Casing

Project: Trap Pond Splash Park **Date:** 7/3/2024
Project No.: JDH-10/23/338
Test Location: SWM-2

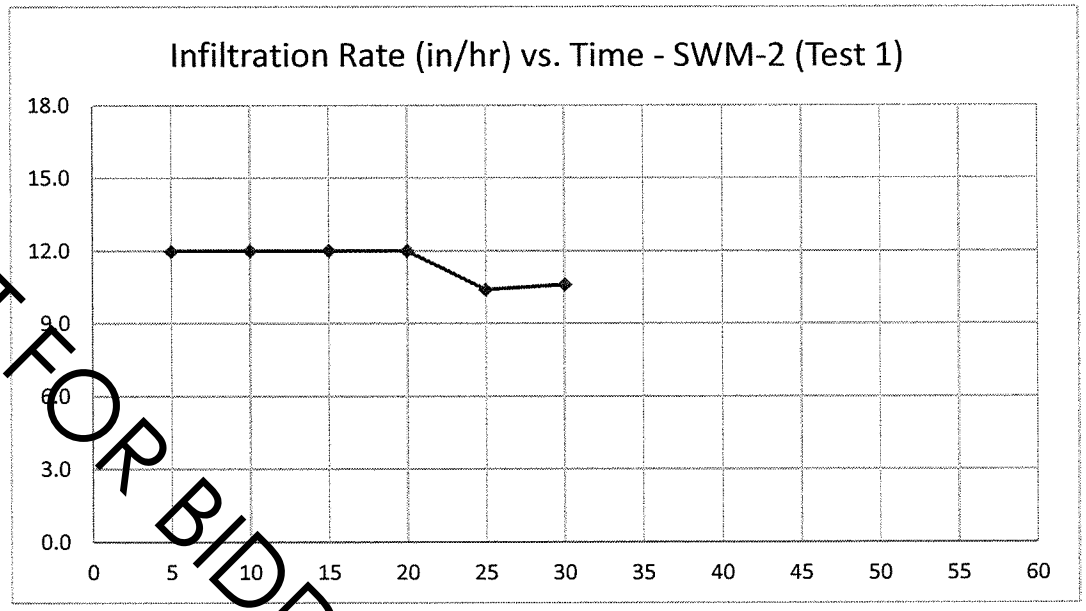
Weather: Sun, 90°
Test Elevation: 34.5 ft.
Casing Embedment: 2.5 in.
Tester/ Technician Performing Test: B.Hynes

	Time (t)	Time Elapsed (min)	Hydraulic Head (h) (in)	Change (Δh) (in)	Incremental Inf. Rate (in/hr)
Presoak	0	-	12.00	-	-
	40	40	0.00	12.00	N/A
Test 1	0	-	6.00	-	-
	5	5	5.00	1.00	12.0
	10	5	4.00	1.00	12.0
	15	5	3.00	1.00	12.0
	20	5	2.00	1.00	12.0
	25	5	1.13	0.87	10.4
	30	5	0.25	0.88	10.6
	35	5	DRY	-	-
	Test 1		Average Infiltration Rate (in./hr.) :		11.5
			Steady State Infiltration Rate (in./hr.) :		10.6
Test 2	0	-	6.00	-	-
	5	5	5.13	0.87	10.4
	10	5	4.13	1.00	12.0
	15	5	3.25	0.88	10.6
	20	5	2.25	1.00	12.0
	25	5	1.38	0.87	10.4
	30	5	0.50	0.88	10.6
	35	5	DRY	-	-
	Test 2		Average Infiltration Rate (in./hr.) :		11.0
			Steady State Infiltration Rate (in./hr.) :		10.6

NOT FOR BIDDING PURPOSES

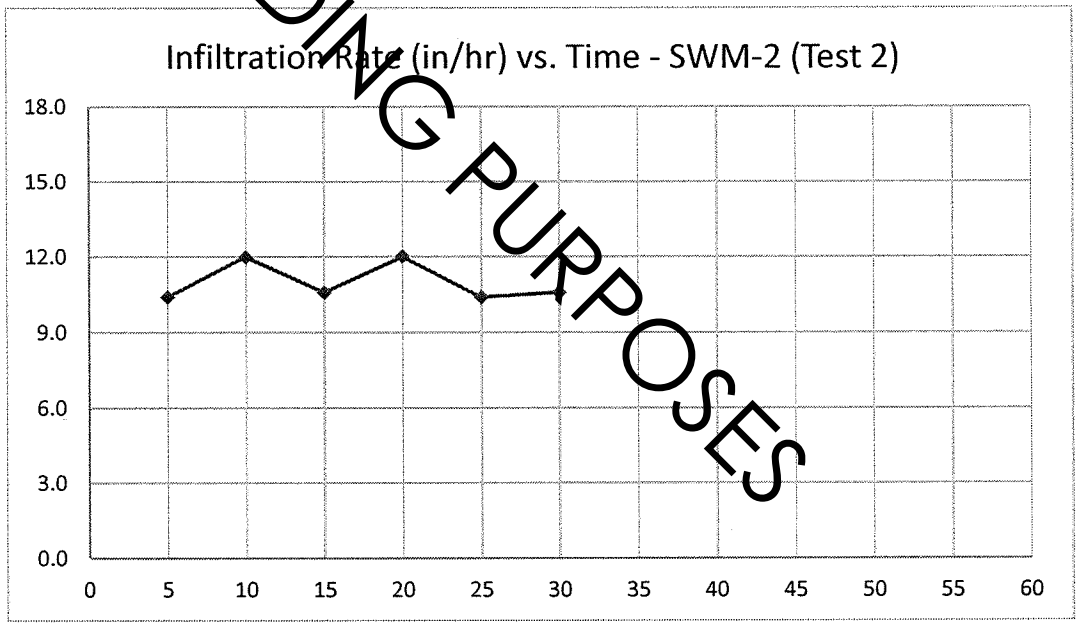
SWM-2 Test 1

Interval #	Interval(min)	Cumulative Time	Rate(in/hr)
1	5	5	12.0
2	5	10	12.0
3	5	15	12.0
4	5	20	12.0
5	5	25	10.4
6	5	30	10.6



SWM-2 Test 2

Interval #	Interval(min)	Cumulative Time	Rate(in/hr)
1	5	5	10.4
2	5	10	12.0
3	5	15	10.6
4	5	20	12.0
5	5	25	10.4
6	5	30	10.6



NOT FOR BIDDING PURPOSES

Single Ring
Falling Head Infiltration Test
4 Inch Casing

Project: Trap Pond Splash Park
Date: 7/3/2024
Project No.: JDH-10/23/338
Test Location: SWM-3

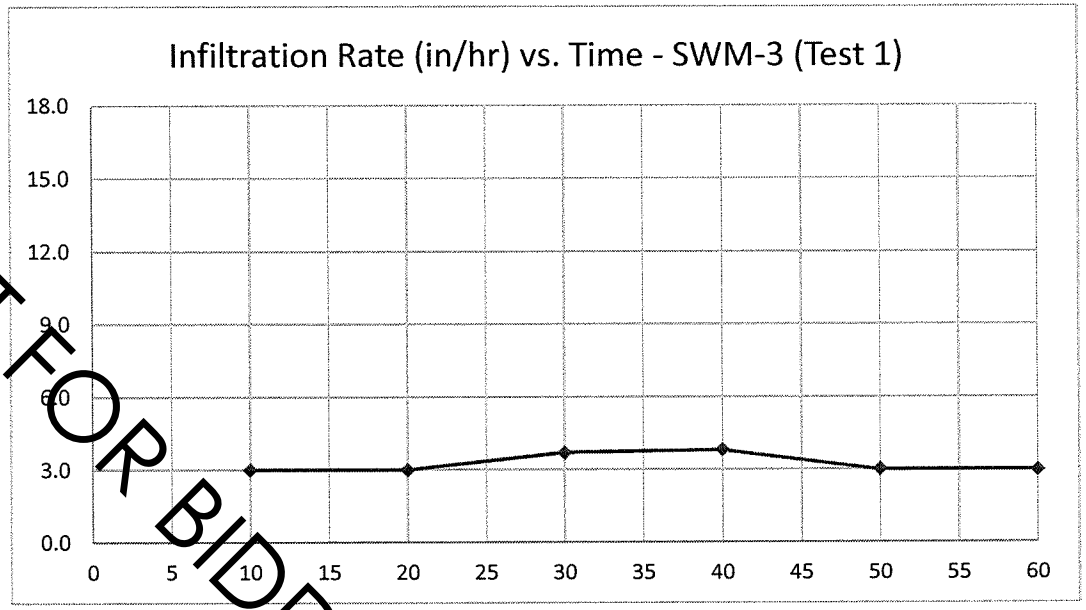
Weather: Sun, 90°
Test Elevation: 35.0 ft.
Casing Embedment: 2.5 in.
Tester/ Technician Performing Test: B.Hynes

	Time (t)	Time Elapsed (min)	Hydraulic Head (h) (in)	Change (Δh) (in)	Incremental Inf. Rate (in/hr)
Presoak	0	-	12.00	-	-
	60	60	5.00	7.00	N/A
Test 1	0	-	6.00	-	-
	10	10	5.50	0.50	3.0
	20	10	5.00	0.50	3.0
	30	10	4.38	0.62	3.7
	40	10	3.75	0.63	3.8
	50	10	3.25	0.50	3.0
	60	10	2.75	0.50	3.0
	Test 1		Average Infiltration Rate (in./hr.) :		3.3
			Steady State Infiltration Rate (in./hr.) :		3.0
Test 2	0	-	6.00	-	-
	10	10	5.50	0.50	3.0
	20	10	5.00	0.50	3.0
	30	10	4.38	0.62	3.7
	40	10	3.87	0.51	3.1
	50	10	3.38	0.49	2.9
	60	10	2.87	0.51	3.1
	Test 2		Average Infiltration Rate (in./hr.) :		3.1
			Steady State Infiltration Rate (in./hr.) :		3.1

NOT FOR BIDDING PURPOSES

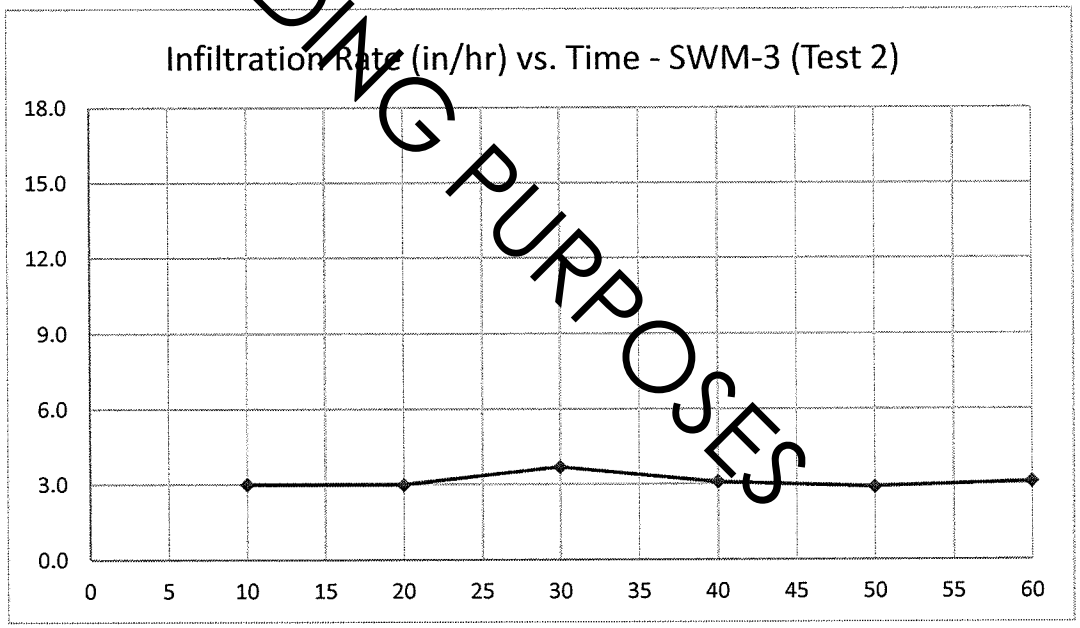
SWM-3 Test 1

Interval #	Interval(min)	Cumulative Time	Rate(in/hr)
1	10	10	3.0
2	10	20	3.0
3	10	30	3.7
4	10	40	3.8
5	10	50	3.0
6	10	60	3.0



SWM-3 Test 2

Interval #	Interval(min)	Cumulative Time	Rate(in/hr)
1	10	10	3.0
2	10	20	3.0
3	10	30	3.7
4	10	40	3.1
5	10	50	2.9
6	10	60	3.1



NOT FOR BIDDING PURPOSES

Single Ring
Falling Head Infiltration Test
4 Inch Casing

Project: Trap Pond Splash Park **Date:** 7/3/2024
Project No.: JDH-10/23/338
Test Location: SWM-4

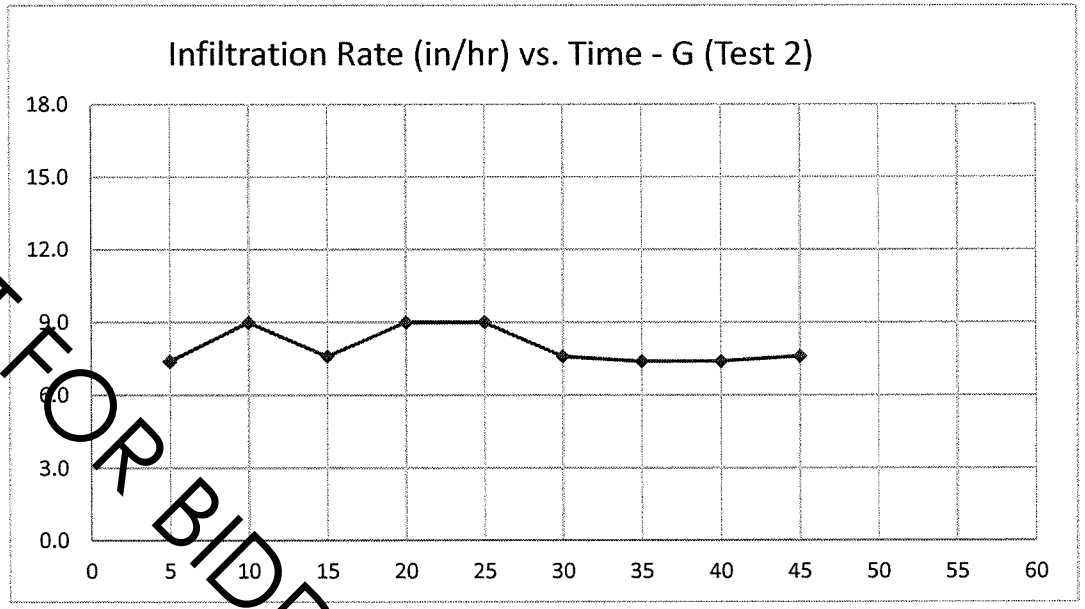
Weather: Sun, 90°
Test Elevation: 33.0 ft.
Casing Embedment: 2.5 in.
Tester/ Technician Performing Test: B. Walters

	Time (t)	Time Elapsed (min)	Hydraulic Head (h) (in)	Change (Δh) (in)	Incremental Inf. Rate (in/hr)
Presoak	0	-	12.00	-	-
	45	45	DRY	12.00	N/A
Test 1	0	-	6.00	-	-
	5	5	5.38	0.62	7.4
	10	5	4.63	0.75	9.0
	15	5	4.00	0.63	7.6
	20	5	3.25	0.75	9.0
	25	5	2.50	0.75	9.0
	30	5	1.87	0.63	7.6
	35	5	1.25	0.62	7.4
	40	5	0.63	0.62	7.4
	45	5	0.00	0.63	7.6
	Test 1		Average Infiltration Rate (in./hr.) :		8.0
			Steady State Infiltration Rate (in./hr.) :		7.6
Test 2	0	-	6.00	-	-
	5	5	5.38	0.62	7.4
	10	5	4.25	1.13	13.6
	15	5	3.50	0.75	9.0
	20	5	2.75	0.75	9.0
	25	5	2.00	0.75	9.0
	30	5	1.38	0.62	7.4
	35	5	0.63	0.75	9.0
	40	5	0.00	0.63	7.6
	Test 2		Average Infiltration Rate (in./hr.) :		9.0
			Steady State Infiltration Rate (in./hr.) :		7.6

NOT FOR BIDDING PURPOSES

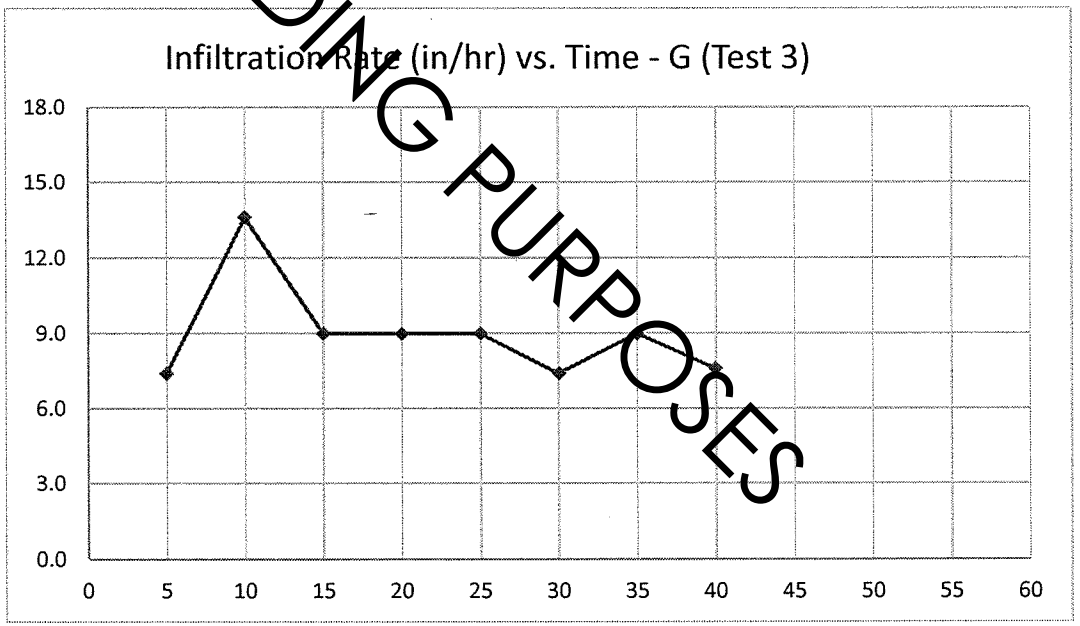
SWM-4 Test 1

Interval #	Interval(min)	Cumulative Time	Rate(in/hr)
1	5	5	7.4
2	5	10	9.0
3	5	15	7.6
4	5	20	9.0
5	5	25	9.0
6	5	30	7.6
7	5	35	7.4
8	5	40	7.4
9	5	45	7.6



SWM-4 Test 2

Interval #	Interval(min)	Cumulative Time	Rate(in/hr)
1	5	5	7.4
2	5	10	13.6
3	5	15	9.0
4	5	20	9.0
5	5	25	9.0
6	5	30	7.4
7	5	35	9.0
8	5	40	7.6



NOT FOR BIDDING PURPOSES

Single Ring
Falling Head Infiltration Test
4 Inch Casing

Project: Trap Pond Splash Park
Date: 7/3/2024
Project No.: JDH-10/23/338
Test Location: SWM-5

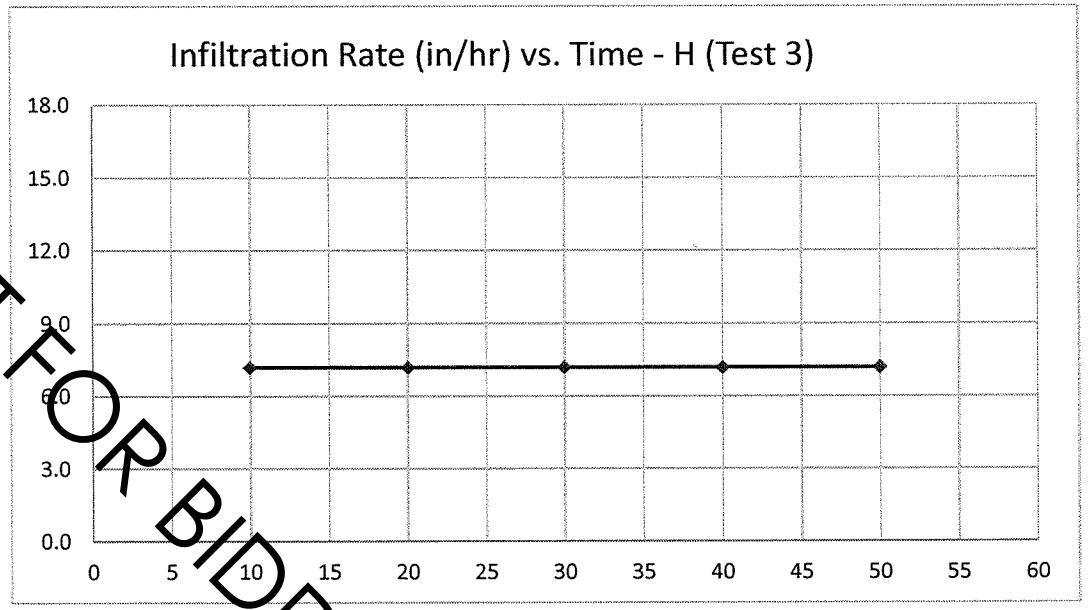
Weather: Sun, 90°
Test Elevation: 34.0 ft.
Casing Embedment: 2.5 in.
Tester/ Technician Performing Test: B. Brisbane

	Time (t)	Time Elapsed (min)	Hydraulic Head (h) (in)	Change (Δh) (in)	Incremental Inf. Rate (in/hr)
Presoak	0	-	12.00	-	-
	60	60	0.25	11.75	N/A
Test 1	0	-	6.00	-	-
	10	10	4.80	1.20	7.2
	20	10	3.60	1.20	7.2
	30	10	2.40	1.20	7.2
	40	10	1.20	1.20	7.2
	50	10	0.00	1.20	7.2
	Test 1		Average Infiltration Rate (in./hr.) :		7.2
			Steady State Infiltration Rate (in./hr.) :		7.2
Test 2	0	-	6.00	-	-
	10	10	4.80	1.20	7.2
	20	10	3.60	1.20	7.2
	30	10	2.40	1.20	7.2
	40	10	1.20	1.20	7.2
	50	10	0.00	1.20	7.2
	Test 2		Average Infiltration Rate (in./hr.) :		7.2
			Steady State Infiltration Rate (in./hr.) :		7.2

NOT FOR BIDDING PURPOSES

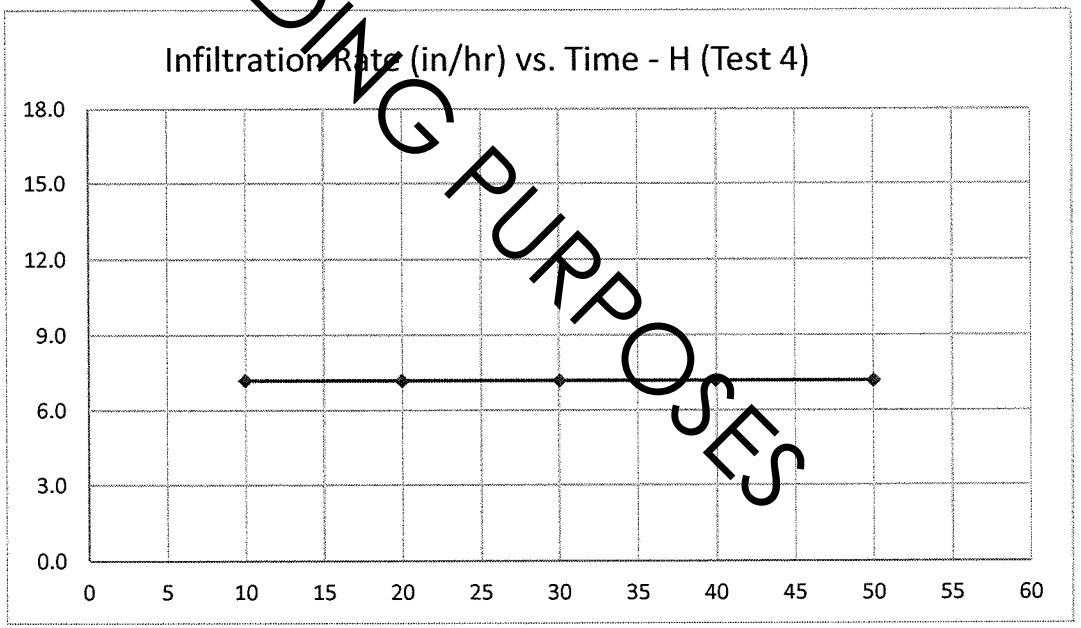
SWM-5 Test 1

Interval #	Interval(min)	Cumulative Time	Rate(in/hr)
1	10	10	7.2
2	10	20	7.2
3	10	30	7.2
4	10	40	7.2
5	10	50	7.2



SWM-5 Test 2

Interval #	Interval(min)	Cumulative Time	Rate(in/hr)
1	10	10	7.2
2	10	20	7.2
3	10	30	7.2
4	10	40	7.2
5	10	50	7.2



NOT FOR BIDDING PURPOSES

Falling Head
Single Ring Infiltration Test
(Delaware)
4 inch (cased borehole)

Tools and Supplies:

- ☐ 50 gallons of clean water per test
- ☐
- ☐ One 4 inch ring per test
- ☐ Well Sand
- ☐ Shovels Flat/Round
- ☐ Hand Rake
- ☐ Sledge Hammer
- ☐ Driving Block and Cap
- ☐ Purge Pump, tubing, and buckets
- ☐ Battery
- ☐ Mini Excavator – Rental (pits deeper than 2 feet)
- ☐ Gator/ATV (as necessary
- ☐ Hand Auger (with extensions)
- ☐ 4 inch thin wall PVC (at least one foot longer than test depth)

Note: 1 test period equals 1 hour max. or until water empties out of ring, or until infiltration rate equilibrates. Total cumulative time for all tests (after presoak) must be 2 hrs or more. Contact Project manager with questions about testing. **Be prepared to run 2 to 7 tests per location.**

Procedure:

A. Set up ring (permeameter)/Pre-soak

1. Advance a 5-inch diameter soil boring to the specified test depth. Check boring log to ensure that soil at bottom of excavation is soil type to be tested.
2. Cut thin wall PVC to length (approximately 1 to 2' longer than desired test depth).
3. If necessary, use 3-inch auger to clean out bottom of test hole to remove any soils that caved in during PVC placement. Drive PVC casing an additional 2" to ensure that bottom of test hole does not extend beyond the bottom of the PVC pipe.
4. Collect initial test information using water level indicator or tape measure.
5. Determine the total depth to the bottom of the hole from top of pipe and record.
6. Determine riser height above ground and record.
7. Fill ring with approximately **12** inches of water. Be careful not to erode soil at bottom
8. ****Contact project manager after pre-soak with infiltration data.****

B. Run Test (2 to 7 test periods)

1. Readings should be no greater than 15 minutes apart. Reading interval to be based on pre-soak data. See attached data sheet.
2. For each test period, fill ring with 6 inches of water.
3. After pre-soak, run min. of 2 test periods, depending on test data. **Unless the ring runs dry in less than 10 minutes, we should collect 0.5 to 2 hours of data (after pre-soak).** That means you will be running 2 to 7 tests per location. Call project manager after 2nd test period to determine if additional test periods are necessary. **Contact Project Manager after 2 test periods**. Have infiltration data readily available.

NOT FOR BIDDING PURPOSES

Falling Head
Single Ring Infiltration Test
(Delaware)
4 inch (cased borehole)

4. Test period can be terminated after 1 hour if four successive readings (water level drops) during a test period vary by ¼ inch or less (between the highest and lowest level drops) for rates greater than 2 in/hr., or vary by 1/8 inch for rates less than 2 in/hr. Note that test periods can run longer than 1 hour. Contact Project Manager if the water level changes don't meet the listed criteria after 1 hour of testing.
5. If ring runs dry in less than 10 minutes, contact project manager.

Example Readings:

Time	Change in Time	Water Level	Level Change
1:00	N/A	6 in	N/A
1:15	15 min	4.75	**1.25** *(6-4.75)*
1:30	15 min	3.625	**1.125** *(4.75-3.625)*
1:45	15 min	2.625	**1** *(3.625-2.625)*
2:00	15 min	1.625	**1** *(2.625-1.625)*

The difference between the greatest Level Change (1.25) and the least Level Change (1.00) is 0.25 (1.25 - 1.00 = 0.25). These readings meet the test criteria since the infiltration rate was more than 2 inches per hour, so the test period can be stopped.

Time	Change in Time	Water Level	Level Change
1:00	N/A	6 in	N/A
1:15	15 min	5.625	**0.375** *(6-5.625)*
1:30	15 min	5.375	**0.25** *(5.625-5.375)*
1:45	15 min	5.25	**0.125** *(5.375-5.25)*
2:00	15 min	5.125	**0.125** *(5.25-5.125)*

The difference between the greatest Level Change (0.375) and the least Level Change (0.125) is 0.25 (0.375 - 0.125 = 0.25). These readings **do not** meet the test criteria since the infiltration rate was less than 2 inches per hour, and the difference was more than 1/8 inch (0.125), so the test must continue.

NOT FOR BIDDING PURPOSES

Falling Head
Single Ring Infiltration Test
(Delaware)
4 inch (cased borehole)

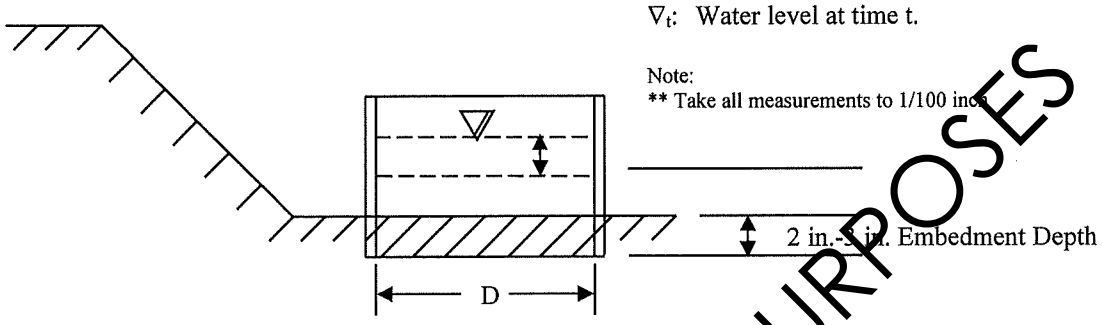
D: Diameter of Ring.

∇: Water level in infiltration Ring or Casing.

∇_i: Water level at time t=0.

∇_t: Water level at time t.

Note:
** Take all measurements to 1/100 inch



NOT FOR BIDDING PURPOSES

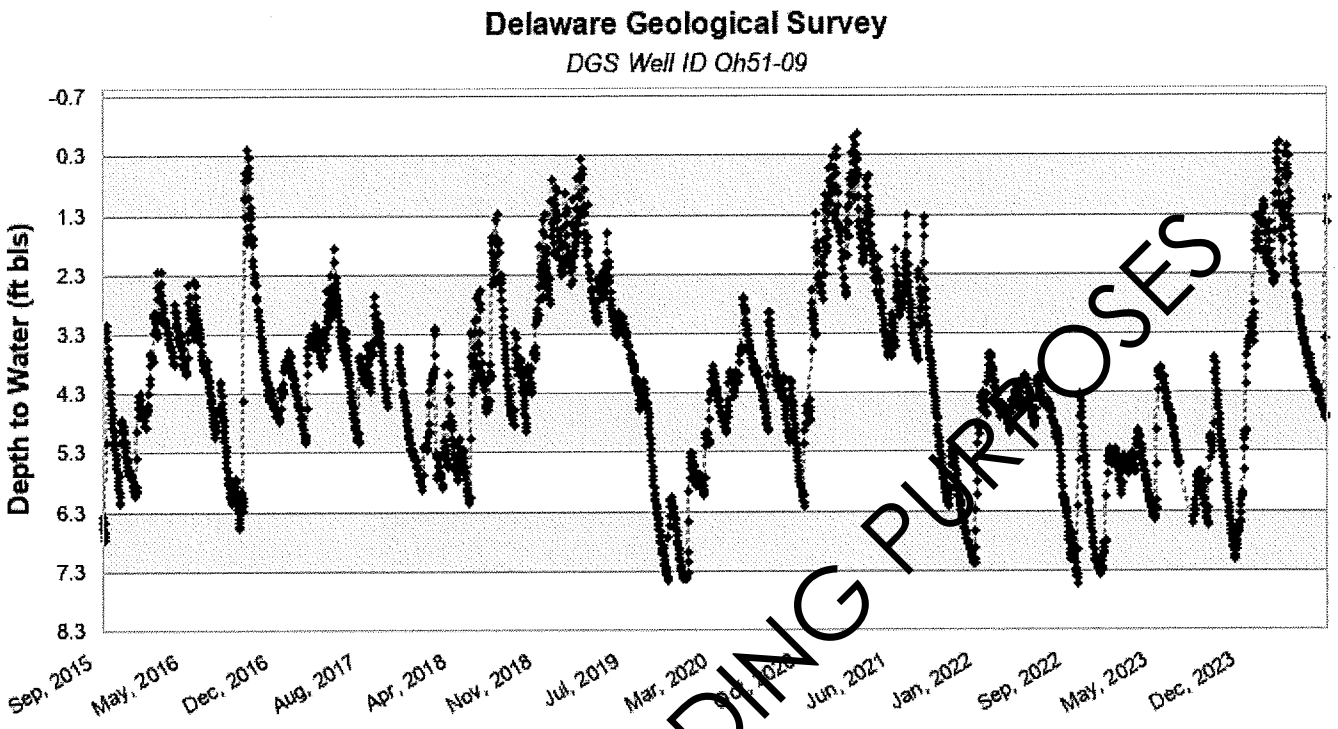
DGS Well ID Oh51-09

Print Data Download

Location: Sussex County
Easting/Northing: 478486.2, 4281188.2
Latitude/Longitude: 38.67903, -75.24734
Altitude: 34.2 ft

Drilled Date: 2015-09-24
Start Date: 2015-09-24
End Date: 2023-04-11
Number of Obs: 1969

Screen Top: 8 ft
Screen Bottom: 13 ft
Aquifer: Columbia



Created on: July 29, 2024, 10:05 am

NOT FOR BIDDING PURPOSES

Oh51-09, Note: DM=Daily Mean Waterlevel; DEST=Estimated DM water level
Water levels reported in feet below land surface datum
Created on 07-28-2024 by Delaware Geological Survey (http://www.dgs.udel.edu)
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NOT FOR BIDDING PURPOSES

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NOT FOR BIDDING PURPOSES

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07/15/2024,0818,1.46

NOT FOR BIDDING PURPOSES

DELMARVA ENVIRONMENTAL, Inc.
PO Box 117, Dagsboro, DE 19939
302-732-9858

Preliminary Site Evaluation Report

Owner's Name: State of Delaware
Owner's Address: PO Box 778
Dover, DE 778

Parcel Number: 332-6.00-1.00

Job Number: 23031

Property Location: Trap Pond
Proposed Splash Park
33587 Bald Cypress Lane
Laurel, DE 19956
(Part of approximately 560 Acres)

Evaluation Date: July 17, 2024

DNREC Environmental Navigator Information:
Watershed: Hitch Pond Branch 020801090201
Potential Floodplain: None

Potential Wetlands: None
Potential Tax Ditch Right of Ways: None

Depth to and Type of Limiting Zones Encountered:

Soil Boring NW: ~64 inches to redoximorphic features, >72 inches to free water.
Grossarenic Hapludult
Soil Boring SW: ~54 inches to redoximorphic features, >72 inches to free water.
Arenic Hapludult
Soil Boring SE: ~54 inches to redoximorphic features, >72 inches to free water.
Arenic Hapludult
Soil Boring NE: ~68 inches to redoximorphic features, >72 inches to free water.
Arenic Hapludult
Soil Boring Center: ~54 inches to redoximorphic features, >72 inches to free water.
Arenic Hapludult

Summary of Preliminary Evaluation: This evaluation was conducted to determine the type of on-site wastewater treatment and disposal system (OWTDS) suited for this property under current DNREC Regulations and policies. Soils in the evaluated area somewhat well drained based on the depth to redoximorphic features used to estimate the depth of the seasonal high water table. The purpose of this Site Evaluation is for a new OWTDS to serve a proposed Splash Park within Trap Pond State Park. This disposal system is proposed to serve the OWTDS needs for associated bathrooms and periodic system maintenance of the Splash Park. There is a nearby Septic System installed under Permit 237258 that serves the existing Nature Center including public bathrooms there.

The Web Soil Survey (NRCS, 2024) indicates that the evaluated portion of the site is potentially underlain by somewhat well drained Runclint loamy sand, 0 to 2 percent slopes (RuA) and 2 to 5 percent slopes (RuB). It is Delmarva Environmental's opinion that all soils in the vicinity of the above Soil Borings correlate to the RuB Soil Mapping Unit and the somewhat well drained Rosedale Soil Series.

The soils have slight to moderate limitations for an OWTDS related to the extent of somewhat well drained soils. The evaluated area is all wooded and slopes are irregular especially adjacent to the edge of the woods. The area in the immediate vicinity of the Soil Borings above is potentially suited for a Gravity Capping Fill or Pressure Dosed Capping Fill system. Suitabilities are provided that setback requirements under DNREC Exhibit C can be met. Field estimated permeabilities in the immediate vicinity of the Soil Borings above are moderately rapid to moderate based on sandy loam subsoils and DNREC Exhibit Y. A design rate of 30 minutes per inch is estimated for these soils.

The public well near the existing Nature Center as depicted in Septic Permit 237258 may impact the proposed disposal area.

7/24/24
Date

Ian Kaufman
License Number: 2175

NOTE: This Site Evaluation Report is a summary of the investigation conducted by Delmarva Environmental, Inc. This report is not a Site Evaluation Approval which typically, but not always, comes with this report. A Site Evaluation Approval, signed by DNREC is required to obtain a septic permit.

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Trap Pond
Write a description for your map.
Baldcypress Nature Center
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NW
NE
Center
SW
SE
P
Google Earth
Image © 2024 Airbus
N
200 ft

DELMARVA ENVIRONMENTAL, Inc.

Soil, Water, And Environmental Consulting

SOIL PROFILE NOTES

Profile #: SOIL BORING NW **Job Number:** 23031

Date of Observation: 7/17/24

Tax ID Number: 332-6.00-1.00
Project Name: TRAP POND
Location; PROPOSED SPLASH PARK

Slope: 1-3%
Relief: RECTILINEAR BACKSLOPE

Depth to Redoximorphic Features or other potential limiting factor: ~64"
Estimated Permeability based on field estimates of soil textures: ~20-30 MPI
Free water at time of observation: >72"
Soil Classification: COARSE-LOAMY, MIXED, SUBACTIVE, MESIC TYPIC HAPLUDULT

GPS Coordinates: 38.524674 °, -75.482042 °

Horizon	Depth (inches)		Moist Munsell Colors Matrix	Redoximorphic Features (RMF)	Non-RMF & Mottles	RMF or Non-RMF Colors; Quantity/Size/Contrast	Field Estimated Soil Texture	Structure Grade/Size/Type	Consistence (moist)
A	0	6	10YR3/1 10YR5/2	—	—	—	LS	0 MA	VFR
E_1	6	24	10YR7/4	—	—	—	LS	0 MA	VFR
E_2	24	40	10YR6/6	—	—	—	LS+	1M SBK	VFR
B_t	40	62	10YR5/4	—	—	—	SL	1M SBK	FR
C_1	62	64	10YR7/6	—	—	—	LS	0 MA	VFR
C_2	64	72	10YR7/3	10YR5/2 10YR7/8	—	2 F 2.5	LS	0 MA	VFR

Nomenclature and abbreviations are adapted from the *Field Book for Describing and Sampling Soils; Version 3.0* (NRCS, 2012)

Comments: WOODS

NOT FOR BIDDING PURPOSES

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DELMARVA ENVIRONMENTAL, Inc.

Soil, Water, And Environmental Consulting

SOIL PROFILE NOTES

Profile #: Soil Boring SW **Job Number:** 23031

Date of Observation: 7/14/24

Tax ID Number: 332-6.00-1.00
Project Name: TRAP POND
Location; PROPOSED SPLASH PARK

Slope: 0-2%
Relief: IRREGULAR

Depth to Redoximorphic Features or other potential limiting factor: ~54"
Estimated Permeability based on field estimates of soil textures: ~20-30 MPI
Free water at time of observation: >72"
Soil Classification: ARENIC HAPLAQUULT

GPS Coordinates: 38.524439 °, -75.48014 °

Horizon	Depth (Inches)		Moist Munsell Colors Matrix	Redoximorphic Features (RMF)	Non-RMF & Mottles	RMF or Non-RMF Colors; Quantity/Size/Contrast	Field Estimated Soil Texture	Structure Grade/Size/Type	Consistence (moist)
A	0	6	10YR4/2 10YR5/1	—	—	—	LS	0 MA	VFR
E1	6	24	10YR6/4	—	—	—	LS	0 MA	VFR
E2	24	32	10YR7/4	—	—	—	LS+	0 MA	VFR
Bt	32	48	10YR6/4	—	—	—	SL-	1 M SBK	FR
C1	48	54	10YR7/4	—	—	—	LS	0 MA	VFR
C2	54	64	10YR7/4	10YR8/2 10YR 7/8	—	C 2 F F 2 D	LS	0 MA	VFR
C3	64	72	10YR 8/2	10YR7/8	10YR 8/3	C 3 F C 2 D	LS	0 MA	VFR

Nomenclature and abbreviations are adapted from the *Field Book for Describing and Sampling Soils; Version 3.0* (NRCS, 2012)

Comments:

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DELMARVA ENVIRONMENTAL, Inc.

Soil, Water, And Environmental Consulting

SOIL PROFILE NOTES

Profile #: SOIL BORING SE **Job Number:** 23031

Date of Observation: 7/17/24

Tax ID Number: 332-600-1.00
Project Name: TRAP POND
Location; PROPOSED SPLASH PARK

Slope: 0-1%
Relief: NEARLY LEVEL

Depth to Redoximorphic Features or other potential limiting factor: ~54"
Estimated Permeability based on field estimates of soil textures: ~20-30 MPI
Free water at time of observation: >72"
Soil Classification: ARENIC HAPLUDULT

GPS Coordinates: 38.524438 °, -75.479973 ° (GARMIN GPSMAP 66s)

Horizon	Depth (inches)		Moist Munsell Colors Matrix	Redoximorphic Features (RMF)	Non-RMF & Mottles	RMF or Non-RMF Colors; Quantity/Size/Contrast	Field Estimated Soil Texture	Structure Grade/Size/Type	Consistence (moist)
A	0	6	10YR5/1	—	—	—	LS	0 MA	VFR
E1	6	16	10YR6/6	—	—	—	LS	0 MA	VFR
E2	16	28	10YR6/6	—	—	—	LS	0 MA	VFR
Bt	28	40	10YR5/4	—	—	—	SL	1 MSBK	FR
C1	40	54	10YR7/4	—	10YR5/6	C 2 D	LS	0 MA	VFR
C2	54	72	10YR7/4	10YR5/2	10YR5/6	C 2 F D	LS	0 MA	VFR

Nomenclature and abbreviations are adapted from the *Field Book for Describing and Sampling Soils; Version 3.0* (NRCS, 2012)

Comments: WOODS

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DELMARVA ENVIRONMENTAL, Inc.

Soil, Water, And Environmental Consulting

SOIL PROFILE NOTES

Profile #: Soil Boring NE **Job Number:** 23031

Date of Observation: 7/17/24

Tax ID Number: 332-6.00-1.00
Project Name: FLAP POND
Location; PROPOSED SPLASH PARK

Slope: 1-3%
Relief: BACKSLOPE

Depth to Redoximorphic Features or other potential limiting factor: ~68"
Estimated Permeability based on field estimates of soil textures: ~20-30 MPI
Free water at time of observation: >72"
Soil Classification: ARENIC HAPLUDULT

GPS Coordinates: 38.524668 °, -75.477702 ° (GARMIN GPSMAP 66s)

Horizon	Depth (inches)		Moist Munsell Colors Matrix	Redoximorphic Features (RMF)	Non-RMF & Mottles	RMF or Non-RMF Colors; Quantity/Size/Contrast	Field Estimated Soil Texture	Structure Grade/Size/Type	Consistence (moist)
A	0	6	10YR5/1	—	—	—	LS	0 MA	VFR
E1	6	16	10YR6/6	—	—	—	LS	0 MA	VFR
E2	16	28	10YR7/6	—	—	—	LS	0 MA	VFR
Bw	28	38	10YR6/6	—	—	—	LS	1 M SBK	VFR
Bt	38	48	10YR5/6	—	—	—	SL	1 M SBK	FR
C1	48	68	10YR7/6	—	10YR5/6	C 2 D	LS	0 MA	VFR
C2	68	72	10YR7/6	10YR5/2	10YR5/6	C 2 F C 2 D	LS	0 MA	VFR

Nomenclature and abbreviations are adapted from the *Field Book for Describing and Sampling Soils; Version 3.0* (NRCS, 2012)

Comments: WOODS

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DELMARVA ENVIRONMENTAL, Inc.

Soil, Water, And Environmental Consulting

SOIL PROFILE NOTES

Profile #: Soil Boring Center **Job Number:** 23031

Date of Observation: 7/17/24

Tax ID Number: 332-6.00-1.00
Project Name: TRAP POND
Location; SPLASH PARK

Slope: 0-1%
Relief: NEARLY LEVEL

Depth to Redoximorphic Features or other potential limiting factor: 25+"
Estimated Permeability based on field estimates of soil textures: ~20-30 MPI
Free water at time of observation: >72"
Soil Classification: ARENIC HAPLAQUOLT

GPS Coordinates: 38.584556 °, -76.474258 °

Horizon	Depth (inches)		Moist Munsell Colors Matrix	Redoximorphic Features (RMF)	Non-RMF & Mottles	RMF or Non-RMF Colors; Quantity/Size/Contrast	Field Estimated Soil Texture	Structure Grade/Size/Type	Consistence (moist)
A	0	7	10YR 5/1	—	—	—	LS	0 MA	VFR
AE	7	11	10YR 6/3 10YR 6/4	—	—	—	LS	0 MA	VFR
E	11	30	10YR 7/1	—	—	—	LS	0 MA	VFR
Bt	30	44	illegible	—	—	—	SL	1 M SBK	FR
C1	44	54	10YR 7/6	—	—	—	LS	0 MA	VFR
C2	54	68	10YR 7/6	10YR 8/2 10YR 7/6	—	C 3 P	LS	0 MA	VFR
C3	68	72	10YR 7/1	+	—		LS	0 MA	VFR

Nomenclature and abbreviations are adapted from the *Field Book for Describing and Sampling Soils; Version 3.0* (NRCS, 2012)

Comments:

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Trap Pond
State Park
Baldcypress
Nature Center
Existing septic field.
American Holly Trail
Location of proposed
septic system.
NOT FOR BIDDING PURPOSES
Loblolly Rd
Loblolly Rd
Loblolly Rd
P
Google

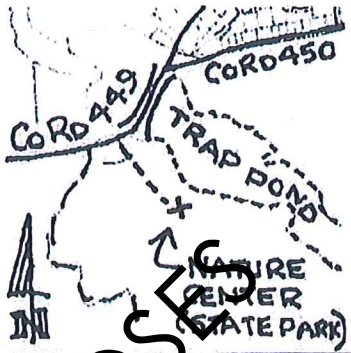
- SITE PLAN & CROSS SECTION -

(INDICATE DIRECTION OF NORTH & SCALE OF SITE PLAN)

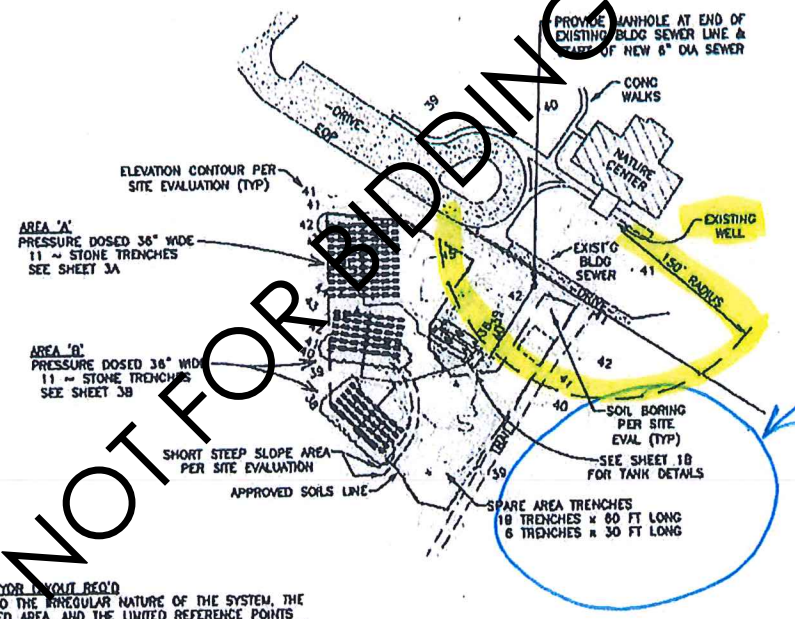
SEE SHEET 1 ATTACHED FOR PLOT PLAN DETAILS

PERMIT 237258

Draw a general location map of project location and give distance to nearest road junction



NATURE CENTER
MAX DAILY FLOW ... 13,720 (SINGLE ANNUAL EVENT)
TYPICAL DAILY FLOWS VARY BETWEEN 495 GPD & 1,370 GPD



NOTE
ADJACENT LANDS ARE LANDS OF TRAP POND STATE PARK - NO OTHER WELLS ARE WITHIN 150 FT OF THE PROPOSED SEPTIC SYSTEM

SPLASH PARK EVALUATED AREA

SURVEYOR LAYOUT REQ'D
DUE TO THE IRREGULAR NATURE OF THE SYSTEM, THE WOODED AREA, AND THE LIMITED REFERENCE POINTS AVAILABLE IT WILL BE NECESSARY FOR A SURVEYOR TO LAYOUT THE LOCATIONS FOR THE TANKS & DRAINFIELD TRENCHES. (SEE SHEET 1A FOR LOCATING DIMENSIONS)

THE SURVEYOR WILL NEED TO LAYOUT THE AREA WHERE TREES NEED TO BE REMOVED FOR INSTALLATION OF THE SYSTEM (AFTER CONSULTATION WITH THE SELECTED SYSTEM INSTALLATION CONTRACTOR). TREES TO BE REMOVED INCLUDE:
- TREES WITHIN 10' OF DISPOSAL TRENCHES
- TREES IN THE AREA OF THE SEPTIC & DOSING TANKS
- TREES NECESSARY TO CONTRACTOR TO ACCESS THE AREA TO PERFORM THEIR WORK

OWNER'S / AUTHORIZED AGENT SIGNATURE _____ DATE 28 MAY 2018

* A copy of this page must be submitted with both the septic and well completion reports

NOT FOR BIDDING PURPOSES

332-6.00-1.00 - DNREC NavMap



7/24/2024, 1:54:06 PM

Non-Public Wells
- Domestic - Standard
- Observation - Standard
- Agricultural - Standard
- Irrigation - Standard
- Soil Borings - Standard

Septic Soil Borings
HUC 12
2017 Wetlands (not regulatory)
FEMA Flood Maps
AE
X, 0.2 PCT ANNUAL CHANCE FLOOD HAZARD
State Parcels

1:2,257

0 0.02 0.04 0.07 mi

0 0.03 0.06 0.11 km

Wetland mapping is supported with funding provided by the Environmental Protection Agency.
U.S. Geological Survey
Maxar, Microsoft
FEMA

Department of Natural Resources and Environmental Control

Search

Map Unit Legend

Sussex County, Delaware (DE005)

Sussex County, Delaware (DE005)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
RuA	Runclint loamy sand, 0 to 2 percent slopes	0.5	55.1%
RuB	Runclint loamy sand, 2 to 5 percent slopes	0.4	44.9%
Totals for Area of Interest		**0.9**	**100.0%**

Soil Map

Scale (not to scale)



Warning: Soil Map may not be valid at this scale.

Sussex County, Delaware

RuB—Runclint loamy sand, 2 to 5 percent slopes

Map Unit Setting

National map unit symbol: 1qtk1
Elevation: 0 to 120 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 58 degrees F
Frost-free period: 180 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Runclint and similar soils: 75 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Runclint

Setting

Landform: Knolls, dunes, fluviomarine terraces, flats
Landform position (three-dimensional): Rise
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Parent material: Sandy eolian deposits and/or fluviomarine sediments

Typical profile

Ap - 0 to 9 inches: loamy sand
E - 9 to 22 inches: sand
Bw - 22 to 39 inches: sand
BC - 39 to 59 inches: sand
2C - 59 to 80 inches: loamy coarse sand

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to very high (0.57 to 19.98 in/hr)
Depth to water table: About 40 to 72 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.5 inches)

Interpretive groups

Land capability classification (irrigated): 3s
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A

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Ecological site: F153DY170NJ - Sandy, Excessively Drained Upland
Hydric soil rating: No

Minor Components

Evesboro
Percent of map unit: 10 percent
Landform: Flats
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F153DY170NJ - Sandy, Excessively Drained Upland
Hydric soil rating: No

Galloway
Percent of map unit: 5 percent
Landform: Flats, depressions
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Ecological site: F153DY150NJ - Moist Sandy Upland
Hydric soil rating: No

Hurlock, drained
Percent of map unit: 5 percent
Landform: Flats, depressions, swales
Landform position (three-dimensional): Dip
Down-slope shape: Linear, concave
Across-slope shape: Linear, concave
Ecological site: F149AY090NJ - Coastal Plain Hardwood Swamp
Hydric soil rating: Yes

Klej
Percent of map unit: 5 percent
Landform: Depressions, flats
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Ecological site: F153DY150NJ - Moist Sandy Upland
Hydric soil rating: No

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Data Source Information

Soil Survey Area: Sussex County, Delaware
Survey Area Data: Version 24, Sep 12, 2023

PARID: 332-6.00-1.00
DELAWARE STATE OF

33587 BALD CYPRESS LN

Property Information

Property Location:	33587 BALD CYPRESS LN
Unit:	
City:	LAUREL
State:	DE
Zip:	19956
Class:	EXM-Exempt
Use Code (LUC):	ST-STATE GOVERNMENT
Town	00-None
Tax District:	332 – LITTLE CREEK
School District:	2 - LAUREL
Fire District:	81-Laurel
Deeded Acres:	560.0000
Frontage:	0
Depth:	.000
Irr Lot:	
Plot Book Page:	/PB
100% Land Value:	$24,600
100% Improvement Value	$221,300
100% Total Value	$245,900

Legal

Legal Description	N/RT 72 60450

Owners

Owner	Co-owner	Address	City	State	Zip
DELAWARE STATE OF		PO BOX 778	DOVER	DE	19903

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JOHN D. HYNES & ASSOCIATES, INC.

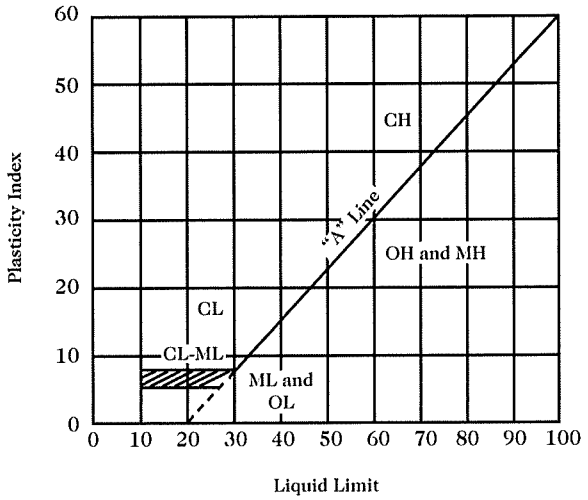
Geotechnical and Environmental Consultants
Monitoring Well Installation
Construction Inspection and Materials Testing

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions			*Group Symbols*	*Typical Names*	*Laboratory Classification Criteria*	
Coarse-grained soils (More than half of material is larger than No 200 sieve size)	Gravels (More than half of coarse fraction is larger than No 4 sieve size)	Clean gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})_2}{D_{10} \times D_{60}}$ between 1 and 3	
			GP	Poorly graded gravels, gravel sand mixtures, little or no fines	Not meeting all graduation requirements for GW	
		Gravels with fines (Appreciable amount of fines)	GM[a] d u	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures	Atterberg limits above "A" line with P.I. greater than 7	
	Sands (More than half of coarse fraction is smaller than No 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands,	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})_2}{D_{10} \times D_{60}}$ between 1 and 3	
			SP	Poorly graded sands, gravelly sands, little or no fines	Not meeting all graduation requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM[a] d u	Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are *borderline* cases requiring use of dual symbols.
			SC	Clayey sands, sand-clay mixtures	Atterberg limits above "A" line with P.I. greater than 7	
Fine-grained soils (More than half material is smaller than No 200 sieve)	Silts and clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity		
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays		
			OL	Organic silts and organic silty clays of low plasticity		
	Silts and clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts		
			CH	Inorganic clays of high plasticity, fat clays		
			OH	Organic clays of medium to high plasticity, organic silts		
	Highly organic soils		Pt	Peat and other highly organic soils		

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No 200 sieve size), coarse grained soils are classified as follows:

Less than 5 percent	GW, GP, SW, SP
More than 12 percent	GM, GC, SM, SC
5 to 12 percent	*Borderline cases requiring dual symbols*[c]



NOT FOR BIDDING PURPOSES

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E-mail - jdh@jdhynesinc.com

HYNES

FIELD CLASSIFICATION SYSTEM FOR SOIL EXPLORATION

NON-COHESIVE SOILS
(Silt, Sand, Gravel and Combinations)

DENSITY

Very Loose	- 5 blows/ft. or less
Loose	- 6 to 10 blows/ft.
Medium Dense	- 11 to 30 blows/ft.
Dense	- 31 to 50 blows/ft.
Very Dense	- 51 blows/ft. or more

RELATIVE PROPORTIONS

Descriptive Term	Percent
Trace	1 - 10
Little	11 - 20
Some	21 - 35
And	36 - 50

PARTICLE SIZE IDENTIFICATION

Boulders	- 8 inch diameter or more
Cobbles	- 3 to 8 inch diameter
Gravel	- Coarse - 1 to 3 inch
	- Medium - 1/2 to 1 inch
	- Fine - 4.75 mm to 1/2 inch
Sand	- Coarse - 2.0 mm to 4.75 mm
	- Medium - 0.425 mm to 2.0 mm
	- Fine - 0.075 mm to 0.425 mm
Silt	- 0.075 mm to 0.002 mm

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COHESIVE SOILS
(Clay, Silt and Combinations)

CONSISTENCY

Very Soft	- 3 blows/ft. or less
Soft	- 4 to 5 blows/ft.
Medium Stiff	- 6 to 10 blows/ft.
Stiff	- 11 to 15 blows/ft.
Very Stiff	- 16 to 30 blows/ft.
Hard	- 31 blows/ft. or more

PLASTICITY

Degree of Plasticity	Plasticity Index
None to Slight	0 - 4
Slight	5 - 7
Medium	8 - 22
High to Very High	over 22

Classification on logs are made by visual inspection of samples unless a sample has been subjected to laboratory classification testing.

Standard Penetration Test - Driving a 2.0" O.D., 1-3/8" I.D., splitspoon sampler a distance of 1.0 foot into undisturbed soil with a 140 pound hammer free falling a distance of 30.0 inches. It is customary to drive the spoon 6 inches to seat into undisturbed soil, then perform the test. The number of hammer blows for seating the spoon and making the test are recorded for each 6 inches of penetration on the drill log (Example - 6/8/9). The standard penetration test value (N - value) can be obtained by adding the last two figures (i.e. 8 + 9 = 17 blows/ft.). (ASTM D-1586)

Strata Changes - In the column "Soil Descriptions," on the drill log, the horizontal lines represent strata changes. A solid line (—) represents an actually observed change, a dashed line (----) represents an estimated change.

Groundwater - Observations were made at the times indicated. Porosity of soil strata, weather conditions, site topography, etc. may cause changes in the water levels indicated on the logs.

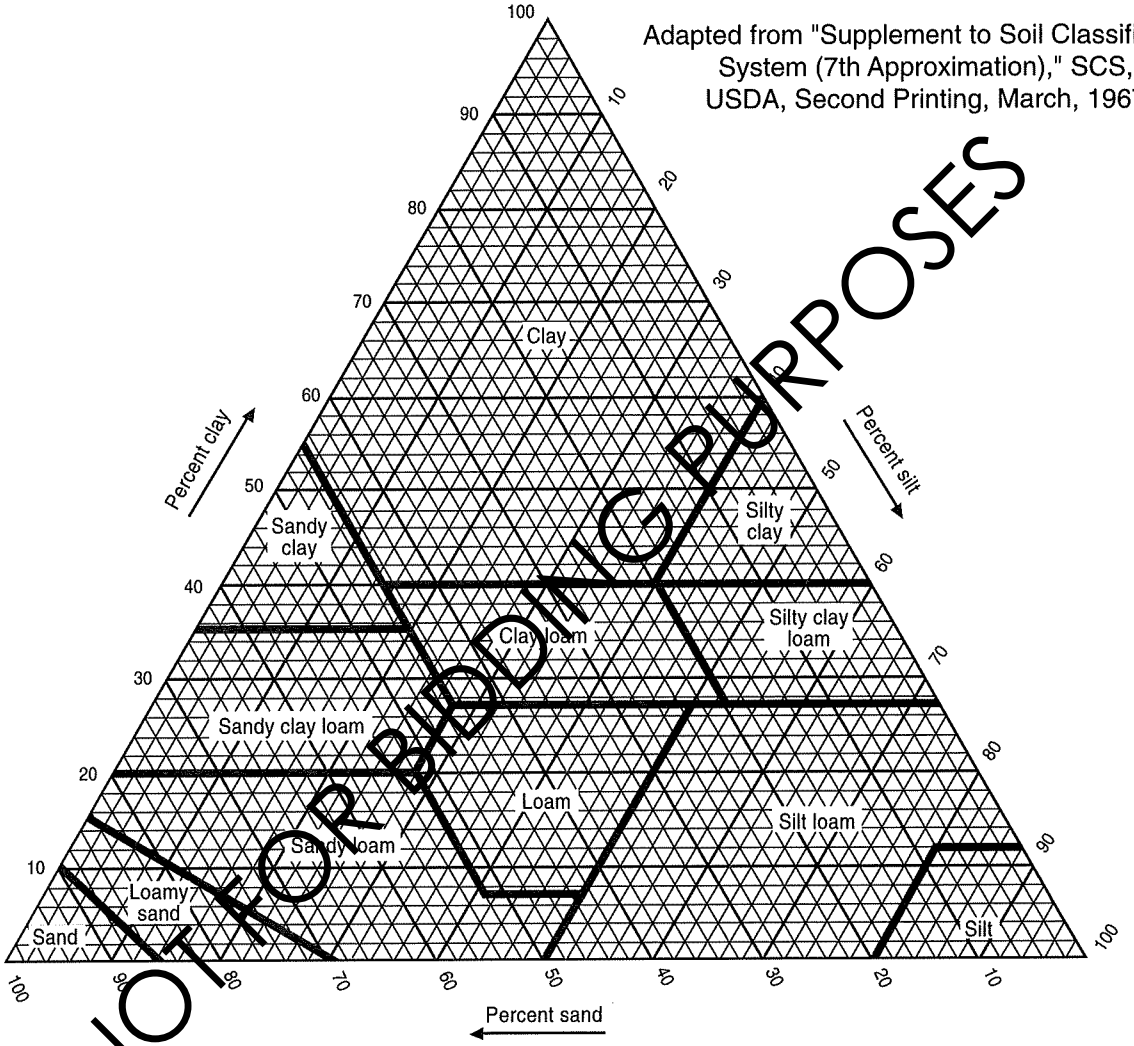
32185 Beaver Run Drive • Salisbury, Maryland 21804
410-546-6462 • Fax 410-548-5346

HYNES

USDA SOIL CLASSIFICATION SYSTEM

Adapted from "Supplement to Soil Classification System (7th Approximation)," SCS, USDA, Second Printing, March, 1967

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COMPARISON OF PARTICLE - SIZE SCALES

Sieve Openings in Inches — U.S. Standard Sieve Numbers

3 2 1½ 1 ¾ ½ ⅜ 4 10 20 40 60 200

USDA	GRAVEL	SAND					SILT	CLAY
		Very Coarse	Coarse	Medium	Fine	Very Fine		

UNIFIED	GRAVEL		SAND			SILT OR CLAY
	Coarse	Fine	Coarse	Medium	Fine	

AASHTO	GRAVEL OR STONE			SAND		SILT OR CLAY	
	Coarse	Medium	Fine	Coarse	Fine	Silt	Clay

100 50 10 5 2 1 0.5 0.42 0.25 0.1 0.074 0.05 0.02 0.01 0.005 0.002 0.001

Grain Size in Millimeters

Soil triangle of the basic soil textural classes. (U.S. Soil Conservation Service.) 288-D-2782.

☐ *Main Office* - 32185 Beaver Run Drive • Salisbury, Maryland 21804 • 410-546-6462 • Fax 410-548-5346
E-mail Salisbury jdhynes@aol.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 <u>not</u> 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 the 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 <u>Not</u> 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 <u>not</u> 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 <u>not</u> building-envelope or mold specialists.***

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SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 GENERAL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Miscellaneous wood nailers, furring, and grounds.

1.2 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

B. AWPA U1 - Use Category System: User Specification for Treated Wood.

C. PS 20 - American Softwood Lumber Standard.

1.3 SUBMITTALS

A. Product Data: Provide technical data on products used..

B. PS 20 - American Softwood Lumber Standard.

1.4 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.

2.2 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.

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2. Anchors: Expansion shield and lag bolt type for anchorage to solid masonry or concrete.

2.3 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

PART 3 EXECUTION

3.1 PREPARATION

A. Coordinate installation of rough carpentry members specified in other sections.

3.2 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.3 TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

3.4 CLEANING

A. Waste Disposal: Comply with the requirements of 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 any wood, shavings, sawdust, etc. on the ground or buried in fill.

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C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

PART 3 EXECUTION

5.1 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

5.2 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 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.

C. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

5.3 CLEANING

A. Waste Disposal: See Section 01 74 19 - Construction Waste Management and Disposal.

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 41 00 - ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Countertops.

C. Cabinet hardware.

1.2 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2009.

B. BHMA A156.9 - American National Standard for Cabinet Hardware; Builders Hardware Manufacturers Association; 2010 (ANSI/BHMA A156.9).

C. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association; 2005.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.4 SUBMITTALS

A. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

1. Minimum Scale of Detail Drawings: 1-1/2 inch to 1 foot.

2. Provide the information required by AWI/AWMAC/WI Architectural Woodwork Standards.

3. Include certification program label.

B. Product Data: Provide data for hardware accessories.

C. Samples: Submit actual samples of architectural cabinet construction, minimum 8 inches square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.

D. Manufacturer's installation instructions.

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1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.

2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.7 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.1 CABINETS

A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI//AWMAC/WI Architectural Woodwork Standards for Custom Grade.

B. Plastic Laminate Faced Cabinets: Custom grade.

2.2 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.3 LAMINATE MATERIALS

A. Manufacturers:

1. Formica Corporation: www.formica.com.

2. Panolam Industries International, Inc\Nevamar: www.nevamar.com.

3. Wilsonart International, Inc: www.wilsonart.com.

B. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.

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C. Provide specific types as follows:

1. Horizontal Surfaces: HGL, 0.039 inch nominal thickness, through color, colors as scheduled, textured, low gloss finish.

2. Vertical Surfaces: VGL, 0.020 inch nominal thickness, through color, colors as scheduled, matte finish.

3. Cabinet Liner: CLS, 0.020 inch nominal thickness, through color, colors as scheduled, textured, low gloss finish.

2.4 COUNTERTOPS

A. Solid Surface: Acrylic resins, fire-retardant mineral fillers, and proprietary agents with through-the-body color for the full thickness of the sheet material.

1. Basis of Design: Corian Solid Surface

2. Material Thickness

a. Countertop: 1/2 inch

b. Backsplash: 3/4 inch

3. Provide continuous, loose backsplashes to be installed in field.

B. Plywood for Supporting Substrate

1. PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.

a. Contains no added urea formaldehyde resins.

2.5 ACCESSORIES

A. Adhesive: Type recommended by AWI/AWMAC to suit application.

B. Plastic Edge Banding: Extruded PVC, flat shaped; smooth finish; self locking serrated tongue; of width to match component thickness.

1. Color: As selected by Engineer from manufacturer's full range.

C. Fasteners: Size and type to suit application.

D. Concealed Joint Fasteners: Threaded steel.

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E. Grommets: Standard painted metal grommets for cut-outs, in color to match adjacent surface.

2.6 HARDWARE

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.

B. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, satin chrome finish, for nominal 1 inch spacing adjustments.

C. Drawer and Door Pulls: "U" shaped wire pull, steel with satin finish, 4 inch centers.

D. Sliding Door Pulls: Circular shape for recessed installation, steel with satin finish.

E. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with satin finish. Provide where indicated on drawings.

F. Catches: Magnetic.

G. Drawer Slides:

1. Type: Full extension.
2. Static Load Capacity: Commercial grade.
3. Mounting: Side mounted.
4. Stops: Integral type.

H. Hinges: European style concealed self-closing type, steel with satin finish.

2.7 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises.

1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.

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D. Solid Surface:

1. Fabricate components in shop in sizes and shapes indicated according to approved shop drawings and manufacturer's fabrication requirements.

2. Form joint seams between solid surface components with manufacuturer's seam adhesive. Completed joints inconspicuous in appearance and without voids. Provide joint reinforced if required by manufacturer for particular installation conditions.

3. Provide holes and cutouts indicated on approved shop drawings. Rout cutouts and complete by sanding all edges smooth.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

3.2 INSTALLATION

A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level. Use concealed shims where necessary.

B. Use fixture attachments in concealed locations for wall mounted components.

1. Fasten wall cabinets through back, near top, at not less than 16 inches on center.

C. Use concealed joint fasteners to align and secure adjoining cabinet units.

D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

1. Where indicated on Drawings, fasten together cabinets in continuous runs, with joints flush, uniform, and tight. Misalignment of adjacent units not to exceed 1/16 inch. In addition, do not exceed the following tolerances:

a. Variation of tops of base cabinets from level: 1/16 inch in 10 feet.

b. Variation of bottoms of wall cabinets from level: 1/8 inch in 10 feet.

c. Variation of faces of cabinets from a true plane: 1/8 inch in 10 feet.

d. Variation of adjacent surfaces from a true plane (lippage): 1/32 inch.

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e. Variation in alignment of adjacent door and drawer edges: 1/16 inch.

E. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

F. Install hardware uniformly and precisely. Set hinges snug and flat in mortises, unless otherwise indicated. Adjust and align hardware so moving parts operate freely and contact points meet accurately. Allow for final adjustment after installation.

G. Adjust casework and hardware so doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

H. Countertops: Install countertops intended and furnished for field installation in one true plane, with ends abutting at hairline joints, and no raised edges.

1. Field jointing: Minimize field jointing where necessary. Make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.

2. Secure field joints in plastic-laminate countertops with concealed clamping devices located within 6 inches (150 mm) of front and back edges and at intervals not exceeding 24 inches (600 mm). Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.

3. Secure tops to cabinets or supports with Z-type fasteners or equivalent, using two or more fasteners at each front, end, and back.

4. Secure backsplashes where indicated to tops with concealed metal brackets at 16 inches (400 mm) o.c. and walls with adhesive.

5. Seal junctures of top, splash, and walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

I. Shelving: Securely fasten adjustable shelving supports to partition framing, wood blocking, or reinforcements in partitions.

J. Install shelf standards plumb and at heights to align shelf brackets for level shelves. Install shelving level and straight, closely fitted to other work where indicated.

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3.3 ADJUSTING

A. Adjust installed work.

B. Adjust moving or operating parts to function smoothly and correctly.

3.4 COORDINATION

A. Provide cutouts for plumbing fixtures. Dimensions of cutouts shall be provided by the Contractor based on approved plumbing fixture submittals.

B. Provide cutouts, and other requirements, for electrical connections.

C. Verify locations of all cutouts based on field conditions.

3.5 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

3.6 PROTECTION

A. Do not permit finished casework to be exposed to continued construction activity.

B. Protect casework and countertops from ongoing construction activities. Prevent workmen from standing on, or storing tools and materials on casework and countertops.

C. Repair damage, including to finishes, that occurs prior to Date of Substantial Completion, using methods prescribed by manufacturer; replace units that cannot be repaired to like-new condition.

END OF SECTION 06 41 00

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SECTION 08 16 13 - FIBERGLASS DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fiberglass doors.

B. Fiberglass door frames.

1.2 REFERENCE STANDARDS

A. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors.

B. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Obtain hardware templates from hardware manufacturer prior to starting fabrication.

1.4 SUBMITTALS

A. Product Data: Provide manufacturer's standard details, installation instructions, hardware and anchor recommendations.

B. Shop Drawings: Indicate layout and profiles; include assembly methods.

1. Indicate product components, including hardware reinforcement locations and preparations, accessories, finish colors, patterns, and textures.

2. Indicate wall conditions, door and frame elevations, sections, materials, gauges, finishes, location of door hardware by dimension, and details of openings; use same reference numbers indicated on drawings to identify details and openings.

C. Selection Samples: Submit two complete sets of color chips, illustrating manufacturer's available finishes, colors, and textures.

D. Verification Samples: Submit door surface samples for each finish specified, 10 inches by 10 inches in size, illustrating finishes, colors, and textures.

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E. Door Corner Sample: Submit corner cross sections, 10 inches by 10 inches in size, illustrating construction, finish, color, and texture.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

H. Specimen warranty.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer’s original, unopened, undamaged containers with identification labels intact.

B. Store materials in original packaging, under cover, protected from exposure to harmful weather conditions and from direct contact with water.

1. Store at temperature and humidity conditions recommended by manufacturer.

2. Do not use non-vented plastic or canvas shelters.

3. Immediately remove wet wrappers.

C. Store in position recommended by manufacturer, elevated minimum 4 inches above grade, with minimum 1/4 inch space between doors.

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1.7 FIELD CONDITIONS

A. Do not install doors until structure is enclosed.

B. Maintain temperature and humidity at manufacturer's recommended levels during and after installation of doors.

1.8 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 5-year manufacturer warranty covering materials and workmanship, including degradation or failure due to chemical contact. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Molded Fiberglass Doors:

1. Special-Lite: https://special-lite.com.
2. ChemPruf Door Company, Ltd: www.chem-pruf.com/#slc.
3. Or approved equal.

2.2 DOOR AND FRAME ASSEMBLIES

A. Door and Frame Assemblies: Factory-fabricated, prepared and machined for hardware.

1. Physical Endurance: Swinging door cycle test to ANSI/SDI A250.4, Level A (1,000,000 cycles) minimum; tested with hardware and fasteners intended for use on project.
2. Screw-Holding Capacity: Tested to 890 pounds, minimum.
3. Surface Burning Characteristics: Flame spread index (FSI) of 0 to 25, Class A, and smoke developed index (SDI) of 450 or less, when tested in accordance with ASTM E84.
4. Flammability: Self-extinguishing when tested in accordance with ASTM D635.
5. Sizes: As indicated on drawings.
6. Clearance Between Door and Frame: 1/8 inch, maximum.
7. Clearance Between Bottom of Door and Finished Floor: 3/4 inch, maximum; not less than 1/4 inch clearance to threshold.
8. Provide frame anchors that allow for variation in rough opening size; field cutting of doors or frames to fit is not permitted.

2.3 COMPONENTS

A. Doors: Fiberglass construction with reinforced core.

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1. Type: As indicated on drawings, including swinging doors.
2. Thickness: 1-3/4 inch, nominal.
3. Core Material: Manufacturer's standard core material for application indicated.
4. Construction:
   a. Molded in one piece including through color gel coating on each side; manufacturer's standard subframe, core and faces fused during curing; hardware reinforcements.
5. Face Sheet Texture: Smooth.
6. Door Panel Configuration: As indicated on drawings.
7. Subframe and Reinforcements: Manufacturer's standard materials.
8. Waterproof Integrity: Provide factory fabricated edges, cut-outs, and hardware preparations of fiberglass reinforced plastic (FRP); provide cut-outs with joints sealed independently of glazing, louver inserts, or trim.
9. Hardware Preparations: Factory reinforce, machine, and prepare for door hardware including field installed items; provide solid blocking for each item; field cutting, drilling or tapping is not permitted; obtain manufacturer's hardware templates for preparation as necessary.

B. Door Frames: Provide type in compliance with performance requirements specified for doors.
1. Type: Factory assembled with chemically welded joints.
2. Profiles: As indicated on drawings.
3. Corner Joints: Mitered with concealed corner blocks or angles of same material as frame; fiberglass and aluminum joined with screws; steel and stainless steel spot welded; sealed watertight with silicone sealant.
4. Hardware Cut-outs: Provide continuous backing or mortar guards of same material as frame, with watertight seal.
5. Frame Anchors: Stainless steel, Type 304; provide three anchors in each jamb for heights up to 84 inches with one additional anchor for each additional 24 inches in height.

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6. Reinforcing: Provide manufacturer's standard reinforcing at hinge, strike, and closer locations.

2.4 FINISHES

A. Gel Coating: Ultraviolet (UV) stabilized polyester finish.

1. Thickness: Minimum 15 mils, 0.015 inch wet thickness, plus/minus 3 mils, 0.003 inch.

2. Color: As selected by Engineer from manufacturer's standard line of colors.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify actual dimensions of openings by field measurements before door fabrication; show recorded measurements on shop drawings.

B. Do not begin installation until substrates have been properly prepared.

3.2 PREPARATION

A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

B. Clean and prepare substrate in accordance with manufacturer's directions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions; do not penetrate frames with anchors.

B. Install door hardware as specified in Section 08 71 00.

C. Set units plumb, level, and true-to-line, without warping or racking doors, and with specified clearances; anchor in place.

D. In stud walls, install frames prior to building walls; anchor frames to studs using concealed anchors.

E. Separate aluminum and other metal surfaces from sources of corrosion of electrolytic action at points of contact with other materials.

NOT FOR BIDDING PURPOSES

3.4 ADJUSTING

A. Lubricate, test, and adjust doors to operate easily, free from warp, twist or distortion, and to fit watertight for entire perimeter.

B. Adjust hardware for smooth and quiet operation.

C. Adjust doors to fit snugly and close without sticking or binding.

END OF SECTION 08 16 13

NOT FOR BIDDING PURPOSES

SECTION 08 71 00 - DOOR HARDWARE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Hardware for fiberglass doors.

1.2 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.

B. BHMA A156.1 - American National Standard for Butts and Hinges.

C. BHMA A156.4 - American National Standard for Door Controls - Closers.

D. BHMA A156.7 - American National Standard for Template Hinge Dimensions.

E. BHMA A156.8 - American National Standard for Door Controls - Overhead Stops and Holders.

F. BHMA A156.13 - American National Standard for Mortise Locks & Latches Series 1000.

G. BHMA A156.16 - American National Standard for Auxiliary Hardware.

H. BHMA A156.18 - American National Standard for Materials and Finishes.

I. BHMA A156.20 - American National Standard for Strap and Tee Hinges, and Hasps.

J. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames.

K. ICC A117.1 - Accessible and Usable Buildings and Facilities.

L. UL (DIR) - Online Certifications Directory.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware will be installed upon.

B. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

NOT FOR BIDDING PURPOSES

C. Convey Owner's keying requirements to manufacturers.

1.4 SUBMITTALS

A. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project.

B. Hardware Schedule: Detailed listing of each item of hardware to be installed on each door. Use door numbering scheme as included in the Contract Documents. Identify electrically operated items and include power requirements.

C. Keying Schedule: Submit for approval of Engineer.

D. Keys: Deliver with identifying tags to Engineer by security shipment direct from hardware supplier.

E. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.

1. Tools: One set of all special wrenches or tools applicable to each different or special hardware component, whether supplied by the hardware component manufacturer or not.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Hardware Supplier Qualifications: Company specializing in supplying the type of products specified in this section with at least three years documented experience.

1.6 WARRANTY

A. Provide five year warranty for door closers.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Allegion Brands, Ives, LCN, Schlage, Steelcraft, or Von Duprin; ____: www.allegion.com/us.

B. Assa Abloy Brands, Corbin Russwin, Curries, McKinney, Norton, Sargent, or Yale; ____: www.assaabloydss.com.

NOT FOR BIDDING PURPOSES

C. Best Access Systems, division of Stanley Security Solutions; ____: www.bestaccess.com.

D. C. R. Laurence Company, Inc; ____: www.crl-arch.com/sle.

E. DORMA USA, Inc; ____: www.dorma.com.

F. Hager Companies; ____: www.hagerco.com.

G. Trimco Hardware; ____: www.trimcohardware.com.

2.2 DOOR HARDWARE - GENERAL

A. Provide hardware specified or required to make doors fully functional, compliant with applicable codes, and secure to the extent indicated.

B. Provide items of a single type of the same model by the same manufacturer.

C. Provide products that comply with the following:

1. Applicable provisions of federal, state, and local codes.

2. Accessibility: ADA Standards and ICC A117.1.

3. Auxiliary Hardware: BHMA A156.16.

4. Straps, Tee Hinges and Hasps: BHMA A156.20.

5. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

D. Electrically Operated and/or Controlled Hardware: Provide all power supplies, power transfer hinges, relays, and interfaces required for proper operation; provide wiring between hardware and control components and to building power connection.

E. Finishes: Provide door hardware of the same finish unless otherwise indicated.

1. Primary Finish: Satin chrome plated over nickel on brass or bronze, 626 (approx US26D).

2. Secondary Finish: Satin chrome plated over nickel on brass or bronze, 626 (approx US26D).

NOT FOR BIDDING PURPOSES

a. Use secondary finish in kitchens, bathrooms, and other spaces containing chrome or stainless steel finished appliances, fittings, and equipment; provide primary finish on one side of door and secondary finish on other side if necessary.

3. Finish Definitions: BHMA A156.18.

4. Exceptions:

a. Where base metal is specified to be different, provide finish that is an appearance equivalent according to BHMA A156.18.

2.3 HINGES

A. Hinges: Provide hinges on every swinging door.

1. Provide five-knuckle full mortise butt hinges unless otherwise indicated.

2. Provide ball-bearing hinges at all doors having closers.

3. Provide hinges in the quantities indicated.

4. Provide non-removable pins on outswinging doors.

B. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7; standard weight, unless otherwise indicated.

1. Provide hinge width required to clear surrounding trim.

C. Quantity of Hinges Per Door:

1. Doors From 60 inches High up to 90 inches High: Three hinges.

2.4 LOCKS AND LATCHES

A. Locks: Provide a lock for every door, unless specifically indicated as not requiring locking.

1. Hardware Sets indicate locking functions required for each door.

2. If no hardware set is indicated for a swinging door provide an office lockset.

3. Trim: Provide lever handle or pull trim on outside of all locks unless specifically stated to have no outside trim.

NOT FOR BIDDING PURPOSES

4. Lock Cylinders: Provide key access on outside of all locks unless specifically stated to have no locking or no outside trim.

B. Lock Cylinders: Manufacturer's standard tumbler type, seven-pin standard core.

1. Provide cams and/or tailpieces as required for locking devices required.

2. Locksets are to accommodate the Owner's standard cylinder.

a. Standard Cylinder: Best Core Max

3. Cylinders shall be Construction Master keyed.

4. Permanent cylinders shall be factory keyed as directed by the Owner.

C. Keying: Per Owner's requirements.

1. Keys shall be stamped as directed by the Owner.

2. Cylinders shall be keyed to the Owner's existing key system and are subject to the Great Grand Master, Grand Master, Master, and Change Keys.

D. Latches: Provide a latch for every door that is not required to lock, unless specifically indicated "push/pull" or "not required to latch".

2.5 MORTISE LOCKSETS

A. Mortise Locksets - Basis of Design: Schlage L Series Grade I Mortise Lock.

B. Locking Functions: As defined in BHMA A156.13, and as follows:

1. Always-Locked: F07, may not be left unlocked.

2.6 CLOSERS

A. Closers: Complying with BHMA A156.4.

1. Provide surface-mounted, door-mounted closers on every door.

2.7 STOPS AND HOLDERS

A. Stops: Complying with BHMA A156.8; provide a stop for every swinging door, unless otherwise indicated.

1. Provide wall stops for every door.

NOT FOR BIDDING PURPOSES

2. If wall stops are not practical, due to configuration of room or furnishings, provide overhead stop.

3. 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 specifically so stated.

2.8 PROTECTION PLATES AND ARCHITECTURAL TRIM

A. Protection Plates:

1. Kickplate: Provide on push side of every door with closer, except aluminum storefront and glass entry doors.

2. Mop Plates: Provide on pull side of every door with closer, except aluminum storefront and glass entry doors..

2.9 KEY CONTROLS

A. Key Management System: For each keyed lock on project, provide one set of consecutively numbered duplicate key tags with hanging hole and snap catch.

B. Facility Manager's Key Cabinet: Sheet steel construction, piano hinged door with key lock.

1. Mounting: Wall mounted.

2. Capacity: Actual quantity of keys, plus 25 percent additional capacity.

3. Size key hooks to hold 6 keys each.

4. Finish: Baked enamel, manufacturer's standard color.

5. Key cabinet lock to building keying system.

6. Locate within Ticketing Kiosk building.

2.10 FIRE DEPARTMENT LOCK BOX

A. Fire Department Lock Box: Heavy-duty, surface mounted, solid stainless-steel box with hinged door and interior gasket seal; single drill resistant lock with dust covers.

1. Capacity: Holds 2 keys.

2. Finish: Manufacturer's standard dark bronze.

NOT FOR BIDDING PURPOSES

3. Confirm required manufacturer and model with Fire Marshal's office.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Use templates provided by hardware item manufacturer.

C. Mounting heights for hardware from finished floor to center line of hardware item. As indicated in the following list; unless noted otherwise in Door Hardware Sets Schedule or on the drawings.

1. For doors and frames: Comply with DHI (LOCS) "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames".

3.2 ADJUSTING

A. Adjust hardware for smooth operation.

HARDWARE SETS

4.1 HARDWARE SETS - GENERAL

A. These Hardware Sets indicate requirements for single doors of that type, with conditional requirements for pairs and other situations.

4.2 SWING DOORS - MAY NOT BE LEFT UNLOCKED

A. HW-30: Always-Locked, Non-Fire-Rated:

1. Lockset, Always-Locked.

END OF SECTION 08 71 00

NOT FOR BIDDING PURPOSES

SECTION 09 21 16 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Gypsum wallboard.

C. Joint treatment and accessories.

1.2 REFERENCE STANDARDS

A. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

B. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.

C. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.

D. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

E. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base.

F. ASTM C1396/C1396M - Standard Specification for Gypsum Board.

G. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels.

H. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

J. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

K. ASTM E413 - Classification for Rating Sound Insulation.

L. GA-216 - Application and Finishing of Gypsum Panel Products.

NOT FOR BIDDING PURPOSES

M. GA-600 - Fire Resistance Design Manual.

N. UL (FRD) - Fire Resistance Directory.

1.3 SUBMITTALS

A. Product Data: Provide data on gypsum board, glass mat faced gypsum board, accessories, and joint finishing system.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board application and finishing, with minimum 3 years of documented experience.

PART 2 PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

2.2 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:

1. CertainTeed Corporation: www.certainteed.com/#sle.

2. Georgia-Pacific Gypsum: www.gpgypsum.com/#sle.

3. National Gypsum Company: www.nationalgypsum.com/#sle.

4. USG Corporation: www.usg.com/#sle.

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, unless otherwise indicated.

2. Glass mat faced gypsum panels as defined in ASTM C1658/C1658M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.

3. Unfaced fiber-reinforced gypsum panels as defined in ASTM C1278/C1278M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.

NOT FOR BIDDING PURPOSES

4. Core: Fire-resistance rated gypsum core, with additives to enhance mold/mildew resistance.

5. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

6. Facers: Mold and moisture resistance coated fiberglass mat for abrasion resistance.

7. Long Edges: Tapered. Wrapped with coated fiberglass mat.

8. Flexural Strength: Parallel greater than 100 lbf.; Perpendicular greater than 140 lbf.; when tested in accordance with ASTM C473

9. Humidified Deflection: Less than 1/8 inch when tested in accordance with ASTM C473.

10. Nail Pull Resistance: 90 lbs, when tested in accordance with ASTM C473.

11. Water Absorption: Less than 5 percent when tested in accordance with ASTM C473.

12. Permeance: Greater than 10 perms, when tested in accordance with ASTM C473.

13. Combustibility: Noncombustible when tested in accordance with ASTM E136.

14. Surface Abrasion Resistance: Classification Level 3 in accordance with ASTM C1629.

15. Indentation Resistance: Classification Level 1 in accordance with ASTM C1629.

16. Soft Body Impact Resistance: Classification Level 2 in accordance with ASTM C1629.

17. Hard Body Impact Resistance: Classification Level 1 in accordance with ASTM C1629.

18. Thickness: 5/8 inch unless otherwise indicated on Drawings.

19. Basis-of-Design: Gold Bond eXP Interior Extreme AR Gypsum Panel.

2.3 ACCESSORIES

A. Beads, Joint Accessories, and Other Trim: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.

1. Rigid Corner Beads: Low profile, for 90 degree outside corners.

NOT FOR BIDDING PURPOSES

2. Expansion Joints: V-shaped PVC with tear away fins.

B. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.

1. Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.

2. Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.

3. Ready-mixed vinyl-based joint compound.

4. Chemical hardening type compound.

C. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.2 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 Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Installation on Metal Framing: Use screws for attachment of gypsum board.

3.3 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.

1. Not more than 30 feet apart on walls and ceilings over 50 feet long.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

NOT FOR BIDDING PURPOSES

3.4 JOINT TREATMENT

A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, bedded and finished with chemical hardening type joint compound.

B. Paper Faced Gypsum Board: Use paper joint tape, bedded with ready-mixed vinyl-based joint compound and finished with ready-mixed vinyl-based joint compound.

C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:

1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.

2. Level 3: Walls to receive textured wall finish.

3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.

4. Level 1: Wall areas above finished ceilings, whether or not accessible in the completed construction.

D. 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.

2. Taping, filling and sanding is not required at base layer of double layer application.

3.5 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION 09 21 16

NOT FOR BIDDING PURPOSES

SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal partition framing.

B. Framing accessories.

1.2 REFERENCE STANDARDS

A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members.

D. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

E. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

F. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

G. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

H. ASTM E413 - Classification for Rating Sound Insulation.

1.3 SUBMITTALS

A. Shop Drawings:

1. Indicate component details, stud layout, framed openings, anchorage to structure, acoustic details, type and location of fasteners, accessories, and items of other related work.

2. Describe method for securing studs to tracks, splicing, and for blocking and reinforcement of framing connections.

NOT FOR BIDDING PURPOSES

B. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.

C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.

PART 2 PRODUCTS

2.1 FRAMING MATERIALS

A. Non-Loadbearing Framing System Components: ASTM C645; 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/240 at 5 psf.

1. Studs: C shaped with flat or formed webs with knurled faces.

2. Runners: U shaped, sized to match studs.

B. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.

1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.

2. Material: ASTM A653/A653M steel sheet, SS Grade 50, with G60/Z180 hot dipped galvanized coating.

C. Tracks and Runners: Same material and thickness as studs, bent leg retainer notched to receive studs with provision for crimp locking to stud.

D. Fasteners: ASTM C1002 self-piercing tapping screws.

E. Sheet Metal Backing: 0.036 inch thick, galvanized.

F. Anchorage Devices: Powder actuated.

G. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness as indicated.

NOT FOR BIDDING PURPOSES

H. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic.

2.2 FABRICATION

A. Fabricate assemblies of framed sections to sizes and profiles required.

B. Fit, reinforce, and brace framing members to suit design requirements.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that rough-in utilities are in proper location.

3.2 INSTALLATION OF STUD FRAMING

A. Comply with requirements of ASTM C754.

B. Extend partition framing to ceiling in all locations, unless shown otherwise on drawings.

C. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

D. Align and secure top and bottom runners at 24 inches on center.

E. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.

F. Install studs vertically at 12, 16 or 24 inches on center, to meet specified performance requirements.

G. Align stud web openings horizontally.

H. Secure studs to tracks.

I. Stud splicing is not permissible.

J. Fabricate corners using a minimum of three studs.

K. Double stud at wall openings, door and window jambs, not more than 2 inches from each side of openings.

NOT FOR BIDDING PURPOSES

L. Brace stud framing system rigid.

M. Coordinate erection of studs with requirements of all openings; install supports and attachments.

N. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.

O. Blocking: Use wood blocking secured to studs. Provide blocking where indicated, and for support of wall cabinets.

3.3 TOLERANCES

A. Maximum Variation From True Position: 1/8 inch in 10 feet.

B. Maximum Variation From Plumb: 1/8 inch in 10 feet.

END OF SECTION 09 22 16

NOT FOR BIDDING PURPOSES

SECTION 09 96 00 - HIGH-PERFORMANCE COATINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. High performance coatings.

B. Surface preparation.

1.2 REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.

B. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association.

C. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual.

D. SSPC-SP 13 - Surface Preparation of Concrete; (Reaffirmed 2015)..

1.3 SUBMITTALS

A. Product Data: Provide complete list of all products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").

2. MPI product number (e.g. MPI #47).

3. Cross-reference to specified coating system(s) product is to be used in; include description of each system.

4. Manufacturer's installation instructions.

B. Samples: Submit three paper "drop" samples 8-1/2 by 11 inch in size illustrating colors available for selection.

1. Where sheen is specified, submit samples in only that sheen.

2. Where sheen is not specified, submit each color in each sheen available.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

NOT FOR BIDDING PURPOSES

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. Maintenance Data: Include cleaning procedures and repair and patching techniques.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.5 MOCK-UP

A. Provide mock-up , 6 feet long by 6 feet wide, illustrating coating and surface sheen, for each specified coating.

B. Locate where directed by Engineer..

C. Mock-up may remain as part of the work.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of coating, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Coating Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

NOT FOR BIDDING PURPOSES

1.7 FIELD CONDITIONS

A. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

1. Contractor shall test moisture vapor emission of existing concrete slab in accordance with ASTM F2170 or ASTM F1869.

B. Do not install materials when temperature is below 55 degrees F or above 90 degrees F.

C. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of coating.

D. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

E. Restrict traffic from area where coating is being applied or is curing.

1.8 WARRANTY

A. Correct defective Work within a five year period after Date of Substantial Completion.

B. Warranty: Include coverage for bond to substrate.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. High-Performance Coatings:

1. PPG Paints; PSX 700: www.ppgpaints.com/#sle.

2. Sherwin-Williams Company; Polysiloxane XLE-80: www.protective.sherwin-williams.com/industries/#sle.

3. Tnemec Company, Inc.; www.tnemec.com/#sle.

2.2 HIGH-PERFORMANCE COATINGS

A. MPI Standards: Provide products that comply with MPI standards indicated and are listed in MPI Approved Products List.

2.3 TOP COAT MATERIALS

A. Coatings - General: Provide complete multi-coat systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated; number of coats specified does not include primer or filler coat.

1. Volatile Organic Compound (VOC) Content:

a. Provide coatings that comply with the most stringent requirements specified in the following:

1) 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.

NOT FOR BIDDING PURPOSES

b. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

2. Colors: Selected from manufacturer's standard colors.

2.4 ACCESSORY MATERIALS

A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of coated surfaces.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Do not begin application of coatings until substrates have been properly prepared.

C. Verify that substrate surfaces are ready to receive work as instructed by the coating manufacturer. Obtain and follow manufacturer's instructions for examination and testing of substrates.

D. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. Masonry, Concrete, and Concrete Unit Masonry Walls: 12 percent.

2. Concrete Floors and Traffic Surfaces: 8 percent.

3.2 PREPARATION

A. Clean surfaces of loose foreign matter. Existing paint on walls is presumed to contain lead.

B. Remove substances that would bleed through finished coatings. If unremovable, seal surface with shellac.

C. Remove finish hardware, fixture covers, and accessories as applicable and store.

NOT FOR BIDDING PURPOSES

D. Concrete:

1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.

2. Prepare surface as recommended by coating manufacturer and according to SSPC-SP 13.

E. Protect adjacent surfaces and materials not receiving coating from spatter and overspray; mask if necessary to provide adequate protection. Repair damage.

3.3 PRIMING

A. Apply primer to all surfaces, unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

B. Concrete or Masonry: Prior to priming, patch with masonry filler to produce smooth, even surface.

3.4 COATING APPLICATION

A. Apply coatings in accordance with manufacturer's written instructions, to thicknesses specified and recommendations in "MPI Architectural Painting and Specification Manual".

B. Apply in uniform thickness coats, without runs, drips, pinholes, brush marks, or variations in color, texture, or finish. Finish edges, crevices, corners, and other changes in dimension with full coating thickness.

3.5 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Clean surfaces immediately of overspray, splatter, and excess material.

C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.6 PROTECTION

A. Protect finished work from damage.

END OF SECTION 09 96 00

NOT FOR BIDDING PURPOSES

SECTION 10 14 00 - SIGNAGE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Room and door signs.

1.2 SUBMITTALS

A. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

B. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.

C. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.

D. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Flat Signs:

1. Best Sign Systems, Inc: www.bestsigns.com/#sle.

2. Cosco Industries (ADA signs): www.coscoarchitecturalsigns.com/#sle.

3. FASTSIGNS: www.fastsigns.com/#sle.

4. Inpro: www.inprocorp.com/#sle.

NOT FOR BIDDING PURPOSES

2.2 SIGNAGE APPLICATIONS

A. Accessibility Compliance: Signs are required to 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 comprehensive and specific requirements.

B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.

1. Sign Type: Flat signs with injection molded panel media as specified.

2. Sign Height: 6 inches, unless otherwise indicated.

3. Rest Rooms: Identify with pictograms, room numbers to be determined later, and braille.

2.3 SIGN TYPES

A. Flat Signs: Signage media without frame.

1. Corners: Square.

2. Wall Mounting of One-Sided Signs: Concealed screws.

B. Color and Font: Unless otherwise indicated:

1. Character Font: Helvetica, Arial, or other sans serif font.

2. Background Color: To be selected by Engineer from manufacturer's full range.

3. Character Color: Contrasting color to be selected by Engineer from manufacturer's full range.

2.4 TACTILE SIGNAGE MEDIA

A. Injection Molded Panels: One-piece acrylic plastic, with raised letters and braille.

2.5 ACCESSORIES

A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.

NOT FOR BIDDING PURPOSES

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

END OF SECTION 10 14 00

NOT FOR BIDDING PURPOSES

SECTION 10 44 00 - FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fire extinguishers.

B. Accessories.

1.2 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers.

1.3 SUBMITTALS

A. Product Data: Provide extinguisher operational features.

B. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fire extinguishers and fire-protection cabinets through one source from a single manufacturer.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1. Provide fire extinguishers approved, listed, and labeled by FMG.

1.5 COORDINATION

A. Coordinate size of fire extinguisher cabinet to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire protection cabinets with wall depths and materials.

NOT FOR BIDDING PURPOSES

1.6 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of portable fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10.

b. Faulty operation of valves or release levers.

2. Warranty period: Six years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Fire Extinguishers:

1. Ansul, a Tyco Business: www.ansul.com/#sle.

2. Larsen's Manufacturing Co: www.larsenmfg.com.

3. Pyro-Chem, a Tyco Business: www.pyrochem.com/#sle.

B. Fire Extinguisher Cabinets and Accessories:

1. Ansul, a Tyco Business; _____: www.ansul.com/#sle.

2. Larsen's Manufacturing Co; _____: www.larsensmfg.com/#sle.

3. Pyro-Chem, a Tyco Business; _____: www.pyrochem.com/#sle.

2.2 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.

NOT FOR BIDDING PURPOSES

1. Class: A:B:C type.
2. Size: 10 pound.
3. Temperature range: Minus 40 degrees F to 120 degrees F.

2.3 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure rigidly in place.

C. Place extinguishers in cabinets.

END OF SECTION 10 44 00

NOT FOR BIDDING PURPOSES

SECTION 11 14 00 - PEDESTRIAN CONTROL EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Waist-high turnstiles.

B. Pedestrian gates.

C. Stainless steel railings.

1.2 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

D. NAAMM AMP 500-06 - Metal Finishes Manual.

1.3 SUBMITTALS

A. Product Data: Provide material descriptions, dimensions, and finishes for specified pedestrian control equipment.

B. Shop Drawings: Provide plans, installation requirements, and any required attachments to this work.

C. Samples: Submit two 2, 2 inch in size, illustrating factory-applied color finishes.

D. Operation Data: For system and equipment specified include model cut sheet, application manual, and user's guide for inclusion in project operation and maintenance manuals.

1.4 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 the type specified and with at least three years of documented experience.

NOT FOR BIDDING PURPOSES

1.5 WARRANTY

A. Manufacturer agrees to correct defective work within two year period from Date of Substantial Completion.

PART 2 PRODUCTS

2.1 WAIST-HIGH TURNSTILES

A. Waist-High Turnstiles Manufacturers:

1. Alvarado Manufacturing Company, Inc; _____: www.alvaradomfg.com/#sle.
2. Automatic Systems; _____: www.automatic-systems.us/#sle.
3. Controlled Access Turnstiles; _____: www.controlledaccess.com/#sle.
4. dormakaba; HSB-E10: www.dormakaba.us/#sle.
5. Hayward Turnstiles; haywardturnstiles.com/#sle.

B. Lane Configuration:

1. Refer to drawings for lane configurations.
2. Lane Width:
   a. Barrier-Free Access: Clear opening of 36 inch, minimum, and in compliance with ADA Standards.

C. Cabinet Style: Round ends.

1. Cabinet Cladding Material: Stainless steel, Type 304 alloy, No. 4 satin finish.
2. Cabinet Top: Solid surfacing, material and color as selected by Architect.
3. Internal Frame: Welded steel, with exterior welds ground smooth and concealed fasteners used with cladding material.

D. Operating Mechanism: Cast stainless steel ratchet assembly with precision type sealed bearings.

1. Provide stainless steel tube turnstile arm with No. 4 satin finish and anchored into head of ratchet assembly.

NOT FOR BIDDING PURPOSES

E. Manual Operational Control: Provide manual mechanical key override for each direction of turnstile rotation.

F. Basis of Design: Hayward Turnstiles, FastTurn MR200 Plus or approved equal.

2.2 PEDESTRIAN GATES

A. Pedestrian Gates Manufacturers: Same as turnstile manufacturer.

B. Waist-Height Gate: Fully welded stainless steel assembly with round ends and solid surface top. Two-way swing. ADA compliant.

1. Cabinet Cladding Material: Stainless steel, Type 304 alloy, No. 4 satin finish.

2. Cabinet Top: Solid surfacing, material and color as selected by Architect.

3. Basis of Design: Hayward Turnstiles, Swing Gate MR200 Plus ADA Stainless, or approved equal.

2.3 MATERIALS

A. Stainless Steel Components: Comply with ASTM A666, Type 304 alloy.

B. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G60/Z180 coating, plain surface.

2.4 FINISHES

A. Comply with NAAMM AMP 500-06 for recommendations regarding applying and designating finishes.

B. Stainless Steel: No. 4 satin finish.

C. Appearance of Finished Work:

1. Noticeable variations in same piece are not acceptable.

2.5 RAILINGS

A. Stainless Steel Railings: Provide same style as ADA Pedestrian Gate from the same manufacturer.

1. Configuration: See Drawings for configuration.

2. Material: Stainless steel, Type 304 alloy, No. 4 satin finish.

NOT FOR BIDDING PURPOSES

3. Basis of Design: Hayward Turnstiles, AdaptaRail Post and Rail System, or approved equal.

2.6 ACCESSORIES

A. Population Counting: Pedestrian counting using active infrared beams to ensure highly accurate bi-directional count; detecting human passage and ignoring other objects, such as, empty wheelchairs, shopping carts, umbrellas, specific types of briefcases and bags.

1. Population Operations: Working as a stand-alone counting turnstile.

2. Display: Wall mounted digital display used for singular population count applications.

a. Current Population Total: Provide accurate "Real Time" population figures.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, installation areas and conditions for compliance with requirements for installation tolerances, and other conditions affecting performance of this work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install pedestrian control equipment in accordance with manufacturer's instructions.

B. Install pedestrian control equipment at locations and with spacing as indicated on drawings.

C. Provide width for barrier-free access at designated lanes in compliance with ADA Standards.

D. Communication Conduit: Install 2 inch diameter conduit, for communication wiring, located under the floor to interconnect each pedestrian control unit of a set, from external data port to set's main controller unit. Refer to Sections 26 05 33.13 and 26 05 83.

3.3 CLEANING

A. Clean pedestrian control equipment and work areas carefully after installation to remove excess caulk, dirt and labels.

NOT FOR BIDDING PURPOSES

3.4 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate operation of system to Engineer's personnel.

1. Use operation and maintenance data as reference during demonstration.

2. Briefly describe function, operation, and maintenance of each component.

B. Training: Train Engineer's personnel on operation and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

END OF SECTION 11 14 00

NOT FOR BIDDING PURPOSES

SECTION 13 11 00 – SPRAY GROUND GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The scope of the work included under this Section of the Specifications shall include Spray Ground(s) as illustrated on the Drawings and specified herein. The General and Supplementary Conditions of the Specifications shall form a part and be included under this Section of the Specifications. The Spray Ground Subcontractor shall provide all supervision, labor, material, equipment, machinery, plant and any and all other items necessary to complete the work. ALL OF THE WORK IN SECTIONS 13 11 00 - 13 11 08 IS TO BE THE RESPONSIBILITY OF ONE EXPERIENCED SPRAY GROUND SUBCONTRACTOR PRIMARILY ENGAGED IN THE CONSTRUCTION OF COMMERCIAL PUBLIC-USE SPRAY GROUNDS. THE SUBCONTRACTOR MUST HAVE, IN THE LAST FIVE YEARS CONSTRUCTED AT LEAST FIVE (5) COMMERCIALLY DESIGNED MUNICIPAL AND PUBLIC-USE SPRAY GROUNDS, EACH OF WHICH SHALL HAVE INCORPORATED A MINIMUM SIZE OF 1,000 SQUARE FEET OF SURFACE AREA WITH A SELF-MODULATING BALANCE TANK. The Spray Ground Subcontractor shall furnish and install the Spray Ground structures, finishes, forming, Spray Ground mechanical and electrical systems, and all accessories necessary for a complete, functional Spray Ground system, as herein described. Work shall include start-up, instruction of Owner's personnel, as-built drawings and warranties as required.

NOT FOR BIDDING PURPOSES

1.2 CODES, RULES, PERMITS, FEES

A. The Spray Ground shall be constructed in strict accordance with the applicable provisions set forth by authorities having jurisdiction over swimming pool construction and operation in the State of Delaware.

B. The Spray Ground Subcontractor shall give all necessary notices, obtain all permits, and pay all government sales taxes, fees, and other costs in connection with their work; file all necessary plans, prepare all documents and obtain all necessary approvals of governmental departments having jurisdiction; obtain all required certificates of inspection for their work and deliver same to the Designated Representative before request for acceptance and final payment for the work.

C. The Spray Ground Subcontractor shall include in the work any labor, materials, services, apparatus, or drawings in order to comply with all applicable laws, ordinances, rules and regulations, whether or not shown on Drawings and/or specified.

D. The Contractor shall submit all required documents and materials to all Governmental Departments having jurisdiction for any deferred approval items or substituted materials or products to obtain final approval to installation.

1.3 DESCRIPTION OF WORK

A. Furnish and perform supervision, coordination, all layout, formwork, excavation, hand trim, disposing off-site of all unused material or debris to complete the Spray Ground excavation to the dimensions shown on the plans.

B. Furnish and install complete splash pad structures, including reinforcing steel and cast-in-place concrete floors.

C. Furnish and install Spray Ground finishes as shown on the plans.

D. Furnish and install complete Spray Ground mechanical system(s), including, but not limited to, circulation systems, filtration systems, water chemistry control systems, domestic water fill line systems, booster pump and special effects systems, and all pumps, piping, valves, and connections between system(s) and Spray Ground(s).

E. Furnish and install complete Spray Ground electrical system(s) from P.O.C. in Mechanical Room, including, but not limited to, lighting systems, water level control systems, special effects systems, control circuitry, motor starters, time clocks, bonding, and all conduits, conductors, contactors, and switches between the system(s) and Spray Ground(s).

F. Furnish and install all Spray Ground deck equipment and required anchors and inserts for the specified equipment as required by code, shown on the Drawings and specified herein.

G. After the initial filling of the Spray Ground balance tank(s), should any repairs, continuing work, or other Subcontractor responsibility require drainage or partial drainage of the Spray Ground systems, the Spray Ground Subcontractor shall be responsible for any subsequent refilling and shall complete the project with the Spray Ground balance tank(s) full of water, water in chemical balance, complete in every way, and in full operation.

NOT FOR BIDDING PURPOSES

1.4 ASSIGNED RESPONSIBILITIES AND RELATED WORK

A. It is the intent of this section of the Specifications to clarify Work responsibilities of the trades directly and indirectly involved in construction of the pool systems. All labor, equipment, materials and supplies furnished by the Spray Ground Subcontractor and other Subcontractors shall be as directed by the Owner through their Designated Representative.

B. THE SPRAY GROUND SUBCONTRACTOR SHALL NOT SUBCONTRACT ANY PORTION OF THE SPRAY GROUND CONSTRUCTION OR SPRAY GROUND EQUIPMENT INSTALLATION TO ANYONE OTHER THAN A SUBCONTRACTOR THAT SATISFIES THE REQUIREMENTS OF SECTION 13 11 00

C. References to “Spray Ground Systems” shall include the Spray Grounds, equipment, and accessories.

D. The Owner will provide one complete water filling of the Spray Ground balance tank(s) when they have been proved fully operational, complete in every way and accepted by the Designated Representative.

1.5 RESPONSIBILITIES OF THE CONTRACTOR

A. The Contractor shall grade the Spray Ground site(s), establish benchmarks, cut and fill as necessary to provide as level an area as possible at Spray Ground deck elevation before Spray Ground layout.

B. The Contractor shall be responsible for horizontal dimensions and grade elevations accurately from established lines and benchmarks (as indicated on the Drawings) and be responsible for those grades.

C. The Contractor shall provide adequate temporary light, electric power, heat and ventilation per Federal and State OSHA requirements to construct the Spray Ground system(s).

D. The Contractor shall not permit any heavy equipment activity over any area or within five (5) feet of any area under which Spray Ground piping is buried. There shall be no exceptions to this requirement.

E. The Contractor shall keep the swimming pool excavation(s) and Spray Ground structure(s) free of construction residue and waste materials of their workmen or Subcontractors, removing said material from the Spray Ground as required.

F. The Contractor shall protect the Spray Ground(s) from damage caused by their construction equipment and /or workmen and Subcontractors.

G. The Contractor shall provide a representative at time of Spray Ground start-up to coordinate all trades related to Spray Ground system(s).

1.6 RESPONSIBILITIES OF THE MECHANICAL SUBCONTRACTOR

A. The Mechanical Subcontractor shall be licensed in the State of Delaware and provide written notifications to Spray Ground Subcontractor and contractor when necessary to excavate and backfill within the Spray Ground construction site.

B. The Mechanical Subcontractor shall not utilize any Spray Ground piping trench for installation of any sanitary sewer, storm sewer, domestic water, hot water, chilled water or natural gas line.

C. The Mechanical Subcontractor shall furnish and install all sanitary sewer piping, including vent stacks (if necessary), for backwash pits, floor drains and floor sinks as required by code, shown on Drawings, and herein specified.

D. The Mechanical Subcontractor shall furnish and install all storm sewer piping and site drainage systems as required by code, shown on the Drawings, and herein specified.

E. The Mechanical Subcontractor shall provide a minimum 75 psi water supply for Spray Ground construction work within fifty (50) feet of the Spray Ground construction site(s).

F. The Mechanical Subcontractor shall furnish and install reduced pressure backflow protected domestic water lines to P.O.C. within Spray Ground Mechanical Room as required by code, shown on the Drawings, and herein specified.

NOT FOR BIDDING PURPOSES

G. The Mechanical Subcontractor shall furnish and install all ductwork, louvers, and all HVAC equipment within Spray Ground Mechanical Room as required by code, shown on the Drawings, and herein specified.

H. The Mechanical Subcontractor shall provide a representative at time of Spray Ground start-up to coordinate work related to Spray Ground system(s).

1.7 RESPONSIBILITIES OF THE ELECTRICAL SUBCONTRACTOR

A. The Electrical Subcontractor shall be licensed in the State of Delaware and shall furnish and install electrical service to Spray Ground Mechanical Room sized to accommodate all necessary Spray Ground equipment as shown on the Drawings and herein specified.

B. The Electrical Subcontractor shall furnish any temporary power needed by the Spray Ground Subcontractor within fifty (50) feet of the swimming pool construction site(s).

C. The Electrical Subcontractor shall furnish and install all conduits, conductors, starters/disconnects, panels, circuits, switches and equipment as required for lighting, ventilation and HVAC equipment within Spray Ground Mechanical Room as required by code, shown on the Drawings, and herein specified.

D. The Electrical Subcontractor shall furnish and install all conduits, conductors, panels, circuits, switches and equipment for area lighting as required by code, shown on the Drawings, and herein specified.

E. All equipment, material and installation shall be as required under Division 16 of the Specifications and shall conform to NEC Article 680 (latest revision), State and Local Codes, and as may be required by all authorities having jurisdiction over Spray Ground construction within the State of Delaware.

F. The Electrical Subcontractor shall provide a representative at time of Spray Ground start-up to coordinate work related to Spray Ground system(s).

NOT FOR BIDDING PURPOSES

1.8 INTENT

A. It is the intention of these specifications and Drawings to call for finished work, tested and ready for operation. Wherever the work “provide” is used, it shall mean “furnish and install complete and ready for use.”

B. Minor details not usually shown or specified, but necessary for proper installation and operation, shall be included in the work, the same as if herein specified or shown.

1.9 SCHEDULE OF VALUES

A. Provide a Schedule of Values for all work specified in each of the technical specifications listed in the table below, regardless of whether the work is performed by the Spray Ground contractor or others. Values listed shall be fully burdened, with contractor general conditions, overhead, profit and bonds included. Payments for swimming pool work completed shall not be approved until Schedule of Values has been submitted to and approved by Architect.

SPRAY GROUND SCHEDULE OF VALUES			
No.	Section #	Description	Value
1.	13 11 01	Spray Ground Excavation	
2.	13 11 02	Spray Ground Concrete	
3.	13 11 05	Spray Ground Waterproofing	
4.	13 11 06	Spray Ground Equipment	
5.	13 11 07	Spray Ground Mechanical	
6.	13 11 08	Spray Ground Electrical	
Total			

NOT FOR BIDDING PURPOSES

1.10 SUBMITTAL PROCEDURES

A. General: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Architect for Subcontractor's use in preparing submittals.

B. Coordination: Coordinate preparation and processing submittals with performance construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity. 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.

C. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for schedules performance of related construction activities.

D. Processing Time: Allow enough time for submittal review, including time for re-submittals as follows. Time for review shall commence on Architect's receipt of submittal.

1. Initial Review: Allow fifteen (15) days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect will advise Contract when a submittal being processed must be delayed for coordination.

2. Concurrent Review: Where concurrent review of submittals by Architect's consultants, Owner, or other parties is required, allow twenty-one (21) days for initial review of each submittal.

3. Direct Transmittal to Consultant: Where the Contract Documents indicate that submittals may be transmitted directly to Architect's consultants, provide duplicate copy of transmittal to Architect. Submittal will be returned to Architect before being returned to Subcontractor.

4. If intermediate submittal is necessary, process it in same manner as initial submittal.

5. Allow fifteen (15) days for processing each submittal.

6. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.

E. Identification: Place a title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on title block.

2. Provide a space on title block to record Subcontractor's review and approval markings and action taken by Architect.

3. Include the following information on title block for processing and recording action taken: (See Attached Sample)

a. Project name.

b. Date.

c. Name and address of Subcontractor.

d. Name of Subcontractor.

e. Name of Supplier.

f. Name of Manufacturer.

g. Unique identifier, including revision number.

h. Number and title of appropriate Specification Section.

i. Drawing number and detail references, as appropriate.

j. Other necessary identification.

NOT FOR BIDDING PURPOSES

SUMBITTAL FOR:	SUBMITTAL TO:	SUBCONTRACTOR:

Item Number: _____
Section Number: _____
Section Description: _____
Subcontractor: _____
Supplier: _____
Manufacturer: _____
Product Code: _____
Quantity: _____

Subcontractor Certification:

It is hereby certified that the equipment or material designated in this submittal is proposed to be incorporated in the above named project and is in compliance with the contract drawings and / or specifications and is submitted for approval.

Certified by: _____
Date: _____
Job Superintendent: _____
Revisions: _____

Contractor's Submittal Stamp:

Architect's Review Stamp and Comments

NOT FOR BIDDING PURPOSES

F. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract documents on submittal.

G. On all catalogue or cut sheets identify which model or type is being submitted.

H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Product data and shop drawings shall be packaged within a three-ring binder and colored samples shall be packaged on a heavy cardboard. Transmit each submittal using a transmittal form.

1. On an attached separate sheet, prepared on Subcontractor's letterhead, record relevant information, request for data, revisions other than those requested by Architect on previous submittals and deviations from requirements of the Contract documents, including minor variations and limitations. Include the same label information as the related submittal.

2. Include Subcontractor's certification stating that information submitted complies with requires of the Contract Documents.

3. Transmittal Form: Provide locations on form for the following information:

a. Project name.

b. Date.

c. Destination (To:).

d. Source (From:).

e. Names of Subcontractor, manufacturer, and supplier.

f. Category and type of submittal.

g. Submittal purpose and description.

h. Remarks.

I. Distribution: Furnish copies of final submittals to manufacturers, Subcontractors, suppliers, fabricators, installers, authorities having jurisdiction and others as necessary for performance of construction activities. Show distribution on transmittal forms.

J. Use for Construction: Use only final submittals with mark indicating action taken by Architect in connection with construction.

NOT FOR BIDDING PURPOSES

1.11 SUBSTITUTIONS

A. To obtain approval to use unspecified products, bidders shall submit requests for substitution at least ten (10) days prior to bid date. Requests shall only be considered if they clearly describe the product for which approval is asked, including all data necessary to demonstrate acceptability. All unspecified products and equipment will be considered on an "or equal" basis at the discretion of the Designated Representative. Requests for substitution received after the specified deadline will not be considered. Where a conflict exists between the requirements of the General Conditions / Special Conditions / Division 1 concerning substitutions and the requirements of this Article, this Article (Section 13 11 00, Article 1.10) shall govern.

B. Where the Spray Ground Subcontractor proposes to use an item of equipment other than that specified or detailed on the Drawings which requires any redesign of the structure, partitions, foundations, piping, wiring, or any other part of the architectural, mechanical, or electrical layout, all such redesign and all new drawings (stamped by Delaware Licensed Engineer) and detailing required shall be prepared by the Spray Ground Subcontractor, at their own expense, submitted for review and approval by the Designated Representative prior to bid.

C. Where such approved deviation requires a different quantity and arrangement of piping, supports and anchors, wiring, conduit, and equipment from that specified or indicated on the Drawings, the Spray Ground Subcontractor shall furnish and install any such piping, structural supports, controllers, motors, starters, electrical wiring and conduit, and any other additional equipment required by the system, at no additional cost to the Owner.

1.12 SURVEYS AND MEASUREMENTS

A. The Spray Ground Subcontractor shall base all measurements, both horizontal and vertical, from benchmarks established by the Contractor. All work shall agree with these established lines and levels. The mechanical Drawings do not give exact details as to elevations of piping, exact locations, etc. and do not show all offsets, control lines, pilot lines and other installation details. Verify all measurements at site and check the correctness of same as related to the work.

NOT FOR BIDDING PURPOSES

1.13 DRAWINGS

A. Drawings are diagrammatic and indicate the general arrangement of the systems and work included in the Subcontractor. Drawings are not to be scaled. The architectural drawings and details shall be examined for exact dimensions. Where they are not definitely shown, this information shall be obtained from the Designated Representative.

1.14 SPRAY GROUND SUBSUBCONTRACTOR

A. The Spray Ground construction work as herein described and specified in Division 13 of the Project Manual shall be the complete responsibility of a qualified Spray Ground Subcontractor with extensive experience in commercial public use Spray Ground installations.

B. The Contractor shall require the Spray Ground Subcontractor to furnish to the Contractor performance and payment bonds in the amount of 100% of the Spray Ground Subcontractor's bid written by a surety Company properly registered in the State of Delaware and listed by the U.S. Treasury. The expense of the bond(s) is to be borne by the Subcontractor. The Contractor shall clearly specify the amount and requirements of the bond(s) in the Contractor's written or published request for subbids. The Contractor's written or published request for subbids shall also specify that the bond(s) expense is to be borne by the Subcontractor.

C. Subcontractor certifies that it meets the qualifications and experience requirements established in Spray Ground General Requirements, Section 13 11 00, as follows:

1. Subcontractor has, in the last five (5) years, constructed at least five (5) commercially designed municipal and public-use Spray Grounds, each of which have incorporated a minimum size of 1,000 square feet of surface area with a self-modulating balance tank.

2. The following list of projects meet the requirements of section (b) above and the contact as reference by the Contractor, the Awarding Authority of their agent or designee.

a. Owner: _____
Scope of Project: _____
Contact Person: _____
Phone Number: _____
Architect for Project: _____

b. Owner: _____
Scope of Project: _____
Contact Person: _____
Phone Number: _____
Architect for Project: _____

c. Owner: _____
Scope of Project: _____
Contact Person: _____
Phone Number: _____
Architect for Project: _____

d. Owner: _____
Scope of Project: _____
Contact Person: _____
Phone Number: _____
Architect for Project: _____

e. Owner: _____
Scope of Project: _____
Contact Person: _____
Phone Number: _____

NOT FOR BIDDING PURPOSES

Architect for Project: _____

D. Spray Ground Deck Subcontractor other than the swimming pool Subcontractor certifies that it meets the qualifications and experience requirements established in Swimming Pool General Requirements, Section 13 11 00, as follows:

1. Subcontract has, in the last five (5) years, constructed at least five (5) commercially designed Spray Ground decks, each of which have incorporated a minimum size of 1,000 square feet of surface area of the Spray Ground.

2. The following list of projects meet the requirements of section (b) above and the contact as reference by the Contractor, the Awarding Authority of their agent or designee.

SPRAY GROUND DECK SUBCONTRACTOR

a. Owner: _____
Scope of Project: _____
Contact Person: _____
Phone Number: _____
Architect for Project: _____

b. Owner: _____
Scope of Project: _____
Contact Person: _____
Phone Number: _____
Architect for Project: _____

c. Owner: _____
Scope of Project: _____
Contact Person: _____
Phone Number: _____
Architect for Project: _____

d. Owner: _____
Scope of Project: _____
Contact Person: _____
Phone Number: _____
Architect for Project: _____

e. Owner: _____
Scope of Project: _____
Contact Person: _____
Phone Number: _____
Architect for Project: _____

NOT FOR BIDDING PURPOSES

1.15 OPERATING INSTRUCTIONS

A. The Spray Ground Subcontractor shall determine from actual samples of Spray Ground water supplied by the Owner, the proper water management program necessary for maximum operating efficiency and comfort. The Spray Ground Subcontractor shall provide the services of experienced personnel familiar with this type of Spray Ground system operation, in conformance with Section 13 11 05 of the Specifications.

1.16 MAINTENANCE MANUALS

A. The Spray Ground Subcontractor shall provide six (6) bound sets for delivery to the Designated Representative of instructions for operating and maintaining all systems and equipment included in this Contract. Manufacturer's advertising literature or catalog pictures will not be acceptable for operating and maintenance instructions.

B. Bound in ring binders shall be all parts lists, periodic maintenance instructions and troubleshooting guidelines for all pool equipment, including but not limited to filters, pumps, controllers, water chemistry control equipment, etc.

1.17 SECURE FROM THE OWNER

A. A complete Owner-furnished filling of the Spray Grounds.

B. The Owner's assistance, as specified herein, from the time of start-up until final written acceptance of the Spray Ground system(s).

C. Chemicals as required for swimming pool operation after Spray Ground Subcontractor completes initial water chemistry balance and water treatment during the maintenance period described in Section 13 11 05 of the Specifications.

1.18 WARRANTY

A. The Spray Ground Subcontractor shall warrant all Spray Ground structures, finishes and systems against defects in material and workmanship for a period of two (2) years after the date of acceptance by the Owner. Any repair or replacement required due to defective material or workmanship will be promptly corrected by the Spray Ground Subcontractor.

PART 2 - PRODUCTS
NOT USED

PART 3 - EXECUTION
NOT USED

NOT FOR BIDDING PURPOSES

END OF SECTION 13 11 00

NOT FOR BIDDING PURPOSES

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NOT FOR BIDDING PURPOSES

SECTION 13 11 01 – SPRAY GROUND EXCAVATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Finish and fine grading to bring the surface of the ground to the required grades and elevations as indicated on the Drawings.

B. Subgrade improvements and placing of compacted fills.

C. Excavation and backfill for all Spray Ground structural requirements, including footings, foundations, slabs and balance tank.

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Conform with requirements of the General Conditions, and more specifically the following:

1. Comply with the International Building Code, latest edition.

2. Comply with applicable construction safety orders, latest edition, Federal and State OSHA.

3. Comply with applicable trench safety provisions, latest edition, Federal and State OSHA.

B. Qualifications of Workers:

1. The entity performing the work of this Section shall have been successfully engaged in the respective trade for at least five (5) years immediately prior to commencement of the Work.

2. For actual construction operations, use only trained and experienced workers with a minimum of three (3) years experience with the materials and methods specified.

3. Provide at least one person who shall be present at all times during execution of the work of this Section, with a minimum of five (5) years experience with the type of materials being installed, the referenced standards, and who shall direct all Work performed under this Section.

C. Project/Site Conditions:

1. Be familiar with site and subsurface conditions.

2. Excavation is unclassified and includes excavation to sub-grade elevations indicated or necessary, regardless of character of materials and obstructions encountered.

NOT FOR BIDDING PURPOSES

3. Provisions for mitigation of wet soils due to seepage or rain shall be made during excavation and throughout construction. If wet soils are encountered within the Spray Ground excavations, de-watering shall be provided and the Geotechnical Engineer shall make recommendations for moist soil mitigation.

4. Where slope instability is encountered, all excavations within those areas shall be 1:1 or flatter. Forming of vertical walls may be necessary, and all soil conditions shall be field verified by the Geotechnical Engineer.

5. Contractor shall review the Geotechnical Investigation Report as furnished by the Owner's Representative to determine the suitability of the soils.

D. Adverse Weather Conditions:

1. During the periods when site soil moisture content is substantially in excess of moisture content required for optimum compaction, do not perform fill compaction.

2. When unfavorable weather conditions necessitate interrupting filling and grading operations, prepare areas by compaction of surface and grading to avoid collection of water. Provide adequate temporary drainage to prevent erosion.

NOT FOR BIDDING PURPOSES

1.3 SUBMITTALS AND SUBSTITUTIONS

A. Provide submittals in conformance with requirements of Section 01 3300.

B. Required submittals include:

1. Offsite fill material, if applicable.

C. Submit proof of qualifications as specified in Article 1.2.A of this Section.

1.4 EXCAVATING & TRENCHING, GENERAL REQUIREMENTS

A. Refer to Division 1 of specifications, Temporary Facilities and Controls.

B. All trenches, holes, etc. are to be completely protected using solid barricades, steel plates, and plywood both during construction and during off hours, including nighttime.

C. Flashing warning light barricades are required on sidewalks, roads, and any other critical areas that require nighttime protection.

D. Roads, paths and sidewalks shall not be blocked at any time or in any way. Trenching across roads, paths or sidewalks involves special instructions and review of the construction procedure by the Owner's Representative at least three (3) days prior to the Work actually being started.

E. Construction equipment, including all trucks, cars, etc. shall not be parked or driven on roads, paths or sidewalks. Items not allowed on roads, paths or sidewalks include hoses, power cords, ropes, construction materials, dirt and debris, etc.

F. All roads, paths and sidewalks must remain clear and the Contractor shall maintain temporary safe and effective pedestrian access at all times.

G. Drawings show existing major underground utilities using the best information available. The Contractor shall also fully check public works reference drawings prior to excavation. Call local Dig Alert to locate utilities to ensure safety.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fill Material, General: All material shall be subject to the review and approval of the Geotechnical Engineer.

B. Existing Soils: The existing shallow SP, SP-SM and SM soils that do not contain organics may be re-used for structural fill. Acceptable borrow material shall include GW, SM, SW and SP classified in accordance with USCS. Furthermore, the material to be utilized as structural fill shall have a Plasticity Index (PI) less than 20.

C. Import Soils: The importation of high quality material should be allowed, and acceptable unit rates for importation and placement should be established. Sand, gravel and sand/gravel mixtures would be appropriate for wet weather placement. Otherwise, the materials as noted above will be acceptable for use as structural fill. Native or imported SM soils will be sensitive to alteration in moisture content and will become unworkable during the following periods of precipitation. For this reason, if earthwork is attempted in late autumn, winter or early spring, the above mentioned high quality imported granular materials shall be limited to those soils better than SM. SM materials become unworkable at moisture contents greater than 3 percentage points above optimum. The contractor shall dry these SM materials or set them aside for use in landscaping areas.

D. Fill Placement: Structural fill shall be placed in lifts which are 8 inches or less in loose thickness and shall be compacted to at least 95 percent of the Modified Proctor maximum dry density (ASTM D-1557). Adjustments to the natural moisture content of the soils may be required in order to obtain the specified compaction levels. Should utility construction be performed after earthwork, the Contractor shall be responsible for achieving 95 percent compaction in all trench backfill. These guidelines shall be set for all structural fill at the site including but not limited to building, ground slab, and pavement fills. For the proofrolling and fill compaction operations, fill limits shall extend at least 5 feet beyond the structure exterior walls.

E. Spray Ground Concrete Flatwork

1. The structural elements within the splash lagoon shall be supported on a reinforced structural slab. The spray ground shall be supported by 4 inches of crusher run type stone (CR-1, CR-6, GAB, etc) compacted to at least 95 precent of the modified proctor maximum dry density. (ASTM D-1557)

NOT FOR BIDDING PURPOSES

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify drawing dimensions and elevations with actual field conditions. Inspect related Work and adjacent surfaces and report discrepancies and conditions which prevent proper execution of the Work to the Owner.

3.2 EXCAVATION

A. Checking Layout: Contractor shall, before commencing the excavation work, check all lines, stakes and levels for dimensions, angles, elevations and grades with the survey.

B. Over-Excavation:

1. To provide uniform support, the soil beneath the swimming pool(s) shall be overexcavated and recompacted to a depth of at least three (3) feet below the swimming pool footings, foundations, grade beams and slabs. The overexcavation should extend at least five (5) feet beyond the inside and outside edges of the swimming pool(s). Prior to placing fill, the subgrade exposed by the overexcavation should be scarified to a depth of at least eight (8) inches, moisture-conditioned to at least three percent (3%) above optimum moisture content, and compacted to at least ninety percent (90%) relative compaction.

2. Excavate for footings, foundations, grade beams and slabs to depths indicated on Drawings. Elevations and depths of excavations shown on the Drawings shall govern and will be basis for bidding and execution of work except as otherwise may be directed by the Owner's Representative. Greater or lesser quantities of excavation and backfill required by authorized instructions shall be adjusted in accordance with the General Conditions.

3. In areas where proposed swimming pool decking is anticipated, the site should be excavated to a depth of one (1) foot below existing grade and backfilled with compacted engineered fill. The intent of this recommendation is to remove soils susceptible to compressibility.

4. Except where extra excavation is directed by the Owner's Representative or Geotechnical Engineer, excavations made to a greater depth or size than indicated or required shall be filled with concrete or shotcrete as specified in Sections 13 11 02 / 13 11 03.

C. Dimensions: Excavate to proper dimensions as shown, cut square and smooth with firm level bottoms. Prepared excavations shall be approved by Geotechnical Engineer. Excavations shall be free of loose or disturbed materials.

D. Excess Water Control: Keep all excavations free from standing water by pumping, draining or providing proper protection against water intrusion. If soil becomes soft, soggy or saturated, perform additional excavation to firm soil not affected by water.

NOT FOR BIDDING PURPOSES

E. Form Removal: Make all excavations of sufficient size to permit installation and removal of forms and all other required work.

F. Alternate Forming: Sides of structures may be formed by neat excavations where banks will stand without caving. If banks cave, provide forming as required and widen excavation to permit forming, bracing and inspection. Provide forming in conformance with Section 13 11 02, "Spray Ground Concrete" and all recognized safety standards.

3.3 BACKFILLING

A. Method: After concrete has been placed, forms removed and concrete work approved, backfill the excavations with earth to indicated or required grades. Carry on backfilling simultaneously on each side of walls or grade beams. Remove all rubbish and wood from the excavations before placing backfill.

B. Fill Placement: Structural fill shall be placed in lifts which are 8 inches or less in loose thickness and shall be compacted to at least 95 percent of the Modified Proctor maximum dry density (ASTM D-1557). Adjustments to the natural moisture content of the soils may be required in order to obtain the specified compaction levels. Should utility construction be performed after earthwork, the Contractor shall be responsible for achieving 95 percent compaction in all trench backfill. These guidelines shall be set for all structural fill at the site including but not limited to building, ground slab, and pavement fills. For the proofrolling and fill compaction operations, fill limits shall extend at least 5 feet beyond the structure exterior walls.

C. Concrete Protection: Prior to placing any backfill, adequately cure all concrete and provide any bracing required to ensure the stability of the structure. Protect waterproofing and dampproofing against damage in a manner acceptable to the Owner's Representative. Remove bracing as backfill operations progress.

D. Material: Use the material from the excavations for backfilling, subject to approval by Soils Testing Agency. The earth shall be free from debris, large clods or stones.

E. Moisture: Rigidly control the amount of water used to insure optimum moisture conditions for the type of fill material used. Excessive amounts of water causing saturation of earth will not be permitted. Compaction by flooding or jetting is prohibited.

F. Structural fill or backfill placed below the water table shall be in accordance with Geotechnical Report and observed by Geotechnical Engineer.

3.4 GRADING

A. Slopes: Grade to finish grades indicated on Drawings, with uniform slopes between all points.

B. Subgrades: Blade to required grade and roll or tamp subgrades for exterior slabs, decks and paving.

NOT FOR BIDDING PURPOSES

3.5 CLEAN-UP

A. Disposal: Haul away rubbish, debris, and rocks from site promptly and dispose of legally. Burning rubbish on site is prohibited.

B. Dust and Noise Abatement: During entire period of construction keep area and material being loaded sprinkled to reduce dust in air and annoyance to premises and surrounding property.

END OF SECTION 13 11 01

NOT FOR BIDDING PURPOSES

SECTION 13 11 02 – SPRAY GROUND CONCRETE

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Forming for cast-in-place concrete associated with Spray Ground areas and Spray Ground area decks.

B. Reinforcement for cast-in-place concrete associated Spray Ground areas and Spray Ground area decks.

C. Cast-in-place concrete for Spray Ground area structures. Do not use waterproofing admixture of any kind.

D. Cast-in-place concrete for Spray Ground area decks with Xypex C-500 crystalline waterproofing admixture. Water proofing admixture is for Spray Ground area decks only.

E. Provide labor, materials and equipment as required to install sealant for all Spray Ground area deck expansion joints, or any other caulking, as indicated on the aquatic Drawings and herein specified.

1.2 QUALITY ASSURANCE

A. Qualifications of Workers:

1. The entity performing the work of this Section shall have been successfully engaged in the respective trade for at least five (5) years immediately prior to commencement of the Work. The qualified contractor shall have completed the concrete decking of a minimum of FIVE (5) splash pads within the last FIVE (5) years. The bidding contractor shall submit a list of qualified projects with their bid.

2. For actual construction operations, use only trained and experienced workers with a minimum of three (3) years' experience with the materials and methods specified.

3. Provide at least one person who shall be present at all times during execution of the work of this Section, with a minimum of five (5) years' experience with the type of materials being installed, the referenced standards, and who shall direct all Work performed under this Section.

B. Standards:

1. In addition to complying with the International Building Code (latest edition 1908 comply with all pertinent recommendations contained in "Guide to Formwork for Concrete" Publication ACI 347R-14 of the American Concrete Institute.

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2. In addition to complying with International Building Code (latest edition), comply with all pertinent recommendations contained in "Guide to Presenting Reinforcing Steel Design Details," Publication ACI 315R-18 of the American Concrete Institute.

3. In addition to comply with all local codes and regulations, comply with all pertinent recommendations contained in American Society for Testing and Materials (ASTM); ASTM C 920 "Standard Specification for Elastomeric Joint Sealants."

4. Where provisions of applicable codes and standards conflict with the requirements of this Section, the more stringent provisions shall govern.

C. Tolerances: Construct all Spray Ground concrete straight, true, plumb and square within a tolerance horizontally of one in 200 and vertically of one in 2000.

1.3 SUBMITTAL AND SUBSTITUTIONS

A. Provide submittals in conformance with the requirements of Section 01 33 00.

B. Samples and Certificates, Concrete Reinforcement:

1. Provide all data and access required for testing as described in Section 01 40 00 of the Specifications.

2. All material shall bear mill tags with heat number identification. Mill analysis and report shall be made available upon request.

3. Material not so labeled and identifiable may be required by the Owner's Representative to be tested by the testing laboratory selected by the Owner's Representative and at no additional cost to the Owner, in which case random samples will be taken for one series of tests from each 1-1/2 tons or fraction thereof of each size and kind of reinforcing steel.

4. Design mix from batch plant demonstrating previous use history and associated strengths at 28 days.

5. The Contractor shall submit a mix design stamped and signed by a licensed engineer for approval by the Owner's representative prior to any placement of concrete.

6. The Contractor shall submit a mix design stamped and signed by a licensed engineer for the Spray Ground area decks which contains the specified Xypex C-500 crystalline waterproofing admixture for approval by the Owner's Representative prior to any placement of concrete.

C. Submit proof of qualifications as specified in Article 1.2.A of this Section.

D. Submit reinforcing shop drawings of pool walls, gutters, floors, dike walls and balance tanks, etc. as shown on the construction drawings.

NOT FOR BIDDING PURPOSES

1.4 PRODUCT HANDLING

A. Delivery: Deliver materials to the Project Site in the manufacturer's original unopened containers with all labels intact and legible.

B. Storage: Store materials under cover in a manner to prevent damage and contamination, and store only the specified materials at the Project Site.

C. Protection: Use all means necessary to protect the Spray Ground concrete before, during, and after installation and to protect the installed Work specified in other Sections.

D. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner's Representative.

PART 2 - PRODUCTS

2.1 CONCRETE FORMWORK

A. Form Materials:

1. Form Lumber: All form lumber in contact with exposed concrete shall be new except as allowed for reuse of forms in Part 3 of this Section, and all form lumber shall be one of the following, a combination thereof, or an equal approved in advance by the Owner.

a. "Plyform," Class I or II, bearing the label of the Douglas Fir Plywood Association; "Inner-Seal" Form as manufactured by Louisiana-Pacific, or equal.

b. Douglas Fir-Larch, number two grade, seasoned, surfaced four sides.

2. Form Release Agent: Colorless, non-staining, free from oils; chemically reactive agent that shall not impair bonding of paint or other coatings intended for use.

B. Ties and Spreaders:

1. Type: All form ties shall be a type which do not leave an open hole through the concrete and which permits neat and solid patching at every hole.

2. Design: When forms are removed, all metal reinforcement shall be not less than two (2) inches from the finished concrete surface.

3. Wire Ties and Wood Spreaders: Do not use wire ties or wood spreaders.

C. Alternate Forming Systems: Alternate forming systems may be used subject to the advance approval of the Owner.

NOT FOR BIDDING PURPOSES

2.2 CONCRETE REINFORCEMENT

A. Bars: Bars for reinforcement shall conform to "Specifications for Deformed Carbon-Steel Bars for Concrete Reinforcement," ASTM A-615, Grade 60.

B. Wire Fabric: Wire fabric shall conform to "Specifications for Carbon Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete," ASTM A1064.

C. Tie Wire: Tie wire for reinforcement shall conform to "Specifications for Carbon Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete," ASTM A1064 black annealed 16-gauge tie wire.

2.3 CAST-IN-PLACE CONCRETE

A. Concrete:

1. All concrete, unless otherwise specifically permitted by the Owner, shall be transit-mixed in accordance with ASTM C94. Concrete for water retaining structures that do not receive a waterproofing finish (such as ceramic tile or Spray Ground plaster) shall receive a topical waterproofing finish.

2. The control of concrete production shall be under the supervision of a recognized testing agency, selected by the Owner.

3. Quality: All concrete shall have the following minimum compressive strengths at twenty-eight (28) days and shall be proportioned within the following limits:

a. 4,000 psi minimum compressive strength.

b. 1" maximum size aggregate.

c. 6.0 minimum sacks of cement per cubic yard. *

d. Maximum water to cement ratio of 0.40 minimum - 0.45 maximum.

e. 4" maximum slump.

f. Xypex Admix C-500 2%-2.5% by weight of cement content. Contact Xypex Technical Services to confirm dosage. (To be used for Spray Ground decks only.)

* For estimate only: to be determined by mix design.

4. Cement: All cement shall be Portland Cement conforming to ASTM C-150, Type II or V, and shall be the product of one manufacturer.

5. Aggregates:

a. Shall conform to "Standard Specifications for Concrete Aggregates," ASTM C33, except as modified herein.

NOT FOR BIDDING PURPOSES

b. Coarse Aggregate: Clean sound washed gravel or crushed rock. Crushing may constitute not more than 30% of the total coarse aggregate volume. Not more than 5% flat, thin, elongated or laminated material nor more than 1% deleterious material shall be present. 1" aggregate graded from 1/4" to 1", fineness modulus 6.90 to 7.40. 1-1/2" graded from ½" to 1-1/2", fineness modulus 7.80 to 8.20.

c. Fine Aggregate: Washed natural sand of hard, strong particles and shall contain not more than 1% of deleterious material, fineness modulus 2.65 to 3.05.

d. Aggregate must be certified, non-expansive from a "known" good source.

6. Water: ASTM C1602; Clean, fresh, free from acid, alkali, organic matter or other impurities liable to be detrimental to the concrete (potable).

7. Admixtures: Admixtures shall be used upon approval of the Owner.

a. Air-entraining admixture: Conform to ASTM C260.

b. Water-reducing admixture: Conform to ASTM C494.

c. Waterproofing admixture for swimming pool decks only: Xypex Admix C-500, no substitutions permitted. Conform to ASTM C494.

8. Xypex Admix C-500 Dosage: To be used for Spray Ground decks only.

a. General: Xypex Admix must be added to concrete mix at time of batching. It is important to obtain a homogeneous mixture of Xypex Admix with the concrete. Do not add dry Admix powder directly to wet mixed concrete as this could cause clumping and thorough dispersion may not occur.

b. Dosage Rate: Under normal conditions, the crystalline waterproofing powder shall be added to the concrete mix at the following rates:

1) Xypex Admix C-500 2% – 2.5% by weight of cement content

c. Weather Conditions: For mixing, transporting and placing concrete under conditions of high temperature or low temperature, follow concrete practices such as those referred to in ACI 305R (Hot Weather Concreting) and ACI 306R (Cold Weather Concreting) or other applicable standards.

d. Concrete Batching & Mixing Procedures: Procedures for the addition of Xypex admixture will vary according to type of batch plant operation and equipment. Prior to the placement of any concrete, the concrete batch plant and the contractor shall be responsible to consult with the local Xypex representative concerning additional procedures for the addition, mixing and to confirm dosage.

NOT FOR BIDDING PURPOSES

Note: For enhanced chemical protection or for meeting specific project requirements or where the concrete mix design contains higher than 25% type F fly ash content or includes a Portland cement/slag cement/type C fly ash blend, consult with manufacturer or its authorized representative to determine appropriate dosage rates

B. Construction Joints: Use keyform for slab pour joints. Either preformed galvanized or PVC construction joint forms of a standard manufacturer may be used. Install per manufacturer's recommendations and tool edges of slabs.

C. Waterstops: PVC bulb-type for use between concrete pours / lifts, conforming with ASTM D 570, D 624, and D 638. Provide in configuration(s) as recommended by manufacturer for specific application. Greenstreak, W.R. Meadows, or equal.

A. Curing Materials:

1. Liquid Membrane (covered slab): Chlorinated rubber membrane forming, curing sealing compound conforming to ASTM C309.

2. Liquid Membrane (exposed slab): Clear methyl and butyl methacrylate non-staining, membrane forming, curing-sealing compound conforming to ASTM C309.

D. Cement Grout and Drypack:

1. Cement Grout: Mix 1 part by volume of Portland Cement, 1/2 part by volume of water and fine aggregate enough to make mixture flow under its' own weight.

2. Drypack: Mix 1 part by volume of Portland Cement, 1/2 part by volume of water and fine aggregate enough to make a stiff mix that will mold into a ball. Mix no more than can be used in 30 minutes.

NOT FOR BIDDING PURPOSES

2.4 JOINT SEALANT MATERIALS

A. Caulking: Multipart, non-sag gun grade polyurethane-based sealant meeting the requirements of ASTM C920-02, Type S or M, Mamemco International, Pecora, Sika Corp., Sonneborn Building Products, Tremco or approved equal. Self-leveling caulking materials are not allowed.

B. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

C. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

D. Sealant Backer Rod: Provide compressible polyethylene or polyurethane backer rod as recommended by the sealant manufacturer.

E. Bond Breaker Tape: Provide polyethylene tape or other plastic tape as recommended by sealant manufacturer, to be applied to sealant-contact surfaces where bond to substrate or joint filler must be avoided for proper performance of sealant.

2.5 OTHER MATERIALS

A. All other materials, not specifically described but required for proper completion of the work of this Section, shall be as selected by the Contractor subject to the advance review by the Owner.

2.6 BALANCE TANK / SPRAY GROUND DRAINS WATERPROOFING

A. Provide waterproofing in accordance with Section 13 11 05 of the specifications.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection:

1. Prior to all Work of this Section, carefully inspect the installed Work of other trades and verify that all such Work is complete to the point where this installation may properly commence.

2. Verify that all Work may be constructed in accordance with all applicable codes and regulations, the referenced standards, the original design, and in accordance with site specific Geotechnical Report.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Owner.

2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3. Failure to notify the Owner and give written notice of discrepancies shall constitute acceptance by the Contractor of existing conditions as fit and proper to receive work.

NOT FOR BIDDING PURPOSES

3.2 CONCRETE FORMWORK

A. Construction of Forms:

1. General: Construct all required forms to be substantial, sufficiently tight to prevent leakage of concrete paste, and able to withstand excessive deflection when filled with wet concrete.

2. Layout:

a. Form for all required cast-in-place concrete to the shapes, sizes, lines and dimensions indicated on the Drawings.

b. Exercise particular care in the layout of forms to avoid necessity for cutting concrete after placement.

c. Make proper provisions for all openings, offsets, recesses, anchorages, blocking and other features of the Work as shown or required.

d. Perform all forming required for Work of other trades and do all cutting and repairing of forms required to permit such installation.

e. Carefully examine the Drawings and Specifications and consult with other trades as required relative to providing for pipe and conduit penetrations, reglets, chases and other items in the forms.

3. Imbedded Items: Set all required steel frames, angles, bolts, inserts and other such items required to be anchored in the concrete prior to concrete being placed.

4. Bracings:

a. Properly brace and tie the forms together so as to maintain position and shape and to ensure safety to workmen.

b. Construct all bracing, supporting members and centering of ample size and strength to safely carry, without excessive deflection, all dead and live loads to which they may be subjected.

c. Properly space the forms apart and securely tie them together, using metal spreader ties that give positive tying and accurate spreading.

5. Wetting: Keep forms sufficiently wetted to prevent joints from opening up before concrete is placed.

B. Plywood Forms:

1. Design: Nail the plywood panels directly to studs and apply in a manner to minimize the number of joints.

2. Joints: Make all panel joints tight butt joints with all edges true and square.

C. Footing Forms:

1. Wood Forms: All footing forms shall be wood unless otherwise specifically approved by the Owner, or as specified in paragraph 3.2(C)(2).

2. Earth Forms:

a. Side walls for footings may be of earth provided the soil will stand without caving and the sides of the bank are made with a neat cut to the minimum dimensions indicated on the Drawings.

NOT FOR BIDDING PURPOSES

b. For excavation and backfill of earth forms, conform with applicable provisions of Section 13 11 01, “Spray Ground Excavation”.

D. Reuse of Forms:

1. Reuse of forms shall be subject to advance approval of the Owner.

2. Except as specifically approved in advance by the Owner, reuse of forms shall in no way delay or change the schedule for placement of concrete from the schedule obtainable if all forms were new.

3. Except as specifically approved in advance by the Owner, reuse of forms shall in no way impart less structural stability to the forms nor less acceptable appearance to finished concrete.

E. Removal of Forms:

1. General:

a. In general, side forms of footings may be removed seven (7) days after placement of concrete, but time may be extended if deemed necessary by the Owner.

b. Forms for footings, foundations, grade beams, slabs, walls, and other formed concrete may be removed fourteen (14) days after placement of concrete.

2. Removal:

a. Use all means necessary to protect workers, passersby, the installed Work of other trades and the complete safety of the structure.

b. Cut nails and tie wires or form ties off flush, and leave all surfaces smooth and clean.

c. Remove metal spreader ties on exposed concrete by removing or snapping off inside the wall surface and pointing up and rubbing the resulting pockets to match the surrounding areas.

d. Flush all holes resulting from the use of spreader ties and sleeve nuts using water, and then solidly pack throughout the wall thickness with cement grout applied under pressure by means of a grouting gun; grout shall be one part Portland Cement to 2-1/2 parts sand; apply grout immediately after removing forms.

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3.3 CONCRETE REINFORCEMENT

A. Bending:

1. General:

a. Fabricate all reinforcement in strict accordance with the Drawings.

b. Do not use bars with kinks or bends not shown on the Drawings.

c. Do not bend or straighten steel in a manner that will injure the material. (When opposite end is already encased in concrete.)

2. Design:

a. Bend all bars cold.

b. Make bends for stirrups and ties around a pin having a diameter of not less than two (2) times the minimum thickness of the bar.

c. Make bends for other bars, including hooks, around a pin having a diameter of not less than six (6) times the minimum thickness of the bar.

B. Placing:

1. General: Before the start of concrete placement, accurately place all concrete reinforcement, positively securing and supporting by concrete blocks, metal chairs or spacers, or by metal hangers.

2. Clearance:

a. Preserve clear space between bars of not less than one and one-half (1-1/2) times the nominal diameter of the round bars.

b. In no case let the clear space be less than one and one-half (1-1/2) inches nor less than one and one-third (1-1/3) times the maximum size of the aggregate.

c. Provide the following minimum concrete covering of reinforcement:

1) Concrete deposited against earth: three (3) inches minimum.

2) Concrete below grade deposited against forms: two (2) inches minimum.

3) Concrete elsewhere: As indicated on Drawings or otherwise approved by the Owner.

3. Splicing:

a. Horizontal Bars:

1) Place bars in horizontal members with minimum lap at splices sufficient to develop the strength of the bars.

2) Bars may be wired together at laps except at points of support of the member, at which points preserve clear space described above.

3) Whenever possible, stagger the splices of adjacent bars.

4) Splice sixty (60) bar diameters minimum.

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b. Wire Fabric: Make all splices in wire fabric at least one and one-half (1-1/2) meshes wide.

c. Other Splices: Make only those other splices that are indicated on the Drawings or specifically approved by the Owner.

4. Dowels: Place all required steel dowels and securely anchor them into position before concrete is placed.

5. Obstructions: In the event conduits, piping, inserts, sleeves and other items interfere with placing reinforcement as indicated on the Drawings or otherwise required, immediately consult with the Owner and obtain approval of a new procedure prior to placing concrete.

C. Cleaning Reinforcement: Steel reinforcement, at the time concrete is placed around it, shall be free from rust scale, loose mill scale, oil, paint and all other coatings which will destroy or reduce the bond between steel and concrete. Bend down all the tie wire away from the top of the pool deck. Maintain a 2" clear from top of concrete to the tie wire.

3.4 CAST-IN-PLACE CONCRETE

A. Conveying and Placing Concrete:

1. Before placing concrete, mixing and conveying equipment shall be well cleaned, and the forms and space to be occupied by concrete shall be thoroughly cleaned and wetted. Ground water shall be removed until the completion of the work.

2. No concrete shall be placed in any unit of work until all formwork has been completely constructed, all reinforcement has been secured in place, all items to be built into concrete are in place, and form ties at construction joints tightened.

3. Concrete shall be conveyed from mixer to place of final deposit in such a way to prevent the separation or loss of ingredients. It shall be placed as nearly as practicable in its' final position to avoid rehandling or flowing. Concrete shall not be dropped freely where reinforcing bars will cause segregation, nor shall it be dropped freely more than six (6) feet. Use tremies, spouts and dump boxes in deep sections. Vibrators are not acceptable for facilitating concrete transport.

4. Concrete shall be tamped and spaded to insure proper compaction into all parts of forms and around reinforcement. A mechanical vibrator shall be used to thoroughly compact the concrete. Vibration must be by direct action in the concrete and not against forms or reinforcement.

5. Mixing and transport time as indicated in ASTM C94 is required. If air temperatures are between 85° and 90° F the delivery time is to be reduced to 75 minutes. When air temperatures are in excess of 90° F the delivery time should be reduced to 60 minutes.

6. Truck mixes without batch certificates will be rejected.

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B. Construction Joints / Expansion Joints: Construction joints and expansion joints shall be provided at locations and in the manner shown on the Drawings. With exception of existing concrete / new shotcrete joints, use PVC bulb-type waterstops appropriate for design condition between all concrete pours / lifts to avoid cold joints. Waterstops shall be placed in such a way to protect reinforcing steel from rust and oxidation. All expansion joints must be the full depth of the concrete section in which they are located.

C. Slab Finishes: Concrete slabs shall be compacted and screeded uniformly to grades shown. Push large aggregates below the surface with a screen tamper, screed and bull float. As soon as the surface becomes workable, it shall be wood floated, then finished as indicated on the Drawings to a uniform smooth, true surface in a neat and workmanlike manner. Carefully coordinate slab finish requirements with other trades (ceramic tile, pool plaster) to insure concrete finish is appropriate substrate for final finish material.

1. Contractor shall provide three mock-up deck samples, minimum 3' x3', with a wedge anchor installed in one sample. These three (3) samples shall be constructed; one (1) with a light broom finish, one (1) with a medium broom finish and one (1) with a heavy broom finish for determination and selection of an appropriate deck finish. Each sample shall be edged on all four sides to demonstrate a ¾" radius edge. Anchor installation shall demonstrate acceptable interface between anchor and the top of deck. Deck samples shall remain on job site through final inspection for reference.

2. Spray Ground Decks: Medium Broom Finish.

D. Protection and Curing:

1. Concrete shall be protected from injurious action of the elements and defacement of any nature during construction.

2. All forms must be kept wet to prevent drying out of the concrete.

3. All concrete surfaces including footings must be kept wet for at least seven (7) days after concrete is placed.

4. Apply the appropriate curing materials, as specified in 2.3 of this Section, immediately after finishing slabs. Application shall be as specified by the manufacturer.

E. Form Removal:

1. Take care in removing forms so that surfaces are not marred or gouged and that corners are true, sharp and unbroken.

2. No steel spreaders, ties or other metal shall project from or be visible on any concrete surfaces.

F. Defective Work:

1. Should the strength of any concrete for any portion of the work indicated by tests of molded cylinders and core tests fall below minimum 28 days strength specified or indicated, concrete will be deemed defective work and shall be replaced.

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2. Concrete work that is not formed as indicated, is not true to intended alignment, not plumb or level where so intended, not true to intended grades or elevations, not true to specified or selected finish, contains sawdust shavings, wood, or embedded debris, which exhibits cracks or contains fine or coarse sulfide particles, or expansive aggregates detrimental to performance or appearance of the concrete shall be deemed defective.

3. Promptly perform work required to replace and properly clean (by sandblasting if necessary) any defective concrete panels (control joint or expansion joint to control joint or expansion joint), at Contractor's expense, including all expense of additional inspection, tests, or supervision made necessary as a result of defective concrete.

3.5 EXPANSION JOINTS

A. Temperatures: Do not install sealants when air temperature is less than 40°F.

B. Tooling: Tool exposed joints to a slightly concave surface using slicking materials recommended by the manufacturer. The tooling procedure shall press sealant against the sides of the joint. No materials shall be left “feathered” out or smeared on the abutting materials. Completed joints shall have a uniform professional appearance.

C. Joint Construction: Sealant joint width, thickness and cross-sectional profile to be constructed in strict accordance with the sealant manufacturer’s recommendations.

3.6 CLEAN-UP

A. Upon completion of the Work of this Section, immediately remove all Spray Ground concrete materials, debris and rubbish occasioned by this Work to the approval of the Owner.

END OF SECTION 13 11 02

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SECTION 13 11 05 – SPRAY GROUND WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Furnish all labor, materials, tools and equipment as necessary to perform Cement Waterproofing on new and existing structures as shown on drawings and as specified in this section.

B. Related Sections:

1. Division 13, Section 13 1102 “Spray Ground Concrete.”

1.2 QUALITY ASSURANCE

A. Qualifications of Workers:

1. The entity performing the work of this Section shall have been successfully engaged in the respective trade for at least five (5) years immediately prior to commencement of the Work.

2. For actual construction operations, use only trained and experienced workers with a minimum of three (3) years experience with the materials and methods specified.

3. Provide at least one person who shall be present at all times during execution of the work of this Section, with a minimum of five (5) years experience with the type of materials being installed, the referenced standards, and who shall direct all Work performed under this Section.

B. Standards:

1. ASTM C 39/C 39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 1999.

2. ASTM C 109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars.

3. ASTM C 267 - Standard Test Methods for Chemical Resistance of Mortars, Grouts, and Monolithic Surfacings and Polymer Concretes; 1997.

4. ASTM C 321 - Standard Test Method for Bond Strength of Chemical-Resistant Mortars.

5. ASTM C 348 - Standard Test Method for Flexural Strength of Hydraulic Cement Mortars.

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6. ASTM E 96 - Standard Test Method for Water Vapor Transmission of Materials.

7. ASTM E 329 - Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction; 1998a.

8. COE CRD-C 48 - Standard Test Method for Water Permeability of Concrete; 1992.

9. NSF 61 - Drinking Water System Components - Health Effects; 2000a.

1.3 SUBMITTALS

A. Submit under provisions of Section 01 33 00.

B. Product Data: Manufacturer's printed data sheet, for specified products.

C. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

1. Testing Agency: Independent laboratory meeting the requirements of ASTM E 329 and certified by the United States Bureau of Standards.

D. Certificates: Product certificates signed by manufacturer certifying that:

1. Materials comply with specified performance characteristics and physical requirements.

2. Installer is qualified and approved by manufacturer.

E. Manufacturer's installation instructions.

F. Manufacturer's report on field inspection of substrates, prior to installation.

G. Executed warranties.

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1.4 PRODUCT HANDLING

A. Deliver and store in a dry area between 40ºF (5ºC) and 90ºF (32ºC). Handle and protect from freezing and direct sun light in accordance with manufacturer's instructions.

B. Deliver materials in manufacturer's unopened containers, fully identified with brand, type, grade, class and all other qualifying information. Provide Material Safety Data Sheets for each product.

C. Take necessary precautions to keep products clean, dry and free of damage.

1.5 SYSTEM REQUIREMENTS

A. Coordinate waterproofing installation with other trades.

B. Provide materials and accessories in timely manner so as not to delay Work.

1.6 PROJECT CONDITIONS

A. Maintain surfaces to be waterproofed and surrounding air temperature at not less than 40ºF (5ºC). Apply only when temperatures are steady or rising.

B. Do not apply materials to frozen or frost-filled surfaces.

C. Exercise caution when temperatures exceed 90ºF (32ºC).

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Approved Manufacturers:

1. Xypex Chemical Corporation; 13731 Mayfield Place, Richmond, BC V6V 2G9. ASD. Tel: (800) 961-4477 or (604) 273-5265. Fax: (604) 270-0451. E-mail: info@xypex.com. www.xypex.com.

2. Miracote Miraflex Membrane C 3000 E. Harcourt St., Rancho Dominguez, CA 90221 Phone: (310) 631-6594, Fax: (310) 886-9119

3. Hycrete, Inc.; 462 Barrett Ave, Carlstadt, NJ, 07072. Phone: (201) 386-8110. Fax: (201) 386-8155. www.hycrete.com

B. Requests for substitutions will be considered only if submitted to the architect/engineer in writing and must include substantiation of product performance, 10 days prior to the original bid date.

2.2 MATERIALS

A. Waterproofing Material - Acrylic Modified Cement Waterproofing: Cementitious, two-component, acrylic emulsion based, highly flexible, crack bridging waterproof membrane barrier against positive water pressure, with the following characteristics:

1. Product: Xypex or Miracote Miraflex two coat crystalline waterproofing or Hycrete W500

2. Color: Gray

3. Dry Component-A: Precise blend of cementitious material

4. Liquid Component-B: White acrylic emulsion and admixtures

5. Working Time: Approximately 45 minutes

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6. Shore A Hardness: > 90

7. Bond/Adhesion: (ASTM C-321) 215 psi (1.5 MPa) @ 28 days

8. Tear Resistance: 190 psi (1.3 MPa) at 68oF (20oC)

9. Elongation: (%) 60 (gray); 40 (white) at 68oF (20oC)

10. Elongation: (mils) 40 (gray); 25 (white)

11. Crack bridging capacity: (inch) 1/16 (gray) (1.5 mm)

12. Vapor Permeability: (US Perms) 1.2 (ASTM E-96)

13. Waterproofing: (CRD C 48-92) Withstands 200 psi = 460 feet (14 bar = 140 m) hydrostatic pressure (positive side) at 3/32 (2.4 mm) thickness.

14. Penetration: At least 2 inches (50 mm) penetration of crystal-forming material, evidenced by scanning electron microscope photographs.

15. Chemical Resistance: No detrimental effects when tested using 4000 psi (27.6 MPa) compressive strength concrete in accordance with ASTM C 267 using hydrochloric acid (pH of 3.5), brake fluid, transformer oil, ethylene glycol, toluene, and caustic soda as test mediums for duration of 84 days each; minimum of 14 percent increase in concrete compressive strength when tested in accordance with ASTM C 39/C 39M.

16. Potable Water Contact Approval: NSF certification for use on structures holding potable water, based on testing in accordance with NSF 61.

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine all construction substrates and conditions under which waterproofing materials are to be installed. Do not proceed with the waterproofing application until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Protect adjacent surfaces not designated to receive waterproofing.

B. Substrate preparation:

1. Remove oil, grease, dirt, loose particles, remains of form oils, water repellents, rust or other coatings by high-pressure water blasting (>3000 psi), wet or dry sand blasting, or other mechanical means to produce surfaces suitable for application of waterproofing.

2. Follow manufacturer's instructions to clean and prepare surfaces and seal cracks and joints.

3. Voids in concrete substrates: 1/4-inch (6 mm) diameter and larger, pre-treat with a cementitious mortar. Less than 1/4-inch (6 mm) diameter can be filled with a scratch coat of two-component waterproofing material.

C. Rinse surfaces to be waterproofed (excluding drywall or similar) with clean water to saturated surface dry (SSD) condition, with no standing water on horizontal surfaces.

3.3 INSTALLATION

A. Mix two-component waterproofing material in proportions recommended by manufacturer.

B. Taping:

1. Apply two-component waterproofing material by brush in a six to seven inch (15 – 18 cm) wide strip coat centered over all joints, cracks, penetrations and changes of plane to be taped.

2. While this coat is still wet, unroll joint sealing tape into the coating and apply a coat of two-component waterproofing material over the tape, smoothing out wrinkles and fish mouths.

C. Positive Side Waterproofing:

1. Apply two-component waterproofing material in quantities as per manufacturer's specifications and recommendations:

a. Apply at 60 mils or 1/16” (1.5 mm) total thickness for water levels up to 2-feet (0.60 m).

b. Apply at 90 mils (2.4 mm) total thickness for water depth greater than 2-feet (>0.60 m).

D. Application considerations:

1. Apply, using stainless steel trowel, tampico brush, short nap roller, or appropriate compressed-air spray equipment.

2. If needed, such as in zones posed to movement or cracking, plaza decks, the waterproofing material can be additionally reinforced with a reinforcing mesh (supplied by waterproofing manufacturer), embedded between two waterproofing layers.

3. Apply only when surface and ambient temperatures are 40°F (5°C) and rising. At high temperatures i.e., 86°F (30°C) and above) protect application from direct sun and wind to prevent premature surface drying and shrinkage cracks. Apply material in two coats minimum.

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4. Application thickness should not exceed 1/8-inch (120 mils (3 mm)).

5. Do not bridge cracks greater than 1/16-inch (1.5 mm).

6. Bridge dynamic cracks or joints with elastomeric joint sealing tape, as supplied by waterproofing manufacturer.

7. Do not overcoat waterproofing material with solvent-based materials.

8. Prime and protect alkali sensitive metals such as copper, aluminum, galvanized or zinc treated metal before over-coating with waterproofing material. Follow manufacturer's recommendations for primer material.

3.4 CURING

A. Follow manufacturer's general instructions for curing and hardening of waterproofing material. Do not use water for curing. Waterproofing material is self-curing.

B. Protect surfaces from rain, frost, and premature dehydration.

3.5 ACCEPTANCE

A. Remove left over materials and any foreign material resulting from the work from the site.

B. Clean adjacent surfaces and materials occasioned by this Work to the approval of the Owner.

END OF SECTION 13 11 05

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SECTION 13 11 06 – SPRAY GROUND EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Spray Ground equipment items required for this Work as indicated on the Drawings and specified herein.

B. Provide start up and operation instructions to the Owner for both the Spray Ground and mechanical equipment. Properly balance Spray Ground water chemistry until such time that the Owner takes occupancy of the project.

1.2 QUALITY ASSURANCE

A. Qualifications of Workers:

1. The entity performing the work of this Section shall have been successfully engaged in the respective trade for at least five (5) years immediately prior to commencement of the Work. The qualified contractor shall submit documentation of a minimum of five (5) interactive Spray Ground play equipment and climb-on structure installations completed within the last five years.

2. For actual construction operations, use only trained and experienced workers with a minimum of three (3) years experience with the materials and methods specified.

3. Provide at least one person who shall be present at all times during execution of the work of this Section, with a minimum of five (5) years experience with the type of materials being installed, the referenced standards, and who shall direct all Work performed under this Section.

B. All equipment supplied or work performed shall comply with regulations governing public Spray Ground areas as contained within State and Local Codes.

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1.3 SUBMITTALS AND SUBSTITUTIONS

A. Provide submittals in conformance with the requirements of Section 01 33 00.

B. Required submittals include:

1. Spray Ground Deck and Mechanical Equipment as specified in Article 2.1-2.15 of this Section.

C. Submit proof of qualifications as specified in Article 1.2.A of this Section.

D. The equipment shown on the plans represent the first listed items in the technical specifications. The Contractor shall be responsible for all required field coordination and installation of any approved equal product to provide a fully working and warranted system. The Contractor shall submit detailed shop drawings for any products used other than the first listed specified items. Contractor provided shop drawings shall include details and quality equal to the original plans and construction documents. The Contractor shall provide any and all required engineering including but not limited to structural and anchorage requirements for any proposed equipment other than the first listed specified equipment. The Contractor is responsible to provide a factory certified representative(s) to start-up and provide on-site training for all swimming pool mechanical equipment provided.

1.4 PRODUCT HANDLING

A. Protection: Use all means necessary to protect Spray Ground equipment items before, during and after installation and to protect the installed work specified in other Sections.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner's Representative.

PART 2 - PRODUCTS

2.1 DECK EQUIPMENT

A. Spray Ground Safety Signs: As required by the Department of Health. Submittal required. Placement at the pool site shall be in conformance with Health Department Inspector. One (1) set minimum per site.

B. Spray Ground Elements: As manufactured by 'Waterplay' or approved equal.

	Elements	Base Bid - Qty	Additive Alternate - Qty	Total Flow
1.	DS Spring Waterplay 0002-1741	1	1	20 GPM
2.	FS Toddler Slide Waterplay 0011-2519	1	1	0 GPM
3.	FS Fish Waterplay 0010-9269	2	2	28 GPM
4.	FS Rain Forest Waterplay 0010-1709	3	4	24 GPM
5.	FS Surf Stone #1 Waterplay 0010-7471	2	3	15 GPM
6.	FS Surf Stone #2 Waterplay 0010-7472	3	7	35 GPM
7.	FS Surf Stone #3 Waterplay 0010-7473	3	5	25 GPM
8.	FS Water-O	1	1	10 GPM

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	Waterplay 0010-7481			
9.	FS Wiggly Waterplay 0010-0418	6	6	18 GPM
10	FS Charlotte's Web Waterplay 0010-7475	6	6	18 GPM
11.	Monster 5 Waterplay 0010-7480	4	4	40 GPM
12.	GS Solo Spurt Waterplay 0010-7481	2	9	9 GPM
13.	GS Split Spurt Waterplay 0010-7482	2	2	3 GPM
14.	GS Spray Tunnel 4 Waterplay 0010-7496	2	2	24 GPM
15.	GS Straight Up Waterplay 0010-7485	4	4	24 GPM
16.	FS Basin Waterplay 0010-3859	1	1	5 GPM
17.	FS Gully Waterplay 0010-4589	1	1	7 GPM
18.	FS Leaflet Waterplay 0010-7947	2	2	16 GPM
19.	FS Waterfall #3 Waterplay 0010-7473	1	1	15 GPM
20.	GS Team Effect Waterplay 0010-9816	3	3	24 GPM
21.	FS Blue Bottle Waterplay 0010-1438	0	1	8 GPM
22.	FS Flutter Waterplay 0010-1443	0	1	8 GPM
23.	FS Lady Bug Soaker Waterplay 0010-3080	0	1	30 GPM
24.	FS Sparx Waterplay 0010-1452	0	2	30 GPM
25.	GS Doughnut Spray Waterplay 0010-7494	0	1	24 GPM
26.	GS Fountain Mountain Waterplay 0010-7477	0	2	33 GPM
27.	GS Geyser Waterplay 0010-7478	0	3	18 GPM
28.	FS Flutterby Waterplay 0011-1438	0	1	1 GPM
29.	FS Hopper #2 Waterplay 0010-3080	0	1	10 GPM
30.	FS Waterfall #1 Waterplay 0010-4590	0	1	10 GPM

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31.	GS Frog Waterplay 0010-7455	0	3	9 GPM
32.	GS Puddle Waterplay 0010-7466	0	4	12 GPM
33.	Activator Sprout Waterplay 0010-1453	2	4	
34.	Circulator Drain Waterplay 0010-4133	4	13	
			Base Bid Total Feature Flow Rate	312 GPM
			Additive Alternate Total Feature Flow Rate	342 GPM
Note: Spray Ground decks shall have non-slip finish and shall slope 2% max. in any direction.				

2.2 SPRAY GROUND CIRCULATION PUMP – Base Bid

A. 'Jandy' SHPF 3.0 3PH pump, 208V 3PH, 3 HP with Danfoss 3 HP variable frequency drive; self-priming pump; 3,450 RPM; rated at 140 GPM at 60 ft. TDH; with integral strainer, pump to be programmed with flow rate of 176 GPM. One (1) total. Jandy, Pentair or approved equal.

2.3 SPRAY GROUND BOOSTER PUMP #1 – Base Bid

A. 'Jandy' SHPF 1.5 3PH pump, 208V 3PH, 3 HP with Danfoss 3 HP variable frequency drive; self-priming pump; 3,450 RPM; rated at 110 GPM at 60 ft. TDH; with integral strainer, pump to be programmed with flow rate of 90 GPM. One (1) total. Jandy or approved equal.

2.4 SPRAY GROUND BOOSTER PUMP #1 – **Additive Alternate**

A. 'Jandy' JCP 5.0 3PH pump, 208V 3PH, 5 HP with Danfoss 5 HP variable frequency drive; self-priming pump; 3,450 RPM; rated at 265 GPM at 60 ft. TDH; with integral strainer, pump to be programmed with flow rate of 245 GPM. One (1) total. Jandy or approved equal.

2.5 SPRAY GROUND BOOSTER PUMP #2 – Base Bid

A. 'Jandy' JCP 5.0 3PH pump, 208V 3PH, 5 HP with Danfoss 5 HP variable frequency drive; self-priming pump; 3,520 RPM; rated at 380 GPM at 60 ft. TDH; with integral strainer, pump to be programmed with flow rate of 310 GPM. One (1) total. Jandy or approved equal.

2.6 SPRAY GROUND BOOSTER PUMP #2 – **Additive Alternate**

A. 'Jandy' JCP 7.5 3PH pump, 208V 3PH, 7.5 HP with Danfoss 5 HP variable frequency drive; self-priming pump; 3,520 RPM; rated at 380 GPM at 60 ft. TDH; with integral strainer, pump to be programmed with flow rate of 310 GPM. One (1) total. Jandy or approved equal.

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2.7 SPRAY GROUND FILTER(S) – Base Bid

A. 'Pentair' Triton #2-TR-140C-3 hi-rate permanent media filter with 14.12 sq. ft. of filter area rated at 211.8 GPM at 15 GPM/sq. ft. Complete with 4" flanges and tandem filter piping manifold kit, 4" backwash, seismic anchorage. Provide all utilities, piping, valving, etc. Two (2) tanks total. (1,007 lbs. each) Pentair, Jandy or approved equal.

2.8 SPRAY GROUND TABLET CHLORINE STORAGE/FEED SYSTEM – Base Bid

A. Provide PPG AccuTab Powerbase chlorination unit model 1030 with 84 lbs. per day output. Complete with piping, valving and venturi injection and 1 HP booster pump. One (1) system total. No known equal.

2.9 SPRAY GROUND TABLET ACID STORAGE/FEED SYSTEM – Base Bid

A. Provide PPG Acid Rite 450, flow rate = 10 GPM from sodium bisulfate tablet feed. Complete system with flowmeter piping, valving, venturi injection and ¾ inch booster pump. NSF 50 certified. One (1) system total. No known equal.

2.10 SPRAY GROUND WATER CHEMISTRY CONTROLLER - Base Bid

A. Provide one (1) BecSysRCM communication module and dedicated ethernet line for one (1) BecSys5. Installed per manufacturers recommendations. One (1) total. Contractor to coordinate with Owner to supply new ethernet line from existing site infrastructure or pull new service from internet provider. BecSys or approved equal.

2.11 EYEWASH/SHOWER – Base Bid

A. Haws model #8300-8309 CRP barrier free combination shower and eye/face wash with corrosion resistant protection. See MEP Sheets for supply piping. One (1) total. Haws or approved equal.

2.12 BACKWASH – Base Bid

A. Provide 12" ø PVC bell receptor at +3'-0" A.F.F. with 6" P trap outlet to sanitary sewer. Provide 2x pipe size air gap at bell receptor.

2.13 SPRAY GROUND FILL SYSTEM – Base Bid

A. 1" 'Levelor' fill system to include 1"solenoid control valve, 1" bronze body, 12V. solenoid wiring shall be wired to and controlled by Levelor K1100 water level controller with water level sensor to balance tank. Provide 2" air gap at fill point.

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2.14 SPRAY GROUND CONTROL PANEL – Base Bid

A. 'Waterplay' manifold including automation controller, wall mounted water distribution manifolds with fifteen (15) outlets, one (1) total. Wall mounted water distributer manifolds with eighteen (18) outlets, one (1) total. Complete with solenoid valves, true union ball valves, proportional valves, one (1) 3" 'Cla-Val' pressure sustaining bypass valve, time clock operated activation. Provide winter drain points adjacent to manifold equipment area for all manifold lines. Two (2) manifolds total. See plumbing plan for pipe diameters. Waterplay or approved equal.

2.15 SPRAY GROUND CONTROL PANEL – **Additive Alternate**

A. 'Waterplay' manifold including automation controller, wall mounted water distribution manifolds with fifteen (15) outlets, three (3) total. Wall mounted water distributer manifolds with eighteen (18) outlets, one (1) total. Complete with solenoid valves, true union ball valves, proportional valves, one (1) 3" 'Cla-Val' pressure sustaining bypass valve, time clock operated activation. Provide winter drain points adjacent to manifold equipment area for all manifold lines. Four (4) manifolds total. See plumbing plan for pipe diameters. Waterplay or approved equal.

2.16 SPRAY GROUND ULTRAVIOLET SYSTEM – Base Bid

A. 'Evoqua' #WF-115-3N, 1x1.5 kw with 20A breakers, rated at 242 GPM @ 40mj/cm^2, 208V 1PH, 3" pipe size, (66 lbs.) Complete with Control Unit: 208V 1 PH 20" x 20" x 10" deep, 66 lbs. Install per manufacturer's instructions. One (1) total. UV to be interlocked with circulation and booster pump so pumps do not operate if UV system is off. Evoqua or approved equal.

2.17 FLOWMETER(S)

A. 'Blue/White' F-300, circulation pump line = 4" line size. Booster pump line #1 = 6" line size. Booster pump line #2 = 6" line size. Three (3) total.

2.18 BYPASS VALVES

A. 3" 'Cla-Val' pressure sustaining valve #50-01B, 3" duct iron, epoxy coated body with cast iron disc retainer and diaphragm washer, bronze trim, flanged globe pattern. One (1) total.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection:

NOT FOR BIDDING PURPOSES

1. Prior to installing the items of this Section, carefully inspect the installed Work of other trades and verify that all such Work is complete to the point where this installation may properly commence.

2. Verify that the Spray Ground equipment items may be installed in strict accordance with original design, pertinent codes and regulations, and the manufacturers' recommendations.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Owner.

2. Do not proceed with installation in areas of discrepancy until all such discrepancies are fully resolved.

3. Failure to notify the Owner and give written notice of discrepancies shall constitute acceptance by the Installer of existing conditions as fit and proper to receive its Work.

3.2 INSTALLATION

A. Supply and install items of Spray Ground equipment in strict accordance with applicable codes and regulations, the original design, and the manufacturer's published recommendations, anchoring firmly and securely for long life under hard use.

B. Coordinate with other trades to insure all imbedded items are set plumb and flush. Railing ends must have anchor sockets and escutcheon plates. Be certain that deck equipment and railings are properly bonded prior to imbedding.

C. All mechanical equipment shall be braced and/or anchored to resist horizontal force acting in any direction using the criteria shown on the Drawings.

3.3 EQUIPMENT ACTIVATION

A. Start Up:

1. Retain a qualified chemistry consultant, familiar with the operation and maintenance of aquatic facilities, to supervise and properly balance the Spray Ground water chemistry.

2. Demonstrate to the Owner's Representative and to all appropriate officials (including State of Delaware) that all systems are fully operational and that calcium hardness, total alkalinity, chlorine residual and pH levels are within the specified limits.

3. Standards: Contractor shall furnish labor and chemicals as required to condition the water properly to the following specifications:

a. Calcium Hardness: 150-300 ppm

b. Total Alkalinity: 100-125 ppm

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c. Chlorine residual: 2.0-5.0 ppm

d. pH 7.4-7.6

B. All water chemistry and filtration mechanical equipment shall be operational upon filling of the balance tank. Chemicals and other related support items as supplied by the Contractor, shall be in supply at start-up.

C. Start up and provide qualified personnel to operate the Spray Ground mechanical equipment for a period not less than fourteen (14) days after the Spray Ground systems are placed in operation, or until the Owner takes occupancy of the facility or letter of substantial completion. During this time, Contractor shall instruct and supervise the Owner's personnel in the various operating and maintenance techniques involved. Contractor shall insure that the Spray Ground filtration equipment is continuously running during the initial fourteen (14) day period. Contractor shall be responsible for supply of chemicals during this not less than fourteen (14) day period and at the time of turnover to Owner, chemical storage tanks shall be full. Owner's personnel shall be fully trained and capable of assuming Spray Ground maintenance tasks; training may begin prior to Owner taking occupancy.

3.4 CLEAN-UP

A. Upon completion of Spray Ground equipment, remove all debris, materials and equipment occasioned by this Work to the approval of the Owner.

END OF SECTION 13 11 06

NOT FOR BIDDING PURPOSES

SECTION 13 11 07 – SPRAY GROUND MECHANICAL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Spray Ground mechanical piping as indicated on the Drawings for circulation and filtration systems, chemical control systems, booster pump systems and appurtenances.

B. Domestic water system from points of connection within Spray Ground mechanical equipment room to make-up water system.

C. Filter backwash piping to point of connection with backwash receptor as required.

1.2 QUALITY ASSURANCE

A. Qualifications of Workers:

1. The entity performing the work of this Section shall have been successfully engaged in the respective trade for at least five (5) years immediately prior to commencement of the Work.

2. For actual construction operations, use only trained and experienced workers with a minimum of three (3) years' experience with the materials and methods specified.

3. Provide at least one person who shall be present at all times during execution of the work of this Section, with a minimum of five (5) years' experience with the type of materials being installed, the referenced standards, and who shall direct all Work performed under this Section.

B. Standards:

1. All equipment supplied or work performed shall comply with International Building Code, latest edition.

2. Work shall be performed in accordance with the applicable editions of all National, State and local codes, laws, regulations and ordinances, including the following:

a. American National Standards Institute (ANSI).

b. American Society for Testing Materials (ASTM).

c. American Waterworks Association (AWWA).

d. American Welding Society (AWS).

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3. Do not construe anything in the Drawings or Specifications to permit Work not conforming to these requirements.

1.3 SUBMITTALS AND SUBSTITUTIONS

A. Provide submittals in conformance with the requirements of Section 01 33 00.

B. Required submittals include:

1. Pipe and Fittings as specified in Article 2.2 of this Section.

2. Valves as specified in Article 2.3 of this Section.

3. Pressure / Vacuum Gauges as specified in Article 2.4 of this Section.

4. Pipe Hangers and Supports as specified in Article 2.5 of this Section.

5. Sleeves and Waterstops as specified in Article 2.6 of this Section.

6. Submit proof of qualifications as specified in Article 1.2.A of this Section.

1.4 PRODUCT HANDLING

A. Delivery: Deliver all materials to the Project Site in the manufacturer's original unopened containers with all labels intact and legible.

B. Storage: Store all materials under cover in a manner to prevent damage and contamination, and store only the specified materials at the Project site.

C. Protection: Use all means necessary to protect Spray Ground mechanical items before, during and after installation and to protect the installed Work specified in other Sections.

D. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner's Representative and at no additional cost to the Owner.

NOT FOR BIDDING PURPOSES

1.5 JOB CONDITIONS

A. Cooperate with entities performing Work specified in other Sections to so that no conflict of new construction or occupied space may occur. Should any installation Work be done without such craft coordination, that Work so installed shall be removed and re-installed.

PART 2 - PRODUCTS

2.1 PRODUCT QUALITY

A. Materials and equipment shall be new, of the best quality for the purpose intended, and shall be clearly marked with the manufacturer's name and nameplate data or stamp and rating. As far as practicable, materials and equipment shall be of one manufacturer.

2.2 PIPE AND FITTINGS

A. PVC Schedule 40: Type 1, normal impact, NSF approved for solvent welding applications, ASTM Specification D-1785, color shall be white. Dura, Lasco, or equal.

B. PVC Schedule 80: Type 1, normal impact, NSF approved for solvent welding applications, ASTM Specification D-1785, color shall be gray. Dura, Lasco, or equal.

C. PVC SDR35: To be used on winterization drainage line only. Conforming to ATSM D-1784, use with epoxy coated bell and spigot-type fittings or epoxy coated mechanical joint by flange adapters with epoxy coated cast iron fittings as specified in Article 2.2 (F), below. Johns-Manville "Big Blue", Diamond Plastics, or equal.

D. CPVC Schedule 80 Influent/Effluent Heater Piping: Type 1, normal impact, NSF approved for solvent welding applications, ASTM Specification D-1785, color shall be gray. Dura or Lasco.

E. Copper Tubing: ASTM Specification B-88, hard drawn, with ANSI Standard B16.22 wrot copper fittings.

F. Steel: ASTM Specification A-120, Schedule 40 black or galvanized pipe with ASTM A-47 150 lb. banded malleable iron threaded fittings.

G. Cast Iron: ASTM Specification B16.1, cast iron flanged fittings, provide epoxy coating as required for use with chlorinated water.

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2.3 VALVES

A. Ball Valves:

1. For pool system: True-Union design, PTFE seat material with FPM or FKM Double O-ring stem seals, locking handle, NSF certified. PVC schedule 80 body for below grade installation. CPVC Schedule 80 body for above grade installation. Furnish ball valves on all pip diameters 2 ½" or less with a rating of at least 200psi at 73° F, Asahi Pool-Pro, Nibco, or Ipex.

2. For copper pipe system: 3-piece full-port Bronze body valve with Teflon seat, 'Apollo', 'Nibco' or equal.

B. Butterfly Valves:

1. Epoxy coated cast or ductile iron body, 316 stainless steel disc and stem, viton seat material, furnish hand wheel/gear operators on all valves 8" and larger. DeZurick, Keystone, or Asahi Pool Pro, or Ipex.

2. PVC body, PVC disc and EPDM construction suitable for chlorinated water applications. Stem shall be of 316 stainless steel and non-wetted. Valves shall be self-gasketed design with a convex sealing arrangement. Valves 1-1/2" – 10" shall be rated to 150 psi and 12" valves shall be rated to 100 psi at 70°F. Asahi Pool-Pro, no known equal.

C. Check Valves: Wafer-type, epoxy coated cast or ductile iron body, 316 stainless steel plates and shaft, viton seat material. Centerline, Metraflex, or equal.

D. RP Backflow Preventer: Febco #835-B for 2" and smaller; #825 for 2-1/2" and larger. Febco, Watts, or equal.

1. Discharge port must be kept clear of obstructions at all times.

2. Backflow assembly must be "Y" pattern for devices 2" or smaller.

3. 2" or smaller shall use brass C x MIP 90.

4. All bolts connecting to water line shall be 304 stainless steel.

E. Make-up Water Control: Provide 1½" 'Cla-val' fill system including 'Cla-val' solenoid control valve #136-01BY, 1½" ductile iron epoxy coated body with cast iron disc retainer and diaphragm washer with bronze trim, flanged globe pattern, 120V at 60 HZ. Solenoid wiring shall be wired to water chemistry controller. Provide 3" air gap at fill point. One (1) system total.

2.4 PRESSURE / VACUUM GAUGES

A. Furnish and install pressure and vacuum gauges on the discharge and suction sides of all pumps. 2" or 2-½" dial, bottom connection, chrome ring and shut-off cock and snubber. Ranges shall be selected to indicate between mid-point and two-thirds of maximum range under design conditions. Marsh, Trerice, or equal.

2.5 PIPE HANGERS AND SUPPORTS

A. General:

1. The requirements of this Section relates to various requirements of the Agreement, General and Supplementary Conditions, Specifications, Drawings, and modifying documents which are part of the Construction Contract. Responsibility for coordination of all such applicable requirements will be that of the Contractor.

B. Description:

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1. This section provides guidelines and limitations for the support of all mechanical, electrical, plumbing or architectural items from the building structure, and for the seismic bracing of such items.

2. Design and install all support and bracing systems as required for the swimming pool systems. Provide for attachment to portions of the building structure capable of bearing the loads imposed. Design these systems to not overstress the building structure.

C. Quality Assurance:

1. Design and install all support systems to comply with the requirements of the International Building Code, latest edition.

2. Seismic bracing is to be designed by a professional engineer licensed in the State of Delaware.

3. For the seismic bracing of mechanical, electrical and plumbing system, refer to "Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems" by Sheet Metal and Air conditioning Contractors National Association, Inc., (SMACNA) for guidelines.

D. Submittals:

1. Submit shop drawings for all substructures and attachment methods.

2. Submit proposed alternative methods of attachment for review and approval by the Architects, prior to deviating from the requirements given below.

3. For all pipe hangers and support systems, submit structural calculations and details which include all resultant forces applied to the building structure and are prepared and signed by the Contractor's licensed Arizona professional engineer. Calculations will be reviewed for compliance with design criteria, not for arithmetic.

E. Materials:

1. Use Kin-Line, Grinnel, or approved equal.

2. Support all pipelines individually with hangers, each branch having at least one hanger. Lateral brace as noted and required.

3. Support piping near floor with steel stanchions welded to end plates secured to pipe and floor.

4. Support vertical piping at each floor level. Install coupling in piping at each support. Coupling shall rest on and transmit load to support. Isolate copper from steel supports with vinyl electrician's tape around pipe and coupling.

5. Use Stoneman "Trisolator," Unistrut, or approved equal, isolators at each hanger and other support points on bare copper tubing system.

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6. For PVC pipe, space hangers four (4) feet apart for pipe sizes 1" and under, five (5) feet apart for pipe sizes 1-1/4" to 2", and six (6) feet apart for pipe sizes over 2". Space hangers for horizontal pipes at a maximum of six (6) feet for copper 2" and smaller and for steel 1-1/4" and smaller; ten (10) feet for copper 2-1/2" and larger and for steel 1-1/2" and larger.

7. Size hanger rods, screws, bolts, nuts, etc., according to manufacturer's sizing charts.

8. Trapeze hangers may be used for parallel lines.

9. Use galvanized or cadmium plated hangers, attachments, rods, nuts, bolts, and other accessories in pool mechanical room, high humidity areas, or where exposed to weather. Hot dip galvanize all items which are not factory furnished. Plating for hinged movements must be done at the factory.

10. Lateral Bracing: To prevent swaying of the piping systems, provide angle iron bracing and anchor into wall or overhead framing. Piping shall be braced or anchored in such a way as to resist a horizontal force of 50% of its operating weight in any direction.

11. Do not use wire or other makeshift devices for hangers.

12. Furnish all substructures and fasteners required to comply with the limitations given below. Use material as specified in the various sections and as appropriate to their use.

F. Guidelines & Limitations:

1. Each Contractor will coordinate the load requirements from all subcontractors so that no combination of loads overstresses the building structure or exceed the limitations given below.

2. Concrete Structure:

   a. Support all loads hung from concrete structure with cast-in-place inserts, unless drilled-in anchors are specifically approved in writing prior to placing the concrete.

   b. Concrete anchors must not penetrate into reinforcing bars. Where the anchors boring indicates the presence of reinforcing bar, patch hole with an epoxy type grout and relocate anchor 12 diameters away.

   c. Individual expansion anchors cannot support any loads greater than 300 pounds or manufacturer’s specified load capacity without approval.

3. Steel Structure:

   a. Hang no more than 20 pounds per metal deck rib in any span.

   b. At beams, hang all beam loads greater than 40 pounds concentric to beam, not off the flanges.

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c. Attached no loads to the beams or girders greater than the following without specific approval from the architect.

1) Roof beams and girders: 300-pound point load or 600-pound total load for a single span.

G. Seismic Bracing:

1. Design and install seismic bracing to not ground out vibration and sound isolation systems.

2. All items of mechanical and electrical equipment 60" or more in height are to be seismically braced whether such bracing is shown or not.

2.6 SLEEVES AND WATERSTOPS

A. Provide sleeves where work of this Section passes through fire-rated partitions, floors and ceilings, concrete slabs or exterior of structure. Caulk clearance space using sealant appropriate for application in conformance with manufacturer's recommendations and Delaware Code of Regulations. 3m, Dow Corning, or equal. In lieu of sleeves and caulking, "Link Seal" products may be used.

B. Provide prefabricated waterstops as indicated on the Drawings at all pipe penetrations through structures containing stored water (i.e. Spray Ground, balance tanks, etc.) to insure leak-proof seals.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection:

1. Prior to Work of this Section, carefully inspect the installed Work of other trades and verify that such work is complete to the point where this installation may properly commence.

2. Verify that items of this Section may be installed in accordance with the original design and referenced standards.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Owner.

2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

NOT FOR BIDDING PURPOSES

3. Failure to notify the Owner and give written notice of discrepancies shall constitute acceptance by the Contractor of existing conditions as fit and proper to receive his work.

3.2 ABBREVIATIONS AND SYMBOLS

A. Abbreviations and symbols on the Drawings are those most commonly used. Obtain clarification from the Owner on any questionable items before bid.

3.3 GENERAL PIPING REQUIREMENTS

A. Size any section of pipe for which size is not indicated or any intermediate section erroneously shown undersized the same size as the largest pipe connecting to it. Sizes listed are nominal.

B. Cut pipe accurately to job measurements and install without springing or forcing, true to line and grade, generally square with building and/or structures and adequately supported to prevent undue stress on pipe, fittings and accessories.

C. Make changes of direction with manufactured fittings. Street ells, bushings, reducing flanges, close nipples or bending of pipe is not allowed.

D. Use great care to install piping in accordance with best practice. Plastic pipe shall be "snaked" in trenches to allow for thermal expansion.

E. All above grade, below grade and buried or imbedded PVC shall be installed using solvent weld fittings. Also, each and every fitting and pipe end shall be prepared with solvent primer. Fittings shall be joined individually and with enough time between assembly of adjacent joints to allow them to seal solidly. After joining, an even ring of primer must be visible around the entire fitting. If any fittings are installed without visible primer, the fitting shall be removed and discarded and piping recut, rechamfered, and joint made up again using a new fitting. All procedures, methods and techniques used to make up solvent weld joints shall be in strict accordance with manufacturer's recommendations.

F. Arrange pipe and hangers to allow for expansion, contraction and structural settlement. No pipe shall contact structure except penetrations as shown on the Drawings.

G. Provide dielectric connections between copper and dissimilar metals. In copper systems, threaded piping including connections to equipment shall be brass pipe and fittings. Install dielectric connections in vertical sections of piping only.

H. Run pipe full size through shut-off valves, balancing valves, etc. Change pipe size within three (3) pipe diameters of final connection to control valves, fixtures and other equipment.

I. Provide unions or flanges at connections to equipment, on service side of valves and elsewhere as required to facilitate ease of maintenance.

J. Locate equipment shut-off valves as close to equipment as possible maintaining easy valve access.

NOT FOR BIDDING PURPOSES

K. Make all connections between domestic water systems and equipment or face piping with approved backflow prevention devices as required.

L. All PVC pipe exposed to direct sunlight shall be painted with two coats of Exterior Acrylic Semi-Gloss Paint, Sherwin Williams or equal. Color to be selected by the Architect. Prior to painting the PVC pipes, the exterior of all PVC pipes shall be wiped with Methyl Ethyl Ketone, or an approved equal, to remove the glaze from the pipes.

3.4 TRENCH EXCAVATION AND BACKFILL

A. Excavation:

B. Excavate and backfill trenches as required for the Work of this Section. Conform with all applicable codes.

C. The Contractor shall perform all excavation of every description and of whatever materials encountered, to the depths indicated on the Drawings or as necessary. The Contractor shall dispose of the excavated materials not required or suitable for backfill as directed and shall perform such grading as may be necessary to prevent surface water from flowing into the trenches. The Contractor shall provide adequate equipment for the removal of storm or subsurface waters which may accumulate in the excavated areas.

D. Trenching:

1. Excavate trenches to lines and grades as indicated on the Drawings and with banks as nearly vertical as practicable.

2. Bottoms of trenches shall be accurately graded to provide uniform bearing on undisturbed soil for the entire length of each section of pipe.

3. The width of the trench at and below the top of the pipe shall be such that the clear space between the barrel of the pipe and the trench wall shall not exceed 8" on either side of the pipe. The width of trench above the top of pipe may be wider if necessary.

4. Over depth excavations shall be filled with tamped sand to required grades.

5. Excavations of five (5) feet or more in depth shall be shored or supported in conformance with rules, and regulations of State and Federal Governments. Shoring shall be constructed, maintained and removed in a manner to prevent caving of the excavation walls or other load on the pipe.

E. Backfilling:

1. Material for backfilling of pipes shall be approved granular material less than two (2) inches in diameter obtained from the excavation, sand or an approved import fill. No material of a perishable, spongy or otherwise unsuitable nature shall be used as backfill.

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2. Backfilling of pipe trenches shall commence immediately after installation and testing to preclude damage to the installed pipe. Backfill around pipe shall be carefully placed so as not to displace or damage the pipe, and shall be carried up symmetrically on each side of the pipe to one foot above the top of the pipe. The material shall be carefully compacted or consolidated before additional backfill is placed.

3. Backfill above an elevation of one foot above the top of pipe in conformance with requirements of Section 13 11 01, “Spray Ground Excavation”. Material for balance of backfill shall be approved granular material less than six (6) inches in diameter taken from the excavation.

4. Unless otherwise indicated on the Drawings, all pipe shall have a minimum of eighteen (18) inches of cover.

3.5 GENERAL EQUIPMENT REQUIREMENTS

A. Position equipment to result in good appearance and easy access to all components for maintenance and repairs.

B. Install piping, flues, breeching and ducts so that they do not interfere with equipment access.

C. Install level, secure and out of moisture. Provide shims, anchors, support straps, angles, grouted bases, or other items as required to accomplish proper installation.

D. All screws, nuts, bolts and washers shall be galvanized, cadmium plated or stainless steel. After fabrication, hot-dip galvanize unfinished ferrous items for outdoor, below grade or other use subject to moisture.

E. Extend 1/2” Schedule 40 black steel pipe lubrication tubes from all hard-to-reach locations to front of equipment or to access points. Terminate with proper type of lubrication fitting.

3.6 VALVES AND STRAINERS

A. If no shut off is indicated, provide ball valves at inlet connections and balance valves at outlet connections to fixtures and equipment. Provide proper valve trim for service intended.

B. Use no solder end valves unless noted otherwise; provide adapters in copper tubing systems.

C. Locate valves with stems above horizontal plane of pipe. In general, locate valves within six (6) feet of floor, out from under equipment, in accessible locations with adequate clearance around hand wheels or levers for easy operation.

D. Provide all valves, cocks and strainers, full pipe size unless indicated otherwise.

E. Provide hand wheel operators on all valves 6” and larger, under 6” lever operators may be used.

F. Provide tool operated valve with stainless steel shaft extension and 'on deck' tool operation for surge chamber butterfly isolation valve.

NOT FOR BIDDING PURPOSES

3.7 IDENTIFICATION OF PIPING

A. Identify each valve by a numbered brass tag with hole and brass chain mounted on valve stem or handle. Tag to be a minimum of 1" in diameter and numbers at least 1/4" high stamped into tag. Valves and plumbing lines shall be labeled clearly with the source or destination descriptions.

B. Install an identification chart in a plastic or glass framed enclosure which schematically illustrates the proper operation of all piping systems and indicates number and location of all valves and control devices within the system.

C. The direction of flow for the recirculation equipment shall be labeled clearly with directional symbols such as arrows on all piping in the equipment area. Where the recirculation equipment for more than one pool is located on site, the equipment shall be marked as to which pool the system serves.

3.8 TESTS

A. Perform tests in presence of Owner with no pressure loss or noticeable leaks.

B. Do not include valves and equipment in tests. Include connection to previously tested sections if systems are tested in sections.

C. Perform tests as follows:

System	Test Pressure	Test Medium	Duration
Skimmer Lines and Lawson Main Drains Sump Lines	20 psig	Water*	4 hours
Spray Ground Piping	50 psig	Water*	4 hours
Spray Ground Piping	50 psig	Water*	4 hours
Spray Ground Main Drains	30 psig	Water*	4 hours
Domestic Water	150 psig	Water*	4 hours

*Never test PVC pipe or fittings with air or other gases, always use water.

3.9 PIPE MATERIAL APPLICATION

A. PVC Schedule 40: Below grade Spray Ground piping and domestic water piping up to 12" line size; use standard solvent weld fittings.

B. PVC Schedule 80: Above grade Spray Ground piping up to 12" line size; use solvent weld Schedule 80 or epoxy coated cast iron fittings.

C. Type L Hard Copper: Above grade domestic water piping.

NOT FOR BIDDING PURPOSES

3.10 CUTTING AND DRILLING

A. Cutting or drilling necessary for installation of Work of this Section shall be done only with approval of the Owner.

3.11 CLOSING-IN OF UNINSPECTED WORK

A. Do not cover or enclose Work before testing and inspection. Re-open Work prematurely closed and restore all Work damaged.

3.12 QUIETNESS

A. Quietness is a requirement. Eliminate noise, other than that caused by specified equipment operating at optimum conditions, as directed by the Owner.

3.13 FLUSHING OF LINES

A. Flush or blow out pipes free from foreign substances before installing valves, stops or making final connections. Clean piping systems of dirt and dust prior to initial start-up.

B. Just prior to plastering the pool, under the observations of the IOR, the pool mechanical system shall be flushed using the pool circulation pump. Circulate water through the mechanical system until the effluent water from the pool return heads runs clean.

3.14 CLEAN-UP

A. After all Work has been tested and approved, the Spray Ground Contractor shall thoroughly clean all parts of the equipment installations, including all pool pipe and fittings in the pool mechanical room. Exposed parts shall be cleaned of cement, plaster and other materials and all grease and oil spots removed with solvent.

B. The Spray Ground Contractor shall remove debris from the Project site. Cartons, boxes, packing crates and excess materials not used, occasioned by this work shall be disposed of to the satisfaction of the Owner.

C. If the above requirements of clean-up are not performed to the satisfaction of the Owner, the Owner reserves the right to order the work done, the cost of which shall be borne by the Spray Ground Contractor.

END OF SECTION 13 11 07

NOT FOR BIDDING PURPOSES

SECTION 13 11 08 – SPRAY GROUND ELECTRICAL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide labor, materials and equipment as required to install the Spray Ground electrical system including but not limited to:

1. A complete and operable system of service equipment, switchboards, panelboards, conduits, switches, time clocks and wiring for power and lighting, motor control centers.

2. Complete grounding system as required and shown on the Drawings.

3. Complete equipotential bonding system as required and shown on the Drawings.

4. Adjusting and preliminary operation of the completed electrical system as described in Article 3.6, A of this Section.

5. Cleaning of all completed Work and installation adjustment of all trim and decorative items.

1.2 QUALITY ASSURANCE

A. Qualifications of Workers:

1. The entity performing the work of this Section shall have been successfully engaged in the respective trade for at least five (5) years immediately prior to commencement of the Work.

2. For actual construction operations, use only trained and experienced workers with a minimum of three (3) years experience with the materials and methods specified.

3. Provide at least one person who shall be present at all times during execution of the work of this Section, with a minimum of five (5) years experience with the type of materials being installed, the referenced standards, and who shall direct all Work performed under this Section.

B. Ordinances and Codes: Materials and construction shall conform with all applicable code requirements, including:

1. National Electrical Code, latest edition; Electrical Safety Orders of the State of Delaware; Department of Industrial Relations; regulations of the State Fire Marshal; rules and regulations of the Board of Underwriters of the Pacific, UL 50, 50E and NEMA 250 rating.

C. International Building Code, latest edition.

NOT FOR BIDDING PURPOSES

D. Verification of Conditions:

1. The locations shown on the Drawings are diagrammatic only and the exact finish location of equipment and materials cannot be indicated. Therefore, locations of all Work and equipment shall be verified to avoid interferences, preserve head room and keep openings and passageways clear. Changes shall be made in locations of equipment and materials which may be necessary to accomplish these purposes.

E. Preliminary Operations and Testing:

1. Motor driven equipment shall be tested for correct rotation and completion of all connections.

1.3 SUBMITTALS AND SUBSTITUTIONS

A. Provide submittals in conformance with the requirements of Section 01 33 00. Requests for substitutions shall conform with requirements of Article 1.10.A of Section 13 11 00.

B. Required submittals include:

1. Conduit and Fittings as specified in Article 2.2 of this Section.

2. Panelboards as specified in Article 2.6 of this Section.

3. Circuit Breakers as specified in Article 2.7 of this Section.

4. Motor Starters as specified in Article 2.10 and 2.11 of this Section.

5. Fuses as specified in Article 2.13 of this Section.

6. Ground Fault Circuit Interrupters as specified in Article 2.15 of this Section.

7. NEC required corrosion resistant enclosures, cabinets and boxes as specified in Article 2.8, 2.11, 2.16 & 218 of this Section.

C. Submit proof of qualifications as specified in Article 1.2.A of this Section.

NOT FOR BIDDING PURPOSES

1.4 PRODUCT HANDLING

A. Delivery: Deliver all materials to the Project Site in the manufacturer's original unopened containers with all labels intact and legible.

B. Storage: Store all materials under cover in a manner to prevent damage and contamination, and store only the specified materials at the Project site.

C. Protection: Use all means necessary to protect Spray Ground electrical materials before, during, and after installation and to protect the installed Work specified in other Sections.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Materials shall be new, in unbroken packages and bear the U.L. label of approval.

B. Equipment of one type shall be by same manufacturer. One type of equipment for classifications such as:

1. Switchboards, panels, buss duct, disconnect switches and allied items.
2. Conduit.
3. Wire.
4. Conduit fittings.
5. Fixtures of the same general type.
6. Wiring devices.

2.2 CONDUIT AND FITTINGS

A. Conduit within or under buildings or where exposed outdoors shall be rigid metal threaded, hot dipped galvanized, or U.L. approved plastic except where noted otherwise on the Drawings. Metallic conduit shall be of the same metal between outlets or terminals.

B. Use flexible metallic conduit only for short connections of motors and where specifically called for on Drawings. Maximum length shall be 40". Use only liquid tight flexible metal conduit. Install an unbroken #12 AWG insulated copper grounding conductor in each liquid tight flexible conduit with permanent connection at motor junction box and service panel ground.

C. Protect, before installation, metallic conduit runs in all slabs laid on grade or in contact with the earth or exposed in damp locations, with two (2) heavy coats of asphaltum rust-resisting compound.

D. Encase conduits 2-1/2" or larger run underground, outside, or under buildings, in concrete envelopes a minimum of 3" thick, except as indicated otherwise on Drawings or stubouts. Conduits 2 and smaller laid 18" below finish surface in soil.

E. Low voltage runs underground outside buildings, 1-1/4" or smaller, may be G.I. or sherardized steel conduit, with machine applied wrapping equal to double wrap or Scotch-Wrap #50 tape, half lapped and quadrupled at joints in lieu of concrete encasement.

F. Service conduits through foundations or concrete members shall run through metal sleeves with adequate clearances for full movement of the conduit. Do not run conduits through footings.

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G. Secure conduits run exposed on surfaces with one-hole heavy-duty straps or fasten with matching fittings to inserts or trapezes, parallel to building walls and ceilings.

H. Cap all conduit or duct stub-outs with standard factory caps; except cap threaded steel conduit with B.I. water pipe caps in outdoor locations.

I. Use conduit fittings as manufactured by Crouse-Hinds Company, Appleton Electric Co., or approved equal.

J. Employ U.L. liquid tight fittings for use with liquid tight flexible metal conduit.

K. Use unions as manufactured by Appleton, O-Z/Gedney, or approved equal. The use of running threads will not be permitted.

L. Exposed conduit and fittings in chemical rooms shall be nonmetallic rigid polyvinyl chloride, corrosion resistant rated suitable for installation in corrosive environments and in accordance with the latest NEC requirements.

2.3 EQUIPOTENTIAL BONDING/GROUNDING

A. Bond together and ground to a common ground at a single point all metallic conduit, piping systems, pool reinforcing steel, metal parts of ladders, lifeguard stands, handrails and their supports and the like. The solid copper bonding conductor shall not be smaller than #8 copper.

2.4 WIRING CONNECTIONS

A. Make connections without strain on conductors, allowing the conductors to take a natural position after connections or taps are made. Include all strand of wire in making the connection.

B. Make connections for wiring by one of the following means:

1. Make all taps or connections to conductors with compression type connectors except those smaller than #8 B&S gauge may have soldered connections. Solderless connections for #10 AWG or smaller may be used and shall be "Scotchlok", Buchanan, or approved equal. For #8 AWG or larger, they shall be T&B "LockTite", Burndy "Versitaps", or approved equal.

2. All cable or conductor terminal lugs shall be Burndy "Quicklug", Ilsco, or approved equal. Two piece stamped lugs and solder lugs will not be approved.

3. Paint taped splices in damp or outdoor locations with two (2) coats of insulating paint.

4. Tag all branch circuit wires with circuit number at the panelboard and at each point of use with linen or plastic tags.

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2.5 CONDUCTORS

A. Copper RHW or THW. Do not make splices between boxes.

2.6 COLOR CODING

A. Neutrals (identified conductors shall be white).

B. Phase conductors shall be red for phase B; blue for phase C.

C. Green shall be used for mechanical equipment and receptacle grounds only.

2.7 MOTOR WIRING

A. Make final connections to motors with the required AWG (Minimum #12), Flamenol machine tool wire, 19 strand. Control wiring for equipment shall be Flamenol machine tool wire, 19 strand of required AWG. Provide corrosion resistant junction boxes at each item of equipment to change from standard building wiring to machine tool wire.

B. Phase motors as proper in direction of rotation.

2.8 PANELBOARDS

A. Panelboards shall be flush or surface mounting as indicated with circuit breakers as shown on panel schedule, hinged lockable doors, index card holders and proper bussing.

B. Where indicated on the drawings, panelboards shall be furnished with subfeed breakers and/or lugs, split bussing, contractors, time switches, relays, etc., as required.

C. All panelboards shall be keyed alike.

D. All panelboard enclosures shall be corrosion resistant rated in accordance with the latest NEC requirements.

E. Furnish corrosion resistant panelboard enclosures and terminal cabinets with Yale 46515 flush locks and LL806 keys except where indicated otherwise herein. Fasten the trim to panel boards and terminal cabinet by means of concealed, bolted or screwed fasteners accessible only when the door is open.

F. Panelboards 208/120 volt, three phase, 4 wire, S/N or 120/240 volt, single phase, 3 wire, S/N.

Panelboard types as manufactured by:

Westinghouse	Type B10B
General Electric	Type NLAB
Square D	Type NQOB

G. Panelboards for 480/277 volt, three panes, 4 wire, S/N.

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Panelboard types as manufactured by:	
Westinghouse	Type Pow-R-Line 2
General Electric	Type AE
Square D	Type NEHB
Sylvania	Type NH1B
I.T.E.	Type Approved Equal

H. Panelboard for bussing sizes thru 400 amp shall be 20" wide surface mounted type. Recess mounted type shall have a 20" wide (maximum) recess metal enclosure with trim plate cover extending 1" on all sides of enclosure. Depth shall be 5-3/4" nominal. Height of panel as required for devices.

I. Provide 6" additional gutter space in all panels where double lugs are required, or where cable size exceeds bus size. Minimum bottom gutter space shall be 6" high. 12" additional gutter space may be required for aluminum feeders where used.

J. Panelboards shown on the drawings with relays, time clocks or other control devices shall have a separate metal barriered compartment mounted above panel with separate hinged locking door to match panelboard. Provide mounting sub base in cabinet for control devices and wiring terminal strips.

K. Panelboard shall have a circuit index card holder removable type, with clear plastic cover. Index card shall have numbers imprinted to match circuit breaker numbers.

2.9 CIRCUIT BREAKERS

A. Breakers shall have a minimum short circuit interrupting rating of 10,000A symmetrical for panelboard voltage thru 240 volt and 14000A for panelboards thru 600 volts or as specified on the drawings. In no case shall the interrupting rating be less than the bus withstand rating unless noted otherwise on the drawings.

B. Circuit breakers as manufactured by the following companies only are acceptable:

1. General Electric Company
2. Square D Company
3. Westinghouse Company
4. I.T.E. Company

C. Circuit breakers shall be arranged in the panels so that the breakers of the proper trip settings and numbers correspond to the numbering in the panel schedules on the drawings. Circuit numbers of breakers shall be black-on-white micarta tabs or other previously approved method. Circuit number tabs which can readily be changed from front of panel will not be accepted. Circuit number tabs shall not be attached to or be a part of the breaker.

D. Where two or three pole breakers occur in the panels, they shall be common trip units. Single pole breakers with tie-bar between handles will not be accepted.

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E. All circuit breakers shall be padlockable in the "off" position. Locking facilities shall be riveted or mechanically attached to the circuit breaker (submit sample for approval). Other means of attachment shall not be accepted without prior written approval of Architect.

F. Where branch circuit breakers supply the power to motors and signal systems, the breakers shall be furnished with lockout clips, mounted in the "on" position. The breakers shall be able to trip automatically with lockout clips in place.

G. Panelboard circuit breakers shall be bolt-on type.

2.10 BUSSING

A. Bussing shall be rectangular cross section copper, or full-length silver or tin-plated aluminum.

B. Bussing shall be braces to withstand symmetrical short circuit ratings as follows or as noted on drawings. In no case shall bus short circuit bracing be less than specified circuit breakers.

C. Each panelboard shall be equipped with a ground bus secured to the interior of the enclosure. The bus shall have a separate lug for each ground conductor. No more than one conductor shall be installed per lug.

2.11 POOL MECHANICAL EQUIPMENT ENCLOSURES, TERMINAL CABINETS & MISC CABINETS

A. All pool mechanical equipment enclosures, terminal cabinets and miscellaneous cabinets in the pool mechanical room or chemical storage rooms shall be corrosion resistant rated in accordance with the latest NEC requirements. Enclosures and all cabinets shall be flush mounted (except where noted a surface) of the size indicated on the drawings, and complete with hinged lockable doors and the number of 2-way screw terminals required for termination of all conductors. Terminal cabinet locks to operated form same key used for panelboards. The trim to terminal cabinets shall be fastened by means of concealed bolted or screwed fasteners accessible behind door to terminal cabinets. Terminal cabinets shall have 5/8" plywood backing.

B. Provide engraved nameplate on each enclosure and cabinet indicating its designation and system (i.e., Spray Ground - Panel ‘WP’).

2.12 MOTOR CONTROL INDIVIDUAL STARTERS

A. Manual Motor Starters:

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1. Provide flush or surface mounting manual motor starters with number of poles and size of thermal overload heaters as required for the motor being controlled (equipped with overload heaters, one for each motor lead). Back boxes shall be supplied with all flush mounting starters whether they are toggle type requiring only a 4" square outlet box or the larger type requiring a special box and cover designed to accept the particular unit. All box types shall be corrosion resistant rated in accordance with the latest NEC requirements.

2. Unless otherwise noted on the drawings, all manual starters for single phase motors, smaller than 1 h.p., shall be the compact toggle type. Manual starters for all single-phase motors, 1 to 5 h.p., and all three phase motors up to 5 h.p. shall be the heavy duty type.

3. Where manual motor starter is shown with pilot light, the pilot light shall be installed in a separate outlet box adjacent to the starter outlet, and engrave nameplate in indicate function of pilot light.

1. The following motor starters as manufactured by:

Manufacturer	Single Phase 1HP and Below	Others
Arrow Hart	Type RL	Type LL
General Electric	CR 101	Class CR 1062
I.T.E.	Class C10, C11 or C12	Class C20
Square D Company	Class 2510, Type A	Class 2510, Type B & C
Westinghouse	Type MS	Type A100
Allen Bradley	Approved Equal	Approved Equal.

B. Individual Magnetic Motor Starters:

1. Magnetic motor starters shall be A.C. line voltage, across-the-line units in a corrosion resistant rated enclosure in accordance with the latest NEC requirements.

2. All starters located outside of a building whether or not indicated shall be W.P. (weatherproof), and all starters noted W.P. shall be furnished in a corrosion resistant rated stainless-steel enclosure in accordance with the latest NEC requirements.

3. Starter shall be horsepower rated for the motor controlled and shall be equipped with properly sized overload elements. Every pole shall be with overload element.

4. Verify the exact motor current and voltage characteristics with the Contractor supplying the motor before installation of a starter.

5. Each starter shall be equipped with "Hand-Off-Auto" switch or stop-start pushbutton as required.

6. Coils shall be designed to operate on voltage indicated on control diagrams and have built-in-under the voltage release for coil circuit to drop motor starter off the line when the line voltage drops below normal operating voltage.

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7. The coil control circuit shall be independently fused, sized to protect coil.

8. Starters to be equipped with running pilot light indication with a "Push-to-Test" feature.

9. Magnetic starters shall have a minimum of two auxiliary contacts. Additional auxiliary contacts shall be provided as required to comply with the requirements of the wiring diagrams on the electrical and mechanical drawings and the description of the function in the Mechanical Section of the Specifications.

10. Starters shall comply with NEMA standards, size and horsepower ratings as indicated on drawings.

2. The following types of magnetic motor starters as manufactured by:

Manufacture	Type
General Electric	Class CR 106
I.T.E.	Class A20
Square D Company	Class 8536
Westinghouse	Type A200 (Size 4 Max.) or Class II-200 (Sizes 5-8)

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2.13 INDIVIDUAL COMBINATION MOTOR STARTERS

A. Combination starter shall incorporate fused disconnect switch and individual magnetic motor starter. Combination starters shall be mounted in a corrosion resistant rated enclosure in accordance with the latest NEC requirements.

B. Starters shall comply with NEMA standards, size and horsepower ratings as indicated on drawings General Electric, Square D, Westinghouse or I.T.E.

C. The disconnect handle used on combination starters shall control the disconnect device with the door opened or closed. The disconnect handle shall be clearly marked as to whether the disconnect device is "ON" or "OFF", and shall include a two-color handle grip, the black side visible in the "OFF" position indicating a safe condition, and the red side visible in the "ON" position indicating an unsafe or danger condition.

D. All starters used in combination starters shall be manufactured in accordance with the latest published NEMA standards, sizes, and horsepower ratings. These starters shall be furnished with three melting alloy type thermal overload relays.

E. Thermal units shall be of one-piece construction and interchangeable. The starter shall be inoperative if a thermal unit is removed.

2.14 MOTOR CONTROL CENTER, INTERLOCKS AND CONTROL DEVICES

A. Refer to mechanical and plumbing drawings and specifications and provide all control devices including timeswitches, relays and interconnection of starters as required.

B. Mount all relays and timeswitches in a separate compartment in motor control center unless otherwise indicated.

C. Whether shown on mechanical and plumbing drawings or control center schedules or not, where motors are controlled by external devices (i.e., thermostats, relays, float or pressure switches, etc.) or interlocked with other motors, each motor starter to be equipped with a "Hand-Off-Auto" selector switch in starter cover. Other starters equipped with a "Start' Stop" pushbutton station in starter cover. The Contractor shall be responsible to submit a complete and detailed set of shop drawings, electrical schematic design along with electrical component cut sheets from the MCC panel or the interlock control device manufacturer, RSD Total Control: Allan Pearson 949-380-7878, South Coast Controls: Anthony Ellis 714-998-5656 or approved equal.

2.15 FUSES

A. Fuses shall be dual element, current limiting type, U.L. Class RK5 unless otherwise indicated on the drawings. Provide one spare set of fuses of each size and type in each motor control center.

2.16 GROUND FAULT CIRCUIT INTERRUPTERS

A. Minimum rating shall be 20 amperes, 125V, 5 milliampere trip setting, Class A per UL943.

B. Manufacturer to be Crouse-Hinds, Leviton, or approved equal.

2.17 BOXES

A. Boxes shall be of the size required by ordinances or larger, must be corrosion resistant in accordance with the latest NEC requirements where concealed or exposed on ceilings or walls.

B. Outlets to be surface where wiring is exposed and flush in areas where conduit is concealed.

C. Provide surface outlets with proper corrosion resistant surface covers. Box and cover shall be deep enough to provide at least 1/4" clearance between back of device and back of box. Where box contains more than one device, use a corrosion resistant rated gang box with proper cover in accordance with the latest NEC requirements. Surface outlet boxes shall be of the threaded hub type wherever below 8'0".

D. If necessary for cable installation, additional pull boxes or junction boxes may be installed in accessible locations. Exposed pull boxes and junction boxes shall be corrosion resistant rated in accordance with the latest NEC requirements.

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E. Where exposed to weather pull boxes larger than outlet boxes are required, galvanized code gauge sheet steel boxes may be used with covers attached by brass machine screws may be used. Boxes exposed to the weather shall be approved for the purpose, and conduit entrances shall be on the bottom made by means of an interchangeable hub with gasket and adapter nut. Pull boxes not shown on Drawings may be added only after approval of size and location is obtained.

F. For outlets exposed to weather or where noted, cast outlet boxes shall be Crouse-Hinds, Appleton, or approved equal. Boxes shall have proper number and size hubs. Device plates, covers, adapters and boxes shall be as manufactured by Crouse-Hinds, Appleton, or approved equal.

G. Exposed junction boxes, outlet boxes and pull boxes for pool chemical rooms shall be non - metallic suitable for a corrosive environment and in accordance with the latest NEC requirements.

2.18 IDENTIFICATION MARKINGS

A. Plainly mark all motor and electrical appliance control equipment indicating the equipment controlled with engraved metal tags.

B. Provide laminated plastic nameplates on panelboards on the outside of the door at the top indicating panel designation and feeder source.

C. Provide laminated plastic nameplates on distribution switchboards and motor control centers at the top center indicating panel designation and feeder source.

D. Identify each distribution switchboard and motor control center circuit breaker with a laminated plastic nameplate indicating its' use.

E. Type panelboard directories on the forms provided with the equipment, indicating the use of each branch circuit breaker.

F. Fasten all laminated plastic nameplates to surfaces with two (2) or more screws.

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PART 3 - EXECUTION

3.1 INSPECTION

A. Verify conditions at the Project site before submitting bid. Be responsible for providing all necessary wiring for the new electrical systems. Wherever wiring is being disrupted due to remodeling or changes, reconnect existing and provide new wiring circuits to accomplish a fully operable system at no additional cost to the Owner.

3.2 COORDINATION

A. The Drawings are essentially diagrammatic and indicate the desired location, size, routes, connection points, etc., and are to be followed as closely as possible. Proper judgment must be exercised in executing the Work so as to provide the best possible installation in the available space and to overcome difficulties, limitations or interference wherever encountered. Be responsible for the correct placement of this Work, the proper location and connection in relation to Work of other trades, for determining the exact location of all conduits, outlets and equipment, and for installing the conduits in such a manner as to conform to the structure, avoid obstruction, preserve headroom and keep openings and passageways clear. Particular attention is directed to the close coordination required on exposed Work. Locations shown on Architectural or Mechanical Drawings if different than those shown on Electrical Drawings should be communicated to the Owner's Representative in writing for clarification.

3.3 INSTALLATION

A. Trenching and Backfill: Conform with requirements of Section 13 11 01. Provide minimum cover as required by Code.

B. Conduit Installation:

1. Conduit and metallic raceway systems shall be mechanically and electrically continuous from sources of current to all outlets in a manner to provide a continuous grounding path. Close ends of conduit during construction to prevent entrance of dirt or moisture.

2. Securely fasten conduit to the building construction within three feet of each outlet and within every ten feet thereafter. Secure it to boxes, cabinets, pull boxes, terminals with two locknuts and ends equipped with bushings or a terminal fitting. Cut square with ends carefully reamed.

3. Make bends or elbows so that the conduit will not be injured or flattened.

4. Use insulated metallic bushings in all places where bushings are required.

5. Run exposed conduits level or plumb and parallel to the construction members of the building. No cutting across or diagonal runs will be permitted. Neatly surmount structural obstructions encountered on conduit runs by the use of fittings or pull boxes.

6. Identify feeder conduits by stamped metal tags secured to exposed section of conduit in main or sub-panels.

7. Make up all threaded conduit joints gas and watertight with conductive sealer except conduit above ground in dry indoor locations.

8. Rigidly support all boxes independently of the conduit system.

C. Connections to Equipment:

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1. Fully connect, in an approved manner, all electrical outlets, apparatus, motors, equipment, fixtures, wiring devices and appliances whether they are installed under the Electrical Contract or not, which require electrical connections, to the corresponding electrical system outlet.

2. Where the Work of this Section requires connections to be made to equipment that is furnished and set-in-place under other Sections, obtain such roughing-in dimensions from the manufacturer or supplier of each item as required and assume full responsibility for the installation of the connections thereto.

3.4 ADJUSTMENT AND CLEAN-UP

A. Preliminary Operation: Should the Owner's Representative deem it necessary to operate the electrical installation or any part thereof prior to Substantial Completion of the Work, consent to such preliminary operation and supervise conduction of same. Subcontractor shall pay all costs occasioned by such operation. Preliminary operation shall not be construed as an acceptance of any Work installed under this Contract.

B. Clean-up: Upon completion of the Work of this Section, immediately remove all Spray Ground electrical materials, debris and rubbish occasioned by this Work to the approval of the Owner's Representative.

END OF SECTION 13 11 08

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SECTION 13 28 00 – PREFABRICATED BUILDING

GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the delegated design, construction, and onsite placement of prefabricated precast concrete buildings.

1. See Division 1 for specific requirements for warranties on products and installations specified to be warranted.

B. Basis of design drawings, prepared by CXT Inc., have been included in Volume 2 of the drawing set.

1.3 DEFINITIONS

A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

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1.4 SUBMITTALS

A. Product List: Submit a list, in tabular form, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.

1. Initial Submittal: Within 10 days after Notice to Proceed is issued, submit 1 electronic copy of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.
2. Final List and Building Layout: Within 25 days after Notice to Proceed is issued, submit 1 electronic copy of completed product list and building layout including interior and exterior elevations. Include a written explanation for omissions of data and for variations from Contract requirements.
3. Architect's Action: Architect will respond in writing to Manufacturer within 2 business days of receipt of above documents. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.

B. Shop Drawings: Submit engineered shop drawings for each building.
1. Include the design engineer’s seal and signature on each sheet of shop drawings. The engineer shall be 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.

C. Substitution Requests: Comply with Division 01 Substitution requirements and the following:

1. Substitution Request Form: Use CSI Form 13.1A.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified material or product cannot be provided.
b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.

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j. Cost information, including a proposal of change, if any, in the Contract Sum.
k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's/Engineer's Action: If necessary, Architect/Engineer will request additional information or documentation for evaluation within 3 working days of receipt of a request for substitution. Architect/Engineer will notify Contractor of acceptance or rejection of proposed substitution within 7 days of receipt of request, or 3 days of receipt of additional information or documentation, whichever is later.

a. Form of Acceptance: Change Order.
b. Use product specified if Architect/Engineer cannot make a decision on use of a proposed substitution within time allocated.

D. Basis-of-Design Product Specification Submittal: Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect/Engineer will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle and place products/restroom building using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to allow for immediate installation upon delivery. .
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
5. Provide the required means and methods to place restroom building on pad prepared by the General Contractor.

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6. Set up restroom building and prepare for use and full operation within two weeks or at substantial completion.
7. Instruct Owner's personnel on operation, maintenance and winterization procedures.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.

C. Warranty Period: Two years after substantial completion.

PRODUCTS

1.1 PRODUCT SELECTION PROCEDURES

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:

B. Basis of Design: Subject to compliance with requirements, provide comparable product by one of the following:

1. Huffcutt Concrete, Inc.
2. Modular Connections LLC
3. Romtec, Inc.

C. The following features shall be provided.

1. All precast construction, marine package or masonry walls, factory built and shipped to site.
2. Building Description:
   a. Building #1 Restrooms: Provide four single-user restrooms, one unassigned room, and one large room with chase.
      1) For Add Alternate #1, provide six single-user restrooms, one unassigned room, and one large room with chase.

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b. Building #2: Provide a single room building to be used for ticketing.
c. Building #3: Provide a building consisting of four modules that is to be used for pool pump equipment.

3. Exterior finish: Board and batten siding with simulated cedar shingle roofing. (Painted lap siding with shake roof exterior appearance, Board and batten with simulated metal roof. Provide alkyd enamel coating.
4. Interior is to be painted walls and ceilings (alkyd enamel). Floor is to have clear Rexthane I with Shark Grip silica slip resistant additive, or approved equal.
5. Fiberglass doors and frames with ventilation grills.
6. Wall vents for each room are to be galvanized steel, painted, mechanically adjustable. L&L Louver Model AG-4054-C, 3-inch or approved equal.
7. Heavy duty restroom entrance hardware with "occupied" and "unoccupied" indicators. Provide removable cores that are Best compatible. Provide to site with construction cores. Provide stainless steel hinges. Each restroom to have one spring hinge. Provide Pemko sweep 18062CP or approved equal. Provide aluminum sill Pemko 170A or approved eqaul.
8. Heavy duty mechanical room and chase door hardware as manufactured by Russwin or Schlage. Provide removable cores that are CoreMax compatible. Provide with construction cores. Provide Pemko sweep 18062CP or approved equal. Provide aluminum sill Pemko 170A or approved equal. Provide perimeter gasketing Pemko 312-R or approved equal.
9. Hand dryers to be sensor activated, Xcelerator ThinAir or approved equal. Provide white epoxy coated units.
10. Mirrors in each restroom are to be stainless steel framed, 24"x36" with shelf. Bobrick B-166 or approved equal.
11. Feminine napkin disposal shall be plastic. Bobrick B-5270 or approved equal. Provide one in each restroom.
12. Soap and toilet paper dispensers are not to be provided.
13. Grab bars are to be heavy duty stainless steel. Provide one 18-inch Bobrick B-5806x18, one 36-inch Bobrick B-5806x24 and one 42-inch grab bar Bobrick B-5806x42 or approved equal per restroom.
14. Provide Koala KB-101 or KB-200 or approved equal baby changing station in each restroom.
15. Room signs are to be plastic with braille.
16. Provide three coat hooks per restroom, Tubular Steel Specialties, MFG., Inc. #895 or approved equal.
17. Sealant to be BASF Sonolastic NP-1 or approved equal.
18. Vitreous wall hung plumbing fixtures including lavatories Kohler K-2005 and flush toilets Kohler K-4323 or approved equal. Flushometers: Slone Royal Flush #952-1.6. L-3 & W=4" and Sloan HY33A Acuator, or approved equal.
19. Mop Sink with Chicago Faucet 445-DJ18 or approved equal: Composite w/ Wall Mop Hanger. Locate in chase.
20. Symmons S-71 push button faucets or approved equal.
21. Each fixture shall have water shut-off valves.
22. One exterior hose bib in lockable enclosure.
23. Heavy duty floor drains.
24. Water Heater: LP Propane Tankless Takagi or approved equal. 10 GPM Required.
25. Each room is to have an exhaust fan, Fantech RVF-6XL or approved equal. Fans are to have occupancy sensor and have adjustable speeds.
26. The restrooms and mechanical chase heating shall be provided by others. Provide holes in roof for exhaust.
27. All water piping is to be insulated.

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28. Interior and exterior lighting is to be vandal resistant, LED lights rated for wet conditions. Interior lighting to have motion sensors. Exterior lighting to be controlled with photocell sensors and be night sky rated.
29. Each room and chase are to have battery operated egress light that will light when power goes out.
30. Provide one exterior quad outlet in lockable, weatherproof enclosure.
31. Provide one GFI outlet in each restroom at lavatory and in chase.
    a. Other outlets to be provided as shown on drawings.
32. Provide service panels as indicated in the contract documents.
33. A Delaware registered Architect or Engineer shall sign/seal the documents. A COMCheck is to be provided.
34. Provide operation and maintenance manual.
35. Provide operation instructions. Allow two hours for Park staff training.

D. Add Alternate #1 features:
1. Provide all of the above listed features for the two additional restrooms. Coordinate all mechanical, plumbing, electrical, and equipment. Coordinate the size of the electrical panel and provide additional circuits as required for the additional features.

E. The restroom facility shall meet all Federal, State and Sussex County code requirements including ANSI ICC 117.1-2009 and the Federal Register 2010 ADA Standards for Accessible Design.

F. The restroom shall allow for winterization with minimal effort.

G. All plumbing and electrical conduits shall be concealed from restrooms.

H. Provide custom exterior colors as selected by the Owner.

PART 3 - EXECUTION

1.1 PRECAST CONCRETE BUILDINGS

A. Building manufacturer shall construct, assemble, paint, install plumbing and electrical at their plant so that it may be transported to the jobsite in finished modules and placed using a crane.

B. Building manufacturer shall provide mechanical rough-in drawing showing where electrical, water supply line, waste line, and floor drains are to be located for hook up to building.

C. The Owner's contractor will make final mechanical and electrical connections after the building is placed by manufacturer.

D. Manufacturer will seal and caulk interior and exterior seams between modules. Manufacturer will also perform any shipping and handling repairs during installation.

1.2 ONSITE OPERATIONS

A. The Owner's contractor shall provide adequate access and a level pad for the crane and semis to sit side by side under their own power. Working radius shall be 35' from center pin on crane.

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B. The Owner's contractor shall lay a foundation suitable for building to sit on. Foundation shall be level to within ¼".

C. The Owner's contractor shall rough in mechanicals according to mechanical rough in drawing provided by building manufacturer. Mechanicals shall be terminated at top of foundation. Final mechanical connections shall be done by Owner's contractor including floor drains.

D. The Building Manufacturer shall provide crane for building component installation.

E. The Building Manufacturer will perform initial startup of building using O & M manual as a reference. The Building Manufacturer will perform any troubleshooting and resolution during initial startup.

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Knowledge for Creating and Sustaining the Built Environment

SUBSTITUTION REQUEST

(After the Bidding/Negotiating Phase)

Project: _____ Substitution Request Number: _____

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Phone: _____

Address: _____

Trade Name: _____ Model No.: _____

Installer: _____ Phone: _____

Address: _____

History: ☐ New product ☐ 1-4 years old ☐ 5-10 years old ☐ More than 10 years old

Differences between proposed substitution and specified product:

☐ Point-by-point comparative data attached — REQUIRED BY A/E

Reason for not providing specified item:

Similar Installation:

Project: _____ Architect: _____

Address: _____ Owner: _____

_____ Date Installed: _____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explain _____

Savings to Owner for accepting substitution: _____ ($ _____).

Proposed substitution changes Contract Time: ☐ No ☐ Yes [Add] [Deduct] _____ days.

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

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SUBSTITUTION REQUEST
(After the Bidding/Negotiating Phase — Continued)

The Undersigned certifies:
- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by this substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____

Attachments: ☐

A/E's REVIEW AND ACTION

☐ Substitution approved - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.
☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01 25 00 Substitution Procedures.
☐ Substitution rejected - Use specified materials.
☐ Substitution Request received too late - Use specified materials.

Signed by: _____ Date: _____

Additional Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ A/E ☐ Other:

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END OF SECTION 13 28 00

SECTION 22 05 00 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete Work.
2. Sleeves without waterstop.
3. Sleeves with waterstop.
4. Stack-sleeve fittings.
5. Grout.
6. Silicone sealants.
7. Escutcheons.
8. Thermometers, bimetallic actuated, lead free.
9. Thermowells, lead free.
10. Pressure gauges, dial type, lead free.
11. Gauge attachments, lead free.
12. Test plugs, lead free.
13. Test-plug kits, lead free.
14. Contractor coordination.
15. Site examination.
16. Permits
17. Utility connections.
18. Cleaning of systems.
19. Excavation and backfill.

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1.2 DEFINITIONS

A. “Existing Piping To Remain” - Existing piping that is not to be removed and that is not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. “Approve” - To permit use of material, equipment or methods conditional upon compliance with contract document requirements.

C. “Concealed” - Hidden from normal sight; includes work in crawl spaces, above ceilings, and in building shafts.

D. “Directed” - Directed by Engineer.

E. “Equal, equivalent” - Possessing the same performance qualities and characteristics and fulfilling the same utilitarian function.

F. “Exposed” - Not concealed.

G. "Furnish" - Supply and deliver to project site, ready for unloading, unpacking, assembly, installation, and similar operations.

H. "Indicated" - Indicated in Contract Documents.

I. "Install" - Operations at project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimensions, finishing, curing, protecting, cleaning and similar operations.

J. "Piping" - Includes pipe, fittings, valves, supports and accessories comprising a system.

K. "Provide" - Furnish and install, complete and ready for the intended use.

L. "Removable" - Detachable from the structure or system without physical alteration of materials or equipment and without disturbance to other construction.

M. "Review" - Limited observation or checking to ascertain general conformance with design concept of the work and with information given in contract documents. Such action does not constitute a waiver or alteration of the contract requirements.

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1.3 ACTION SUBMITTALS

A. Product Data:

1. For each type of product, excluding motors which are included in Part 1 of the plumbing equipment Sections.

a. Include construction details, material descriptions, and dimensions of individual components and finishes.
b. Include operating characteristics and furnished accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of gauge to include in operation and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1.

B. Pipe and Pressure-Vessel Welding Qualifications: Qualify procedures and operators in accordance with 2021 ASME Boiler and Pressure Vessel Code, Section IX.

C. Contract drawings for plumbing work are diagrammatic, intended to convey scope and general arrangement.

D. Refer questions involving document interpretation or discrepancies to Engineer for review and direction.

E. Correct faulty work due to resolving discrepancies without proper approval.

F. Specifications establish quality of materials, equipment, workmanship and methods of construction.

G. Follow drawings and specifications in laying out work. Consult other applicable contract drawings and specifications, become familiar with conditions affecting work.

H. Regulations: Comply with regulations of NFPA, state, county, and municipal building ordinances, and other applicable codes and regulations.

I. Provide UL label on electric powered equipment or certification that equipment has been tested by a testing agency approved by the local authority as equivalent in safety to UL labeled equipment.

J. Material and Equipment Requirements

1. Use products of one manufacturer where two or more items of same kind of equipment are required.
2. Materials and equipment shall have a record of one-year successful field use.
3. For certain items of equipment, the specification and the project design are based upon the specified manufacturer's product. Other manufacturers' names are listed. Contractor may purchase, conditional upon meeting project requirements, equipment from the listed manufacturers.
4. Only the manufacturer's equipment upon which the specification and the project design has been based, has been checked for this project. Check allocated space and structure for suitability of equipment of other listed manufacturers, including parts replacement and servicing.
5. Basis of Design Products: Where the Specifications or Drawings name a specific manufacturer's product accompanied by the words "Basis of Design," including make or model number or other designation, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Naming of a Basis of Design product is intended to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification. The drawings indicate the general size, configuration, location, connections and/or support for equipment or systems specified with relation to the other building systems.

K. Workmanship

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1. Remove and replace, at no extra cost, work not in conformance with contract requirements.
2. Coordinate work and cooperate with other trades to facilitate execution of work.

L. Coordination with Other Trades

1. Contractor shall give full cooperation and coordination with other trades and shall furnish any information necessary to permit the work of all trades to be installed satisfactorily with the least possible interference or delay.
2. The Contractor shall furnish to other trades, as required, all necessary templates, patterns, setting plans and shop details for the proper installation of the work and for the purpose of coordination adjacent work.
3. Contractor shall coordinate with Pre-Fabricated Buildings. Review all Pre-Fabricated Building drawings. Contractor shall be responsible for providing all components not provided by Pre-Fabricated Building Manufacturer to make complete functioning systems.

M. Asbestos or asbestos-containing materials shall not be utilized or allowed on this project. The Contractor shall be rigorous in assuring that all materials, equipment, systems, and components do not contain asbestos. Any deviations from this exclusion shall be remedied at the Contractor's expense without regard to prior submittal approvals.

N. Access: The Contractor shall specifically consider all materials and equipment installations and shall coordinate with the work of all trades to ensure easy and unobstructed accessibility of all systems for operations, maintenance, repairs, and replacement. Installation of all specified materials and equipment including but not limited to, equipment, supports, pipe, electrical conduit and controls shall be in a manner which will allow complete unobstructed access to all panels, access doors, filter racks, control boxes, controls actuators, sensors, valves, tube bundles and all other items requiring access for operations or maintenance. All items such as controls, actuators and valves which require servicing or manual operations for system use shall be located such as to be accessible without standing on other equipment, whenever it is possible or practical. Any installation of new equipment or materials which causes problems related to access of new equipment shall be disapproved by the Engineer and re-accomplished by the Contractor.

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1.7 COORDINATION

A. References

1. References to standards, codes, catalogs and recommendations are latest edition in effect on date of invitation to bid.
2. Refer to applicable contract drawings and specifications pertaining to other Divisions for conditions affecting work.
3. Refer to Division 01 for description of alternates.
4. Refer to Division 01 for description of base bid items.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Compatibility: Provide products suitable for piping service fluids, materials, working pressures, and temperatures.

B. Capability: Provide products and installations to accommodate maximum axial movement as scheduled or indicated on Drawings.

2.2 CONCRETE WORK

A. Compressive Strength: 3000-psi minimum after 28 days.

B. Reinforcing Steel: Yield strength as determined by structural design.

C. Grout: Non-shrink, non-metallic, pre-mixed, equivalent to Nordbak Fast-set, U.S. Grout Five-star, or Polymeric.

2.3 SLEEVES

A. Sleeves without Waterstop:

1. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron, with plain ends.
2. Steel Pipe Sleeves: ASTM A53, Type E, Grade B, Schedule 40, hot-dip galvanized, with plain ends.
3. Steel Sheet Sleeves: ASTM A653, 24 gauge minimum thickness; hot-dip galvanized, round tube closed with welded longitudinal joint.

B. Sleeves with Waterstop:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advance Products & Systems, LLC.
b. CALPICO, Inc.
c. GPT; a division of EnPRO Industries.
d. Metraflex Company (The).

2. Description: Manufactured galvanized-steel, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.

C. Stack-Sleeve Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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a. Jay R. Smith Mfg Co; a division of Morris Group International.
b. Wade; a subsidiary of McWane Inc.
c. Zurn Industries, LLC.

2. Description: Manufactured, galvanized cast-iron sleeve with integral clamping flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.

a. Underdeck Clamp: Clamping ring with setscrews.

D. Grout:

1. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.
2. Standard: ASTM C1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
3. Design Mix: 5000 psi, 28-day compressive strength.
4. Packaging: Premixed and factory packaged.

E. Silicone Sealants:

1. Silicone Sealant, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) GE Construction Sealants; Momentive Performance Materials Inc.
2) Sherwin-Williams Company (The).
3) The Dow Chemical Company.
4) Tremco Incorporated.

b. Standard: ASTM C920, Type S, Grade NS, Class 25, Use NT.

2. Silicone Foam Sealant: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

a. Manufacturers: Subject to compliance with requirements, provide products by the following:

1) Smooth-On.

2.4 ESCUTCHEONS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. BrassCraft Manufacturing Co.; a Masco company.

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2. Dearborn Brass.
3. Jones Stephens Corp.
4. Keeney Manufacturing Company (The).
5. Mid-America Fittings, LLC; A Midland Industries Company.
6. ProFlo; a Ferguson Enterprises, Inc. brand.

B. Escutcheon Types:

1. One-Piece, Steel Type: With polished, chrome-plated or polished brass finish and setscrew fastener.
2. One-Piece, Stainless Steel Type: With polished stainless steel finish.
3. One-Piece, Cast-Brass Type: With polished, chrome-plated or polished brass finish and setscrew fastener.
4. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel or brass with polished, chrome-plated finish and spring-clip fasteners.
5. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.
6. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed and exposed-rivet hinge; and spring-clip fasteners.

C. Floor Plates:

1. Split Floor Plates: Cast brass with concealed hinge.

2.5 METERS AND GAUGES FOR PLUMBING PIPING

A. Thermometers, Bimetallic Actuated, Lead Free:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ashcroft Inc.
b. Marsh Bellofram.
c. Tel-Tru Manufacturing Company.
d. Trerice, H. O. Co.
e. WATTS; A Watts Water Technologies Company.
f. Weiss Instruments, Inc.
g. Weksler Glass Thermometer Corp.
h. Winters Instruments - U.S.

2. Source Limitations: Provide lead-free bimetallic-actuated thermometers from a single manufacturer.
3. Standard: ASME B40.200.
4. Case: Liquid-filled and sealed type(s); stainless steel with 5-inch nominal diameter.
5. Dial: Nonreflective aluminum with permanent scale markings and scales in deg F and deg C.
6. Connector Type(s): Union joint, adjustable angle and rigid, bottom; with ASME B1.1 or ASME B1.20.1 screw threads to fit thermowell.

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7. Stem: 0.25 or 0.375 inch in diameter; stainless steel.
8. Window: Safety glass or acrylic plastic.
9. Ring: Stainless steel.
10. Element: Bimetal coil.
11. Pointer: Dark-colored metal.
12. Accuracy: Plus or minus 1 percent of span.

B. Thermowells, Lead Free:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: Lead-free copper.
4. Material for Use with Steel Piping: Type 304 stainless steel.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: 1/2, 3/4, or 1 inch, or as required to match threaded opening in pipe.
7. Internal Threads: Size and thread type as required to match thermometer mounting threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length to extend to center of pipe.
10. Lagging Extension: Include on thermowells for insulated piping and tubing. Extension is to be of sufficient length to extend beyond finished insulation surface.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.
12. Heat-Transfer Medium: Mixture of graphite and glycerin.

C. Pressure Gauges, Dial Type, Lead Free - Direct Mounted, Metal Case:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ashcroft Inc.
    b. Marsh Bellofram.
    c. Tel-Tru Manufacturing Company.
    d. Trerice, H. O. Co.
    e. WATTS; A Watts Water Technologies Company.
    f. Weiss Instruments, Inc.
    g. Weksler Glass Thermometer Corp.
    h. Winters Instruments - U.S.

2. Source Limitations: Provide dial-type, lead-free, direct-mounted, metal-case pressure gauges from single manufacturer.
3. Standard: ASME B40.100.
4. Case: Liquid-filled and sealed type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
5. Pressure-Element Assembly: Lead-free Bourdon tube.
6. Pressure Connection: Lead-free brass, with ¼ or 1/2 inch, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
7. Movement: Mechanical, with link to pressure element and connection to pointer.

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8. Dial: Nonreflective aluminum with permanent scale markings graduated in psi and kPa.
9. Pointer: Dark-colored metal.
10. Window: Safety glass or plastic.
11. Ring: Stainless steel.
12. Accuracy: Grade A, plus or minus 1 percent of middle half of span.

D. Gauge Attachments, Lead Free:

1. Snubbers: ASME B40.100, lead-free brass; with 1/4 or 1/2 inch, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.
2. Valves: Lead-free brass or stainless steel needle, with 1/4 or 1/2 inch, ASME B1.20.1 pipe threads.

E. Test Plugs, Lead Free:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Peterson Equipment Co., Inc.
   b. Trerice, H. O. Co.
   c. WATTS; A Watts Water Technologies Company.

2. Source Limitations: Provide lead-free test plugs from single manufacturer.
3. Description: Test-station fitting made for insertion into piping tee fitting.
4. Body: Lead-free brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
5. Thread Size: 1/4 inch or 1/2 inch, ASME B1.20.1 pipe thread.
6. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.
7. Core Inserts: EPDM self-sealing rubber.

F. Test-Plug Kits, Lead Free:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

   a. Peterson Equipment Co., Inc.

2. Source Limitations: Provide lead-free test-plug kits from single manufacturer.
3. Furnish one test-plug kit(s) containing one thermometer(s), one pressure gauge and adapter, and carrying case. Thermometer sensing elements, pressure gauge, and adapter probes are to be of diameter to fit test plugs and of length to project into piping.
4. High-Range Thermometer, Lead Free: Small, bimetallic insertion type with 1- to 2-inch diameter dial and tapered-end sensing element. Dial range is to be at least 0 to 220 deg F.
5. Pressure Gauge, Lead Free: Small, lead-free Bourdon-tube insertion type with 2- to 3-inch diameter dial and probe. Dial range is to be at least 0 to 200 psig.
6. Carrying Case: Metal or plastic, with formed instrument padding.

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2.6 WARNING TAPE

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 as follows:

1. Red: Electric.
2. Blue: Water systems.
3. Green: Sewer systems.

PART 3 - EXECUTION

3.1 INSTALLATION OF CONCRETE WORK

A. Location: Equipment foundation pads, equipment housekeeping pads, and where indicated under plumbing work.

B. Perform work in conformance to American Concrete Institute Standard ACI 301, Specifications for Structural Concrete for Buildings.

C. Bond new work to existing concrete, by approved adhesive or by roughing existing surface to expose aggregate uniformly, then cleaning surface. Key new pads, piers, curbs, and pedestals to concrete floors using expansion bolts.

D. Bevel exposed vertical and horizontal edges 3/4-inch.

E. Install grout according to manufacturer's recommendations.

F. Testing: Test concrete using a qualified testing agency.

G. Submit name and qualifications of testing agency for review by the Engineer.

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3.2 INSTALLATION OF SLEEVES - GENERAL

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.
2. Seal annular space between core-drilled hole and piping or piping insulation; use joint sealants that joint sealant manufacturer's literature indicates is appropriate for size, depth, and location of joint.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.

    a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

3. Using grout, seal the space outside of sleeves in floors/slabs/walls without sleeve-seal system. Select to maintain fire resistance of floor/slab/wall.
4. Seal annular space between sleeve and piping or piping insulation; use joint sealants that joint sealant manufacturer's literature indicates is appropriate for size, depth, and location of joint.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
3. Seal annular space between sleeve and piping or piping insulation; use joint sealants that joint sealant manufacturer's literature indicates is appropriate for size, depth, and location of joint.

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3.3 INSTALLATION OF SLEEVES WITH WATERSTOP

A. Install sleeve with waterstop as new walls and slabs are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange centered across width of concrete slab or wall.

C. Secure nailing flanges to wooden concrete forms.

D. Using grout, seal space around outside of sleeves. Select to maintain fire resistance of floor/slab/wall.

3.4 INSTALLATION OF STACK-SLEEVE FITTINGS

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."

3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Using silicone sealant, seal space between top hub of stack-sleeve fitting and pipe.

3.5 INSTALLATION OF ESCUTCHEONS

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

3.6 INSTALLATION OF METERS AND GAUGES

A. Install thermometer with thermowell at each required thermometer location.

B. Install thermowells in vertical position in piping tees.

C. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

D. Install thermowells with extension on insulated piping.

E. Fill thermowells with heat-transfer medium.

F. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

G. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks.

H. Install direct-mounted pressure gauges in piping tees with pressure gauge located on pipe at most readable position.

I. Install remote-mounted pressure gauges on panel.

J. Install valve and snubber in piping for each pressure gauge for fluids.

K. Install test plugs in piping tees.

L. Install thermometers in the following locations:

1. Inlet and outlet of each water heater.
2. Outlet side of hot-water-balancing valve.
3. Each main hot-water-recirculating line return pipe.

M. Install pressure gauges in the following locations:

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1. Building water service entrance into building.
2. Inlet and outlet of each pressure-reducing valve.
3. Suction and discharge of each domestic water pump.

3.12 INSTALLATION OF EQUIPMENT PADS

A. Concrete Equipment Pads

1. Provide concrete pads not less than 4 inches high and projecting not less than 3 inches on all sides beyond equipment for floor mounted equipment.
2. Place anchor bolts in steel pipe sleeves, with a plate at bottom end of sleeve to hold bolts.
3. Grout between base plate and foundation.

3.7 CONNECTIONS

A. Install meters and gauges adjacent to machines and equipment to allow space for service and maintenance of meters, gauges, machines, and equipment.

3.8 ADJUSTING

A. After installation, calibrate meters according to manufacturer's written instructions.

B. Adjust faces of meters and gauges to proper angle for best visibility.

3.9 FIELD QUALITY CONTROL

A. Sleeves:

1. Perform the following tests and inspections:

a. Leak Test: After allowing for a full cure, test sleeves for leaks. Repair leaks and retest until no leaks exist.
b. Sleeves will be considered defective if they do not pass tests and inspections.

2. Prepare test and inspection reports.

B. Escutcheons:

1. Using new materials, replace broken and damaged escutcheons and floor plates.

3.10 SLEEVES APPLICATION

A. Use sleeves for the following piping-penetration applications:

1. Exterior Concrete Walls above and below Grade:

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a. Sleeves with waterstops.

2. Concrete Slabs-on-Grade:

a. Sleeves with waterstops.

3. Concrete Slabs above Grade:

a. Sleeves with waterstops or stack-sleeve fittings.

4. Interior Wall and Partitions:

a. Sleeves without waterstops.

3.11 ESCUTCHEONS APPLICATION

A. Escutcheons for New Piping:

1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
2. Chrome-Plated Piping: One piece, steel, cast brass or split-casting brass with polished, chrome-plated finish.
3. Insulated Piping:

a. One piece, steel with polished, chrome-plated or polished brass to match adjacent finish.

4. Bare Piping at Wall and Floor Penetrations in Finished Spaces:

a. One piece, steel with polished, chrome-plated or polished brass to match adjacent finish.

5. Bare Piping at Ceiling Penetrations in Finished Spaces:

a. One piece, steel with polished, chrome-plated or polished brass to match adjacent finish.

6. Bare Piping in Unfinished Service Spaces:

a. One piece, steel with polished, chrome-plated finish.

7. Bare Piping in Equipment Rooms:

a. One piece, steel with polished, chrome-plated finish.

B. Install floor plates for piping penetrations of equipment-room floors.

C. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

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1. New Piping: One piece, floor plate.

3.12 THERMOMETER, LEAD FREE, APPLICATION

A. Thermometers at inlet and outlet of each domestic water heater are to be the following:

1. Liquid-filled, bimetallic-actuated type.

B. Thermometer stems are to be of length to match thermowell insertion length.

C. Provide Test plug with EPDM self-sealing rubber inserts where indicated on drawings.

3.13 THERMOMETER, LEAD FREE, SCALE-RANGE APPLICATION

A. Scale Range for Domestic Cold-Water Piping:

1. 0 to 100 deg F and minus 20 to plus 50 deg C.

B. Scale Range for Domestic Hot-Water Piping:

1. 0 to 250 deg F and 0 to 150 deg C.

C. Insert additional paragraphs for thermometer scale ranges and applications.

3.14 PRESSURE-GAUGE APPLICATION

A. Pressure gauges at discharge of each water service into building are to be the following:

1. Sealed, Dial Type, Lead Free - Direct Mounted, Metal Case.

B. Pressure gauges at inlet and outlet of each water pressure-reducing valve are to be the following:

1. Sealed, Dial Type, Lead Free - Direct Mounted, Metal Case.

C. Pressure gauges at suction and discharge of each domestic water pump are to be the following:

1. Sealed, Dial Type, Lead Free - Direct Mounted, Metal Case.

D. Provide Test plug with EPDM self-sealing rubber inserts where indicated on drawings.

3.15 PRESSURE-GAUGE SCALE-RANGE APPLICATION

A. Scale Range for Water Service Piping:

1. 0 to 100 psi and 0 to 600 kPa.

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B. Scale Range for Domestic Water Piping:

1. 0 to 100 psi and 0 to 600 kPa.

3.16 SITE EXAMINATION

A. Failure to visit site and become familiar with local conditions prior to bidding will not relieve the Contractor of their responsibility for complying with the Contract Documents.

3.17 PERMITS

A. Obtain and pay for required permits.

3.18 UTILITY CONNECTIONS

A. Pay connection charges for water and sewers.

B. Arrange for installation of water meters.

3.19 PROTECTION

A. Protect plumbing and associated electrical material and equipment from the elements or other injury as soon as delivered on premises. Protect plumbing fixtures as soon as they are set. Cover water closets and post notices prohibiting their use.

1. Accept in original packaging.
2. Store in clean, dry space.
3. Protect from dirt, water, construction debris, and traffic.
4. Handle in accordance with manufacturer's written instructions.

B. Cap or plug openings in equipment, piping, and conduit systems, to exclude dirt and other foreign material. Do not use rags, wool, cotton, paper, waste or similar materials for plugging.

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3.20 CLEANING OF SYSTEMS

A. Thoroughly clean systems after satisfactory completion of pressure tests and before permanently connecting fixtures, equipment, traps, strainers, and other accessory items. Blow out and flush piping until interior are free of foreign matter.

B. Flush piping in recirculating water systems to remove cutting oil, excess pipe joint compound, and other foreign materials. Provide necessary temporary pumping equipment to thoroughly clean the water piping. Do not use system pumps until after cleaning and flushing has been accomplished to the satisfaction of the Engineer. Employ chemical cleaners, including a non-foaming detergent, not harmful to system components. Discharge flushing solution to sanitary

piping system and not to floor drains connected to storm water systems. After cleaning operation, final flushing and refilling, the residual alkalinity shall not exceed 300 parts per million. Work shall be performed or supervised by a qualified water treatment service company with personnel skilled in the safe and proper use of chemicals and in testing procedures. Submit a certificate of completion to Engineer stating name of service company used.

C. Leave strainers and dirt pockets in clean condition.

D. Pay for labor and materials required to locate and remove obstructions from systems clogged with construction refuse after acceptance. Replace and repair work disturbed during removal of obstructions.

E. Thoroughly clean plumbing fixtures using non-scratching cleaners. Polish chromium plated work.

F. Leave systems clean, and in complete running order.

G. Disinfect potable water systems as prescribed by local code. Take precautions to avoid use of fixtures during disinfecting period.

3.21 EXCAVATION AND BACKFILL

A. Excavate and backfill as required to install underground plumbing work.

B. establish required lines and grade.

C. Excavate to sufficient depth to give 30-inch minimum cover, unless otherwise indicated.

D. Keep excavation drained and pumped out.

E. Remove excavated materials not required or suitable for backfill.

F. Protection

1. Protect existing utilities and underground work by shoring and bracing.
2. Provide guardrail, lamps, flags, and other safeguards at temporary walk and road crossings.
3. Provide shoring, sheet piling and bracing for protection of work and safety of personnel. Timber sheeting below top of pipe shall not be removed.
4. Protect trees, structures, and other property from injury during work.
5. Prevent debris and other materials from entering piping and drains.

G. Trenching

1. Excavate to depth and width required for proper installation of item to be buried with a minimum clearance of 8 inches and a maximum of 12 inches on each side of the pipe and to the top of the pipe with a minimum overdepth of 4 inches. If cinders are encountered at bottom of trench, increase overdepth to 10 inches.

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2. Sides shall be vertical unless otherwise required by governing safety regulations.
3. Provide manholes and similar structures with a minimum of 2-inch and a maximum of 24-inch clearance on each side.

H. Backfill

1. Use only backfill material free of organic matter, cinders, frozen earth, clay, and rocks exceeding 6 inches in any dimension.
2. Provide bed of firmly compacted sand, gravel, or crushed stone of proper grade to form a uniform support. Hollow out for bells. Backfill excessive overdepth with firmly compacted sand or gravel.
3. Provide a structurally suitable reinforced concrete beam supported by the structure and undisturbed earth to support piping where a properly compacted bed is difficult to obtain, because of fill conditions, such as may occur adjacent to building walls.
4. As items to be buried are laid, backfill with layer of sand, crushed stone, or gravel bedding material to centerline of pipe or 6 inches deep, whichever is less, and tamp.
5. After tests and inspections are complete, backfill with fine earth or sand in 6-inch layers until buried item has 1-foot of cover. Carefully tamp each layer. Compact to at least 95 percent of the maximum dry density as determined by ASTM D 1557.
6. Deposit remainder of backfill material in 8-inch layers and tamp each layer. Compact to at least 95 percent of the maximum dry density as determined by ASTM D 1557.
7. Backfill with sand, graded crushed stone, or washed gravel, inside building under or within 3 feet of equipment and under roadways. Compact to at least 95 percent of the maximum dry density as determined by ASTM D 1557.

I. Restoring

1. Restore existing pavement, curbs, sidewalks, fences, sod, shrubs, and other appurtenances removed or damaged in connection with work to original condition.
2. Replace sod with sod and replace trees, which are damaged, with trees of similar type and size.

J. Warning Tape: Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

NOT FOR BIDDING PURPOSES

END OF SECTION 220500

SECTION 22 05 23 – GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ball valves.
2. Butterfly valves.
3. Check valves.
4. Gate valves.

1.2 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene-diene terpolymer.

C. NBR: Nitrile butadiene rubber (also known as Buna-N).

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. PTFE: Polytetrafluoroethylene.

G. RPTFE: Reinforced polytetrafluoroethylene.

H. RS: Rising Stem

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1.3 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

a. Include material descriptions and dimensions of individual components.
b. Include operating characteristics and furnished accessories.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, solder ends, and weld ends.
3. Set ball valves open to minimize exposure of functional surfaces.
4. Set butterfly valves closed or slightly open.
5. Block check valves in either closed or open position.
6. Set gate valves closed to prevent rattling.

B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles, handwheels, stems or other components as lifting or rigging points unless specifically indicated for this purpose in manufacturer's instructions.

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PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of valve from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Standards:

1. Domestic water piping valves intended to convey or dispense water for human consumption must comply with the U.S. Safe Drinking Water Act (SDWA), requirements of authorities having jurisdiction, and NSF 61/NSF 372; or to be certified in compliance with NSF 61/NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded-end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.5 for flanges on steel valves.
4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
5. ASME B16.18 for cast-copper solder-joint connections.
6. ASME B16.22 for wrought-copper solder-joint connections.
7. ASME B16.34 for flanged- and threaded-end connections.
8. ASME B31.9 for building services piping valves.

C. Provide bronze valves made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

D. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream piping unless otherwise indicated.

F. Valve Bypass and Drain Connections: MSS SP-45.

G. Valve Actuator Type:

1. Gear Actuator: For quarter-turn valves 4 inches and larger.
2. Hand Lever: For quarter-turn valves smaller than 4 inches. Butterfly valves 6-inches and smaller.

H. Valves in Insulated Piping:

1. Ball Valves:

a. Provide 2-inch extended neck stems.
b. Extended operating handles with nonthermal-conductive covering material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
c. Memory stops that are fully adjustable after insulation is applied.

2. Gate Valves:

a. With 2-inch stem extensions.

3. Butterfly Valves:

a. Provide 2-inch extended neck stems.

NOT FOR BIDDING PURPOSES

2.3 BALL VALVES, LEAD FREE

A. Ball Valves, Lead Free, Threaded or Soldered Ends - Brass, Two Piece with Full Port and Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
b. Bray Commercial.
c. Jenkins Valves; a Crane Co. brand.

2. Standard: MSS SP-110; MSS SP-145.
3. CWP Rating: 600 psig.
4. Body Design: Two piece.

5. Body Material: Forged brass.
6. Ends: Threaded or soldered. See Part 3 ball valve schedule articles.
7. Seats: PTFE.
8. Stem: Brass.
9. Ball: Chrome-plated brass.
10. Port: Full.

B. Ball Valves, Lead Free, Flanged or Threaded Ends - Iron, Class 125:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
   b. WATTS; A Watts Water Technologies Company.
   c. Zurn Industries, LLC.

2. Standard: MSS SP-72; MSS SP-110; MSS SP-145.
3. CWP Rating: 200 psig.
4. Body Design: Split body.
5. Body Material: ASTM A126, gray iron.
6. Ends: Flanged or threaded. See Part 3 ball valve schedule articles.
7. Seats: PTFE.
8. Stem: Stainless steel.
9. Ball: Stainless steel.
10. Port: Full.

2.4 BALL VALVES, GENERAL PURPOSE

A. Ball Valves, Threaded or Soldered Ends - Brass, Two Piece with Full Port and Brass Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
   b. Bray Commercial.
   c. Jenkins Valves; a Crane Co. brand.

2. Standard: MSS SP-110; MSS SP-145.
3. SWP Rating: 150 psig.
4. CWP Rating: 600 psig.
5. Body Design: Two piece.
6. Body Material: Forged brass.
7. Ends: Threaded or soldered. See Part 3 ball valve schedule articles.
8. Seats: PTFE.
9. Stem: Brass.
10. Ball: Chrome-plated brass.
11. Port: Full.

NOT FOR BIDDING PURPOSES

B. Ball Valves, Flanged Ends - Iron, Class 125:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
   b. WATTS; A Watts Water Technologies Company.
   c. Zurn Industries, LLC.

2. Standard: MSS SP-72.
3. CWP Rating: 200 psig.
4. Body Design: Split body.
5. Body Material: ASTM A126, gray iron.
6. Ends: Flanged.
7. Seats: PTFE.
8. Stem: Stainless steel.
9. Ball: Stainless steel.
10. Port: Full.

2.5 BUTTERFLY VALVES, LEAD FREE

A. Butterfly Valves, Lead Free, Single Flange (Lug Type) - Iron, with Aluminum-Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
   b. Bray Commercial.
   c. Center Line; a Crane Co. brand.
   d. DeZURIK.
   e. Hammond Valve.
   f. Jenkins Valves; a Crane Co. brand.
   g. Kennedy Valve Company; a division of McWane, Inc.
   h. Milwaukee Valve Company.
   i. NIBCO INC.
   j. Stockham; a Crane Co. brand.
   k. WATTS; A Watts Water Technologies Company.
   l. Zurn Industries, LLC.

2. Standard: MSS SP-67, Type I.
3. CWP Rating: 200 psig.
4. Body Design: Single flange (lug type), suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
5. Body Material: ASTM A126, cast iron or ASTM A536, ductile iron.
6. Seat: EPDM or NBR. See Part 3 butterfly valve schedule articles.
7. Stem: One- or two-piece stainless steel.
8. Disc: Aluminum bronze.

NOT FOR BIDDING PURPOSES

2.6 BUTTERFLY VALVES, GENERAL PURPOSE

A. Butterfly Valves, Single Flange (Lug Type) - Iron, with Aluminum-Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
    b. Bray Commercial.
    c. Center Line; a Crane Co. brand.
    d. DeZURIK.
    e. Hammond Valve.
    f. Jenkins Valves; a Crane Co. brand.
    g. Kennedy Valve Company; a division of McWane, Inc.
    h. Milwaukee Valve Company.
    i. NIBCO INC.
    j. Stockham; a Crane Co. brand.
    k. WATTS; A Watts Water Technologies Company.
    l. Zurn Industries, LLC.

2. Standard: MSS SP-67, Type I.
3. CWP Rating: 200 psig.
4. Body Design: Single flange (lug type), suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
5. Body Material: ASTM A126, cast iron or ASTM A536, ductile iron.
6. Seat: NBR.
7. Stem: One- or two-piece stainless steel.
8. Disc: Aluminum bronze.

2.7 CHECK VALVES, LEAD FREE

A. Check Valves, Lead Free, Swing Type, Threaded or Soldered Ends - Bronze, with Bronze Disc, Class 125:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
    b. Crane Fluid Systems; Crane Co.
    c. Jenkins Valves; a Crane Co. brand.
    d. Milwaukee Valve Company.
    e. NIBCO INC.
    f. Stockham; a Crane Co. brand.
    g. Victaulic Company.

2. Standard: MSS SP-80, Type 3.
3. CWP Rating: 200 psig.

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4. Body Design: Horizontal flow.
5. Body Material: ASTM B62, bronze.
6. Ends: Threaded or soldered. See Part 3 check valve schedule articles.
7. Disc: Bronze.

B. Check Valves, Lead Free, Swing Type, Threaded or Soldered Ends - Bronze, with Bronze Disc, Class 150:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
   b. Crane Fluid Systems; Crane Co.
   c. Milwaukee Valve Company.
   d. NIBCO INC.
   e. Stockham; a Crane Co. brand.

2. Standard: MSS SP-80, Type 3.
3. CWP Rating: 300 psig.
4. Body Design: Horizontal flow.
5. Body Material: ASTM B62, bronze.
6. Ends: Threaded or soldered. See Part 3 check valve schedule articles.
7. Disc: Bronze.

C. Check Valves, Lead Free, Swing Type, Flanged or Threaded Ends - Iron, with Metal Seats, Class 125:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
   b. Bray Commercial.
   c. Crane Fluid Systems; Crane Co.
   d. Jenkins Valves; a Crane Co. brand.
   e. Milwaukee Valve Company.
   f. Victaulic Company.

2. Standard: MSS SP-71, Type I.
3. CWP Rating: 200 psig.
4. Body Design: Clear or full waterway.
5. Body Material: ASTM A126, gray iron with bolted bonnet.
6. Ends: Flanged or threaded. See Part 3 check valve schedule articles.
7. Trim: Bronze.
8. Gasket: Asbestos free.

D. Check Valves, Lead Free, Swing Type, Flanged or Threaded Ends - Iron, with Lever- and Spring-Closure Control, Class 125:

NOT FOR BIDDING PURPOSES

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
    b. Bray Commercial.
    c. Crane Fluid Systems; Crane Co.
    d. Jenkins Valves; a Crane Co. brand.
    e. Milwaukee Valve Company.
    f. Victaulic Company.

2. Standard: MSS SP-71, Type I.
3. CWP Rating: 200 psig.
4. Body Design: Clear or full waterway.
5. Body Material: ASTM A126, gray iron with bolted bonnet.
6. Ends: Flanged or threaded. See Part 3 check valve schedule articles.
7. Trim: Bronze.
8. Gasket: Asbestos free.
9. Closure Control: Factory-installed exterior lever and weight.

2.8 CHECK VALVES, GENERAL PURPOSE

A. Check Valves, Swing Type, Threaded or Soldered Ends - Bronze, with Bronze Disc, Class 150:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
    b. Crane Fluid Systems; Crane Co.
    c. Milwaukee Valve Company.
    d. NIBCO INC.
    e. Stockham; a Crane Co. brand.

2. Standard: MSS SP-80, Type 3.
3. CWP Rating: 300 psig.
4. Body Design: Horizontal flow.
5. Body Material: ASTM B62, bronze.
6. Ends: Threaded or soldered. See Part 3 check valve schedule articles.
7. Disc: Bronze.

B. Check Valves, Swing Type, Flanged Ends - Iron, with Metal Seats, Class 125:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
    b. Bray Commercial.
    c. Crane Fluid Systems; Crane Co.

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d. Jenkins Valves; a Crane Co. brand.
e. Milwaukee Valve Company.
f. Victaulic Company.

2. Standard: MSS SP-71, Type I.
3. CWP Rating, 2-1/2 to 12 inch: 200 psig.
4. CWP Rating, 14 to 24 inch: 150 psig.
5. Body Design: Clear or full waterway.
6. Body Material: ASTM A126, gray iron with bolted bonnet.
7. Ends: Flanged.
8. Trim: Bronze.
9. Gasket: Asbestos free.

C. Check Valves, Swing Type, Flanged Ends - Iron, with Lever- and Spring-Closure Control, Class 125:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
b. Bray Commercial.
c. Crane Fluid Systems; Crane Co.
d. Jenkins Valves; a Crane Co. brand.
e. Milwaukee Valve Company.
f. Victaulic Company.

2. Standard: MSS SP-71, Type I.
3. CWP Rating, 2-1/2 to 12 inch: 200 psig.
4. CWP Rating, 14 to 24 inch: 150 psig.
5. Body Design: Clear or full waterway.
6. Body Material: ASTM A126, gray iron with bolted bonnet.
7. Ends: Flanged.
8. Trim: Bronze.
9. Gasket: Asbestos free.
10. Closure Control: Factory-installed, exterior lever and spring.

NOT FOR BIDDING PURPOSES

2.9 GATE VALVES, LEAD FREE

A. Gate Valves, Lead Free, Threaded or Soldered Ends - Bronze, NRS, Class 125:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
b. Crane Fluid Systems; Crane Co.
c. Milwaukee Valve Company.
d. Stockham; a Crane Co. brand.

2. Description:

a. Standard: MSS SP-80, Type 1.
b. CWP Rating: 200 psig.
c. Body Material: Bronze with integral seat and screw-in bonnet.
d. Ends: Threaded or solder joint. See Part 3 gate valve schedule articles.
e. Stem: Bronze.
f. Disc: Solid wedge; bronze.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

B. Gate Valves, Lead Free, Flanged Ends - Iron, NRS, Class 125:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
b. Crane Fluid Systems; Crane Co.
c. Kennedy Valve Company; a division of McWane, Inc.

2. Standard: MSS SP-70, Type I.
3. CWP Rating: 200 psig.
4. Body Material: Gray iron with bolted bonnet.
5. Ends: Flanged.
6. Trim: Bronze.
7. Disc: Solid wedge.
8. Packing and Gasket: Asbestos free.

2.10 GATE VALVES, GENERAL PURPOSE

A. Gate Valves, Threaded or Soldered Ends - Bronze, NRS, Class 125:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
b. Crane Fluid Systems; Crane Co.
c. Milwaukee Valve Company.
d. Stockham; a Crane Co. brand.

2. Standard: MSS SP-80, Type 1.
3. CWP Rating: 200 psig.
4. Body Material: Bronze with integral seat and screw-in bonnet.
5. Ends: Threaded or solder joint. See Part 3 gate valve schedule articles.
6. Stem: Bronze.
7. Disc: Solid wedge; bronze.
8. Packing: Asbestos free.

NOT FOR BIDDING PURPOSES

9. Handwheel: Malleable iron, bronze, or aluminum.

B. Gate Valves, Flanged Ends - Iron, NRS, Class 125:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
b. Crane Fluid Systems; Crane Co.
c. Kennedy Valve Company; a division of McWane, Inc.

2. Standard: MSS SP-70, Type I.
3. CWP Rating: 200 psig.
4. Body Material: Gray iron with bolted bonnet.
5. Ends: Flange.
6. Trim: Bronze.
7. Disc: Solid wedge.
8. Packing and Gasket: Asbestos free.

NOT FOR BIDDING PURPOSES

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves. Remove defective valves from site.

3.2 INSTALLATION OF VALVES

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Provide support of piping adjacent to valves such that no force is imposed upon valves.

C. Locate valves for easy access and where not blocked by equipment, other piping, or building components.

D. For valves in horizontal piping, install valves with stem at or above center of pipe.

E. Install valves in position that does not project into aisles or block access to other equipment.

F. Install valves in position to allow full stem and actuator or manual operator movement.

G. Verify that joints of each valve have been properly installed and sealed to assure there is no leakage or damage.

H. Check Valves: Install check valves for proper direction of flow.

1. Swing Check Valves: In horizontal position with hinge pin level.

I. Valve Tags: Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

J. Adhere to manufacturer's written installation instructions. When soldering or brazing valves, do not heat valves above maximum permitted temperature. Do not use solder with melting point temperature above valve manufacturer's recommended maximum.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service, but before final adjusting and balancing. Replace valves exhibiting leakage.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

B. Select valves with the following end connections:

1. For Copper Tubing, 2 inch and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, 2-1/2 to 4 inch: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Steel Piping, 2 inch and Smaller: Threaded ends.
4. For Steel Piping, 2-1/2 to 4 inch: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
5. Wafer-Type Valves: Flanged connections.

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3.5 DOMESTIC HOT- AND COLD-WATER BALL VALVE SCHEDULE

A. Pipe 2 inch and Smaller:

1. Ball valves, lead free, threaded or soldered ends - brass, two piece with full port and brass trim.

B. Pipe 2-1/2 inch and Larger:

1. Ball valves, lead free, flanged or threaded ends - iron, Class 125.

3.6 DOMESTIC HOT- AND COLD-WATER BUTTERFLY VALVE SCHEDULE

A. Pipe 2-1/2 inch and Larger:

1. Butterfly valves, lead free, single flange (lug type) - iron, with aluminum-bronze disc; 200 CWP, NBR seat.

3.7 DOMESTIC HOT- AND COLD-WATER CHECK VALVE SCHEDULE

A. Pipe 2 inch and Smaller:

1. Check valves, lead free, swing type, threaded or soldered ends - bronze, with bronze disc, Class 125.

B. Pipe 2-1/2 inch and Larger:

1. Check valves, lead free, swing type, flanged or threaded ends - iron, with metal seats, Class 125.

3.8 PUMP-DISCHARGE CHECK VALVE SCHEDULE

A. Pipe 2 inch and Smaller for Domestic Water Pumps:

1. Check valves, lead free, swing type, threaded or soldered ends - bronze, with bronze disc, Class 125.

B. Pipe 2 inch and Smaller for Sanitary Waste and Storm Drainage:

1. Check valves, lead free, swing type, threaded or soldered ends - bronze, with bronze disc, Class 150.

C. Pipe 2-1/2 inch and Larger for Domestic Water Pumps:

1. Check valves, lead free, swing type, flanged or threaded ends - iron, with lever- and spring-closure control, Class 125.

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D. Pipe 2-1/2 inch and Larger for Sanitary Waste and Storm Drainage:

1. Check valves, swing type, flanged ends - iron, with lever- and spring-closure control, Class 125.

3.9 DOMESTIC HOT- AND COLD-WATER GATE VALVE SCHEDULE

A. Pipe 2 inch and Smaller:

1. Gate valves, lead free, threaded or soldered ends - bronze, NRS, Class 125.

B. Pipe 2-1/2 inch and Larger:

1. Gate valves, lead free, flanged ends - iron, NRS, Class 125.

END OF SECTION 220523

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SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal hanger-shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Pipe-positioning systems.
10. Equipment supports.

B. Related Requirements:

1. Section 220500 "Common Work Results for Plumbing."

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1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Fiberglass strut systems.
4. Pipe stands.
5. Equipment supports.

C. Delegated Design Submittals: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Include design calculations for designing trapeze hangers.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

C. All hangers and supports within Equipment Building shall be corrosion resistant.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel or stainless steel.

B. Stainless Steel Pipe Hangers and Supports:

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1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe and Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel or stainless steel.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly, made from structural-carbon-steel shapes, with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 FIBERGLASS PIPE HANGERS

A. Clevis-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 1 steel pipe hanger, except hanger is made of fiberglass or fiberglass-reinforced resin.
2. Hanger Rods: Continuous-thread rod, washer, and nuts made of stainless steel.

B. Strap-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 9 or Type 10 steel pipe hanger, except hanger is made of fiberglass-reinforced resin.

a. Flammability: ASTM D635, ASTM E84, UL 94.

2. Hanger Rod and Fittings: Continuous-thread rod, washer, and nuts made of stainless steel.

2.5 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ABB, Electrification Business.
b. Cooper B-line; brand of Eaton, Electrical Sector.
c. Flex-Strut Inc.
d. Gripple Inc.

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e. Unistrut; Atkore International.

2. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
4. Channels: Continuous slotted carbon-steel channel with inturned lips.
5. Channel Width: Selected for applicable load criteria.
6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel or stainless steel.
8. Paint Coating: Green epoxy, acrylic, or urethane.

2.6 FIBERGLASS STRUT SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Champion Fiberglass, Inc.
2. Fabco Plastics Wholesale Limited.
3. G-Strut.
4. Seasafe, Inc.; AMICO, a Gibraltar Industries Company.
5. Unistrut; Atkore International.

B. Description: Structural-grade, factory-formed, glass-fiber-resin channels and angles for supporting multiple parallel pipes.

1. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
2. Channels: Continuous slotted fiberglass-reinforced plastic channel with inturned lips.
3. Channel Width: Selected for applicable load criteria.
4. Fittings and Accessories: Products provided by channel and angle manufacturer and designed for use with those items.
5. Fitting and Accessory Materials: Same as those for channels and angles**,** except metal items may be stainless steel.
6. Rated Strength: Selected to suit applicable load criteria.
7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.7 THERMAL HANGER-SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Buckaroos, Inc.
2. CADDY; brand of nVent Electrical plc.
3. Carpenter & Paterson, Inc.

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4. National Pipe Hanger Corporation.
5. Pipe Shields Inc.
6. Piping Technology & Products, Inc.
7. Rilco Manufacturing Co., Inc.
8. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100-psig or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with 100-psig, ASTM C552, Type II cellular glass with 100-psig or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.8 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hilti, Inc.
b. ITW Ramset/Red Head; Illinois Tool Works, Inc.
c. MKT Fastening, LLC.

B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cooper B-line; brand of Eaton, Electrical Sector.
b. Hilti, Inc.
c. ITW Ramset/Red Head; Illinois Tool Works, Inc.
d. MKT Fastening, LLC.

2. Indoor Applications: Zinc-coated or stainless steel.
3. Outdoor Applications: Stainless steel.

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2.9 PIPE-POSITIONING SYSTEMS

A. Description: IAPMO PS 42 positioning system composed of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.10 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-carbon-steel shapes.

2.11 MATERIALS

A. Aluminum: ASTM B221.

B. Carbon Steel: ASTM A1011.

C. Structural Steel: ASTM A36 carbon-steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A240.

E. Grout: ASTM C1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 INSTALLATION OF HANGERS AND SUPPORTS

A. Do not support pipes or equipment from ducts, other pipes etc.

B. Support piping so there is no strain on the connections to pumps and other equipment.

C. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

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D. Metal Trapeze Pipe-Hanger Installation: This is a delegated design to be completed by the contractor. Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size, or install intermediate supports for smaller-diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A36 carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

E. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-58. Install hangers and attachments as required to properly support piping from building structure.

F. Framing System Installation: Metal; This is a delegated design to be completed by the contractor. Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.

G. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.

H. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

I. Pipe-Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

J. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

K. Equipment Support Installation: Fabricate from welded-structural-steel shapes. This is a delegated design to be completed by the contractor.

L. Install lateral bracing with pipe hangers and supports to prevent swaying.

M. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, 2-1/2 inch and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms, and install reinforcing bars through openings at top of inserts.

N. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

O. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

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P. Insulated Piping:

1. Attach clamps and spacers to piping.

   a. Piping Operating Above Ambient Air Temperature: Galvanized or Painted Clamp may project through insulation.
   b. Piping Operating Below Ambient Air Temperature: Use Galvanized or Painted thermal hanger-shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. MSS SP-58, Type 39: Install protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe 4 inch and larger if pipe is installed on rollers.

3. MSS SP-58, Type 40: Install protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe 4 inch and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. 1/4 to 3-1/2 inches: 12 inches long and 0.048 inch thick.
   b. 4 inches: 12 inches long and 0.06 inch thick.
   c. 5 and 6 inches: 18 inches long and 0.06 inch thick.

5. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

3.3 INSTALLATION OF EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. This is a delegated design to be completed by the contractor.

C. Grouting: Place grout under supports for equipment, and make bearing surface smooth.

D. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

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B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touchup:

1. Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

a. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A780.

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3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use stainless steel pipe hangers and fiberglass pipe hangers and fiberglass strut systems and stainless steel or corrosion-resistant attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal hanger-shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes 1/2 to 30 inches.
2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes 3/4 to 36 inches, requiring clamp flexibility and up to 4 inches of insulation.
3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes 1/2 to 24 inches if little or no insulation is required.
4. Pipe Hangers (MSS Type 5): For suspension of pipes 1/2 to 4, to allow off-center closure for hanger installation before pipe erection.
5. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes 1/2 to 8 inches.
6. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes 1/2 to 8 inches.
7. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes 3/8 to 8 inches.
8. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes 3/8 to 3 inches.
9. U-Bolts (MSS Type 24): For support of heavy pipes 1/2 to 30 inches.
10. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
11. Pipe Saddle Supports (MSS Type 36): For support of pipes 4 to 36 inches, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
12. Pipe Stanchion Saddles (MSS Type 37): For support of pipes 4 to 36 inches, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
13. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes 2-1/2 to 36 inches if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
14. Single-Pipe Rolls (MSS Type 41): For suspension of pipes 1 to 30 inches, from two rods if longitudinal movement caused by expansion and contraction occurs.

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15. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes 2-1/2 to 24 inches, from single rod if horizontal movement caused by expansion and contraction occurs.
16. Complete Pipe Rolls (MSS Type 44): For support of pipes 2 to 42 inches if longitudinal movement caused by expansion and contraction occurs but vertical adjustment is unnecessary.
17. Pipe Roll and Plate Units (MSS Type 45): For support of pipes 2 to 24 inches if small horizontal movement caused by expansion and contraction occurs and vertical adjustment is unnecessary.
18. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes 2 to 30 inches if vertical and lateral adjustment during installation, in addition to expansion and contraction, is required.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers 3/4 to 24 inches.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers 3/4 to 24 inches if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment of up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.

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11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal Hanger-Shield Inserts: For supporting insulated pipe.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load, and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.

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c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

P. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

S. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

NOT FOR BIDDING PURPOSES

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Warning tape.
4. Pipe labels.
5. Valve tags.
6. Warning tags.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment-Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve-numbering scheme.

E. Valve Schedules: For each piping system. Include in operation and maintenance manuals.

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PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.
b. Craftmark Pipe Markers.
c. Seton Identification Products; a Brady Corporation company.

2. Material and Thickness: Brass, 0.032-inch minimum thickness, with predrilled or stamped holes for attachment hardware.

3. Letter and Background Color: As indicated for specific application under Part 3.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
6. Fasteners: Stainless steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

2.2 WARNING SIGNS AND LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation.
2. Craftmark Pipe Markers.
3. Seton Identification Products; a Brady Corporation company.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.

C. Letter and Background Color: As indicated for specific application under Part 3.

D. Maximum Temperature: Able to withstand temperatures of up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Arc-Flash Warning Signs: Provide arc-flash warning signs in locations and with content in accordance with requirements of OSHA and NFPA 70E, and other applicable codes and standards.

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J. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 WARNING TAPE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation.
2. Craftmark Pipe Markers.
3. Seton Identification Products; a Brady Corporation company.

B. Material: Vinyl.

C. Minimum Thickness: 0.005 inch.

D. Letter, Pattern, and Background Color: As indicated for specific application under Part 3.

E. Waterproof Adhesive Backing: Suitable for indoor or outdoor use.

F. Maximum Temperature: 160 deg F.

G. Minimum Width: 2 inches.

2.4 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation.
2. Craftmark Pipe Markers.
3. Seton Identification Products; a Brady Corporation company.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color coded, with lettering indicating service and showing flow direction in accordance with ASME A13.1.

C. Letter and Background Color: As indicated for specific application under Part 3.

D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings. Also include:

1. Pipe size.
2. Flow-Direction Arrows: Include flow-direction arrows on distribution piping. Arrows may be either integral with label or applied separately.
3. Lettering Size: At least 1/2 inch for viewing distances of up to 72 inches and proportionately larger lettering for greater viewing distances.

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2.5 VALVE TAGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation.
2. Craftmark Pipe Markers.
3. Seton Identification Products; a Brady Corporation company.

B. Description: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.

1. Tag Material: Brass, 0.04-inch minimum thickness, with predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire link chain or beaded chain or S-hook.

C. Letter and Background Color: As indicated for specific application under Part 3.

D. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Include valve-tag schedule in operation and maintenance data.

2.6 WARNING TAGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation.
2. Craftmark Pipe Markers.
3. Seton Identification Products; a Brady Corporation company.

B. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Reinforced grommet and wire or string.
3. Nomenclature: Large-size primary caption, such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Letter and Background Color: As indicated for specific application under Part 3.

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PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 INSTALLATION, GENERAL REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

D. Locate identifying devices so that they are readily visible from the point of normal approach.

3.3 INSTALLATION OF EQUIPMENT LABELS, WARNING SIGNS, AND LABELS

A. Permanently fasten labels on each item of plumbing equipment.

B. Sign and Label Colors.

1. White letters on an ANSI Z535.1 safety-green background.

C. Locate equipment labels where accessible and visible.

D. Arc-Flash Warning Signs: Provide arc-flash warning signs on electrical disconnects and other equipment where are-flash hazard exists, as indicated on Drawings, and in accordance with requirements of OSHA and NFPA 70E**,** and other applicable codes and standards.

E. Equipment requiring identification:

1. Tankless Water Heaters.
2. Tempering Valves.
3. Well Pressure Tanks.

3.4 INSTALLATION OF WARNING TAPE

A. Warning Tape Color and Pattern: Yellow background with black diagonal stripes.

B. Install warning tape on pipes and ducts, with cross-designated walkways providing less than 6 ft. of clearance.

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C. Locate tape so as to be readily visible from the point of normal approach.

3.5 INSTALLATION OF PIPE LABELS

A. Install pipe labels showing service and flow direction with permanent adhesive on pipes.

B. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts and plenums; and exterior exposed locations as follows:

1. Within 3 ft. of each valve and control device.
2. At access doors and similar access points that permit view of concealed piping.
3. Within 3 ft. of equipment items and other points of origination and termination.
4. Spaced at maximum intervals of 25 ft. along each run. Reduce intervals to 10 ft. in mechanical equipment rooms.

C. Do not apply plastic pipe labels or plastic tapes directly to bare pipes conveying fluids at temperatures of 125 deg F or higher. Where these pipes are to remain uninsulated, use a short section of insulation or use stenciled labels.

D. Flow-Direction Flow Arrows: Use arrows, in compliance with ASME A13.1, to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

E. Pipe-Label Color Schedule:

1. Domestic Cold-Water: White letters on an ANSI Z535.1 safety-green background.
2. Domestic Hot-Water: White letters on an ANSI Z535.1 safety-green background.
3. Domestic Hot-Water Return: White letters on an ANSI Z535.1 safety-green background.
4. Sanitary Waste: White letters on a black background.
5. Sanitary Vent: White letters on a black background.
6. Storm Drainage: White letters on a black background.
7. Nonpotable Cold Water: Black letters on an ANSI Z535.1 safety-yellow background.
8. Condensate: White letters on an ANSI Z535.1 safety-green background.

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3.6 INSTALLATION OF VALVE TAGS

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule in the operating and maintenance manual.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:

1. Valve-Tag Size and Shape: 1-1/2 inches round.
2. Valve-Tag Colors:

a. For each piping system, use the same lettering and background coloring system on valve tags as used in the piping system labels and background.

3.7 INSTALLATION OF WARNING TAGS

A. Warning Tag Color: Black letters on an ANSI Z535.1 safety-yellow background.

B. Attach warning tags, with proper message, to equipment and other items where indicated on Drawings and scheduled.

END OF SECTION 220553

NOT FOR BIDDING PURPOSES

SECTION 22 07 19 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.
4. Supplies and drains for handicap-accessible lavatories and sinks.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

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1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training. Preference will be given to those who have successfully completed a manufacturer's installation training program, such as the 'Armacell Qualified Installer Program' (AQIP) or similar.

B. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation system materials are to be delivered to the Project site in unopened containers. The packaging is to include name of the manufacturer, fabricator, type, description, and size, as well as ASTM standard designation and maximum use temperature.

1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84 or UL723, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.

1. All Insulation Installed Indoors and Outdoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General" and "Indoor Piping Insulation Schedule," articles for where insulating materials are applied.

B. Products do not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come into contact with stainless steel have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

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D. Insulation materials for use on austenitic stainless steel are qualified as acceptable in accordance with ASTM C795.

E. Foam insulation materials do not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric: Closed-cell or expanded-rubber materials; suitable for maximum use temperature between minus 70 deg F and 220 deg F. Comply with ASTM C534, Type I for tubular materials.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Aeroflex USA.
b. Armacell LLC.
c. K-Flex USA.

G. Glass-Fiber, Preformed Pipe: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to 850 deg F in accordance with ASTM C411. Comply with ASTM C547.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Johns Manville; a Berkshire Hathaway company.
b. Knauf Insulation.
c. Manson Insulation Inc.
d. Owens Corning.

2. Preformed Pipe Insulation: Type I, Grade A with factory-applied ASJ.
3. Fabricated shapes in accordance with ASTM C450 and ASTM C585.
4. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.3 INSULATING CEMENTS

A. Glass-Fiber Insulating Cement: Comply with ASTM C195.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Ramco Insulation, Inc.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C196.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Ramco Insulation, Inc.

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C. Glass-Fiber Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C449.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Ramco Insulation, Inc.

2.4 ADHESIVES

A. Materials are compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Solvent-based adhesive.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Aeroflex USA.
b. Armacell LLC.
c. Foster Brand; H. B. Fuller.
d. K-Flex USA.

2. Flame-spread index is 25 or less and smoke-developed index is 50 or less as tested in accordance with ASTM E84.
3. Wet Flash Point: Below 0 deg F.
4. Service Temperature Range: 40 to 200 deg F.
5. Color: Black.

C. Glass-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller.
c. Mon-Eco Industries, Inc.

D. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller.
c. Mon-Eco Industries, Inc.

E. PVC Jacket Adhesive: Compatible with PVC jacket.

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1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Johns Manville; a Berkshire Hathaway company.
    b. P.I.C. Plastics, Inc.
    c. Proto Corporation.
    d. Speedline Corporation.
    e. The Dow Chemical Company.

2.5 MASTICS AND COATINGS

A. Materials are compatible with insulation materials, jackets, and substrates.

B. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Foster Brand; H. B. Fuller.
    c. Knauf Insulation.
    d. Mon-Eco Industries, Inc.
    e. Vimasco Corporation.

2. Water-Vapor Permeance: Comply with ASTM E96 or ASTM F1249.
3. Service Temperature Range: 0 to plus 180 deg F.
4. Comply with MIL-PRF-19565C, Type II, for permeance requirements.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Foster Brand; H. B. Fuller.
    c. Knauf Insulation.
    d. Mon-Eco Industries, Inc.
    e. Vimasco Corporation.

2. Water-Vapor Permeance: ASTM E96, greater than 1.0 perm at manufacturer's recommended dry film thickness.
3. Service Temperature Range: 0 to plus 180 deg F.
4. Color: White.

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2.6 LAGGING ADHESIVES

A. Adhesives comply with MIL-A-3316C, Class I, Grade A, and are compatible with insulation materials, jackets, and substrates.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Childers Brand; H. B. Fuller Construction Products.
   b. Foster Brand; H. B. Fuller.
   c. Vimasco Corporation.

2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
3. Service Temperature Range: 20 to plus 180 deg F.
4. Color: White.

2.7 SEALANTS

A. Materials are as recommended by the insulation manufacturer and are compatible with insulation materials, jackets, and substrates.

B. Joint Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Childers Brand; H. B. Fuller Construction Products.
   b. Foster Brand; H. B. Fuller.
   c. Mon-Eco Industries, Inc.
   d. Owens Corning.

2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 58 to plus 176 deg F.
4. Color: White or gray.

C. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Childers Brand; H. B. Fuller Construction Products.
   b. Foster Brand; H. B. Fuller.

2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.

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2.8 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.

2.9 FIELD-APPLIED JACKETS

A. Field-applied jackets comply with ASTM C1136, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Airex Manufacturing Inc.
b. Johns Manville; a Berkshire Hathaway company.
c. P.I.C. Plastics, Inc.
d. Proto Corporation.
e. Speedline Corporation.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

2.10 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Mesh: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Childers Brand; H. B. Fuller Construction Products.

B. Woven Polyester Mesh: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

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1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Foster Brand; H. B. Fuller.
    b. Vimasco Corporation.

2.11 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Cloth: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Alpha Associates, Inc.

2.12 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. 3M Industrial Adhesives and Tapes Division.
    b. Avery Dennison Corporation, Specialty Tapes Division.
    c. Ideal Tape Co., Inc., an American Biltrite Company.
    d. Knauf Insulation.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. 3M Industrial Adhesives and Tapes Division.
    b. Ideal Tape Co., Inc., an American Biltrite Company.

2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.

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5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

2.13 SECUREMENTS

A. Bands:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Johns Manville; a Berkshire Hathaway company.
   b. RPR Products, Inc.

2. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. C & F Wire Products.
   b. Johns Manville; a Berkshire Hathaway company.
   c. RPR Products, Inc.

2.14 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Buckaroos, Inc.
   b. MVG Molded Products.
   c. McGuire Manufacturing.
   d. Plumberex Specialty Products, Inc.
   e. ProFlo; a Ferguson Enterprises, Inc. brand.
   f. Truebro; IPS Corporation.
   g. Zurn Industries, LLC.
   h. Oatey Co.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:

NOT FOR BIDDING PURPOSES

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. ProFlo; a Ferguson Enterprises, Inc. brand.
    b. Truebro; IPS Corporation.
    c. Zurn Industries, LLC.

2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the tradesman installing heat tracing.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.

D. Install insulation with longitudinal seams at top and bottom (12 o'clock and 6 o'clock positions) of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with Contract Documents.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 4 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation.

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N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.

NOT FOR BIDDING PURPOSES

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles below.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation made from same material and density as that of adjacent pipe insulation. Each piece is butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges, mechanical couplings, and unions, using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket, except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

NOT FOR BIDDING PURPOSES

D. Install removable insulation covers at locations that requires removal for maintenance, adjustment, inspection, etc. Installation conforms to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Install insulation in accordance with manufacturer's installation instructions or ASTM C1710.

B. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Flanges:

1. Slit tubular sections and apply onto piping or tubing.
2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation.
3. Install insulation in compression to allow for expansion and contraction.
4. Push insulation onto pipe, do not pull insulation onto pipe.
5. For below-ambient temperature systems, adhere insulation to pipe at least every 18 ft. using manufacturer's recommended adhesive. Terminate joints at critical points, including flanges, T-sections, elbows, supports, and similar fittings.

D. Insulation Installation on Pipe Fittings and Elbows:

1. Install sections of pipe insulation and miter if required in accordance with manufacturer's written instructions.
2. Install pipe insulation to outer diameter of pipe flange.
3. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

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4. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments
5. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

E. Insulation Installation on Valves and Pipe Specialties:

1. Install prefabricated valve covers manufactured of same material as that of pipe insulation when available.
2. When prefabricated valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF GLASS-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install prefabricated pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with glass-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When prefabricated insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

NOT FOR BIDDING PURPOSES

D. Insulation Installation on Valves and Pipe Specialties:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When prefabricated sections are not available, install fabricated sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 INSTALLATION OF FIELD-APPLIED JACKETS

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.9 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum jackets.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections with the assistance of a factory-authorized service representative.

B. Tests and Inspections: Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection is limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

NOT FOR BIDDING PURPOSES

C. All insulation applications will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.11 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.12 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. 1 inch and Smaller: Insulation is one of the following:

   a. Flexible Elastomeric: 1/2 inch thick.
   b. Glass-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick. With vapor barrier.

2. 1-1/4 inch and Larger: Insulation is one of the following:

   a. Flexible Elastomeric: 1 inch thick.
   b. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick. With vapor barrier.

B. Domestic Hot and Recirculated Hot Water:

1. 1-1/4 inch and Smaller: Insulation is one of the following:

   a. Flexible Elastomeric: 1 inch thick.
   b. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

2. 1-1/2 inch and Larger: Insulation is one of the following:

   a. Flexible Elastomeric: 1 inch thick.
   b. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

C. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation is one of the following:

   a. Flexible Elastomeric: 1/2 inch thick.

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b. Glass-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.

D. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation is one of the following:

a. Flexible Elastomeric: 3/4 inch thick. With vapor barrier.
b. Glass-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick. With vapor barrier.

E. Condensate and Equipment Drain Water:

1. All Pipe Sizes: Insulation is one of the following:

a. Flexible Elastomeric: 3/4 inch thick. With vapor barrier.
b. Glass-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick. With vapor barrier.

3.13 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. ASJ

D. Piping, Exposed 10 feet or less above finished floor and throughout mechanical equipment rooms.

1. Field-Applied Fabric-Reinforcing Mesh
2. Field-Applied Cloths

NOT FOR BIDDING PURPOSES

END OF SECTION 220719

SECTION 22 11 16 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper tube and fittings - domestic water.
2. Piping joining materials - domestic water.
3. Dielectric fittings - domestic water.

B. Related Requirements:

1. Section 331415 "Site Water Distribution Piping" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Copper tube and fittings - domestic water.
2. Piping joining materials - domestic water.
3. Dielectric fittings - domestic water.

1.3 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

NOT FOR BIDDING PURPOSES

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Domestic water piping, tubing, fittings, joints, and appurtenances intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act, with requirements of authorities having jurisdiction, and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.2 PIPING MATERIALS

A. Potable-water piping and components are to comply with NSF 14, NSF 61, and NSF 372. Include marking "NSF-pw" on piping.

2.3 COPPER TUBE AND FITTINGS - DOMESTIC WATER

A. Drawn-Temper Copper Tube: ASTM B88, Type L.

B. Annealed-Temper Copper Tube: ASTM B88, Type K.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings. Solder joints on pipe sizes greater than 4 inches shall be made only by a qualified technician.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings. Solder joints on pipe sizes greater than 4 inches shall be made only by a qualified technician.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Solder joints on pipe sizes greater than 4 inches shall be made only by a qualified technician.

F. Cast Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends. Solder joints on pipe sizes greater than 4 inches shall be made only by a qualified technician.

G. Wrought Copper Unions: ASME B16.22. Solder joints on pipe sizes greater than 4 inches shall be made only by a qualified technician.

2.4 PIPING JOINING MATERIALS - DOMESTIC WATER

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B32, lead-free alloys.

D. Flux: ASTM B813, water flushable.

E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

NOT FOR BIDDING PURPOSES

2.5 DIELECTRIC FITTINGS - DOMESTIC WATER

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions - Domestic Water:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. A.Y. McDonald Mfg. Co.
   b. Apollo Valves; a part of Aalberts Integrated Piping Systems.
   c. HART Industrial Unions, LLC.
   d. Jomar Valve.
   e. Matco-Norca.
   f. WATTS; A Watts Water Technologies Company.
   g. Zurn Industries, LLC.

2. Source Limitations: Obtain dielectric unions from single manufacturer.
3. Standard: ASSE 1079.
4. Pressure Rating: 125 psig minimum at 180 deg F.
5. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges - Domestic Water:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Capitol Manufacturing Company.
   b. GF Piping Systems: Georg Fischer LLC.
   c. Matco-Norca.
   d. WATTS; A Watts Water Technologies Company.
   e. Zurn Industries, LLC.

2. Source Limitations: Obtain dielectric flanges from single manufacturer.
3. Standard: ASSE 1079.
4. Factory-fabricated, bolted, companion-flange assembly.
5. Pressure Rating: 125 psig minimum at 180 deg F.
6. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits - Domestic Water:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Advance Products & Systems, LLC.
   b. CALPICO, Inc.
   c. GPT; a division of EnPRO Industries.

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2. Source Limitations: Obtain dielectric-flange insulating kits from single manufacturer.
3. Nonconducting materials for field assembly of companion flanges.
4. Pressure Rating: 150 psig.
5. Gasket: Phenolic, Temperature Rating: 225 deg F.
6. Bolt Sleeves: Phenolic or polyethylene.
7. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples - Domestic Water:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Anvil International/Smith-Cooper International; Tailwind Capital, LLC.
   b. Apollo Valves; a part of Aalberts Integrated Piping Systems.
   c. Matco-Norca.
   d. Sioux Chief Manufacturing Company, Inc.
   e. Victaulic Company.

2. Source Limitations: Obtain dielectric nipples from single manufacturer.
3. Standard: IAPMO PS 66.
4. Electroplated steel nipple complying with ASTM F1545.
5. Pressure Rating and Temperature: 300 psig at 225 deg F.
6. End Connections: Male threaded or grooved.
7. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing when allowed by code.

D. Under-building-slab, domestic water, building-service piping, 3 inches and smaller is to be the following:

1. Annealed-temper copper tube, ASTM B88, Type K; wrought-copper, solder-joint fittings; and brazed joints.

E. Under-building-slab, domestic water piping, 2 inches and smaller is to be the following:

NOT FOR BIDDING PURPOSES

1. Drawn-temper copper tube, ASTM B88, Type L; wrought-copper, solder-joint fittings; and brazed joints.

F. Aboveground domestic water piping, 2 inches and smaller is to be the following:

1. Drawn-temper copper tube, ASTM B88, Type L; wrought-copper, solder-joint fittings; and brazed joints.

G. Aboveground domestic water piping, 2-1/2 to 4 inches is to be the following:

1. Drawn-temper copper tube, ASTM B88, Type L; wrought-copper, solder-joint fittings; and brazed joints.

NOT FOR BIDDING PURPOSES

3.2 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 220500 "Common Work Results for Plumbing."

3.3 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab in accordance with CDA's "Copper Tube Handbook."

C. Install valves in accordance with the following:

1. Section 220523 "General Duty Valves for Plumbing Piping."

D. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

E. Install fittings for changes in direction and branch connections.

F. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

G. Use reducing fittings to make changes in pipe sizes.

H. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 220500 "Common Work Results for Plumbing."

I. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220500 "Common Work Results for Plumbing."

J. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220500 "Common Work Results for Plumbing."

K. Workmanship

1. Cut pipes accurately to measurements established at structure.
2. Install without springing or forcing.
3. Clear windows, doors, and other openings.
4. Permit expansion and contraction without misalignment or damage.
5. During construction, close openings in piping and equipment to keep out foreign matter and to prevent leakage.
6. Piping shall be concealed unless otherwise indicated.
7. Install domestic water piping level without pitch and plumb.
8. Provide offsets required to avoid structural or other interference without extra cost to the Owner.
9. Provide hose end drain valves at bottom of risers, low points and where indicated.
10. Install piping free of sags and bends.
11. Install piping to permit valve servicing. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
12. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
13. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

NOT FOR BIDDING PURPOSES

3.4 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Extruded-Tee Connections: Form tee in copper tube in accordance with ASTM F2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

F. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts in accordance with ASME B31.9.

G. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

NOT FOR BIDDING PURPOSES

3.5 INSTALLATION OF DIELECTRIC FITTINGS

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for 2 inch and Smaller: Use dielectric couplings, nipples or unions as required.

C. Dielectric Fittings for 2-1/2 to 4 inches: Use dielectric flanges, flange kits or nipples as required.

3.6 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for hangers, supports, and anchor devices in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

B. Install hangers for copper tube and pipe, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

C. Support horizontal piping within 12 inches of each fitting.

D. Support vertical runs of copper and ductile iron tube and pipe to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.7 PIPING CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

3.8 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

3.9 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system in accordance with either of the following:

1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
d. Repeat procedures if biological examination shows contamination.
e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Clean non-potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

NOT FOR BIDDING PURPOSES

3.10 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    b. Adjust calibrated balancing valves to flows indicated.
5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Piping Inspections:
    a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
    b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
        1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after installation and before setting fixtures.
        2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
    c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
    d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
2. Piping Tests:
    a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.

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b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 221116

NOT FOR BIDDING PURPOSES

SECTION 22 11 19 - DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Balancing valves.
4. Strainers for domestic water piping.
5. Hose bibbs.
6. Wall hydrants.
7. Drain valves.
8. Trap-seal primer systems.
9. Flexible connectors.

B. Related Requirements:

1. Section 220500 "Common Work Results for Plumbing."

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.

1. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Test and inspection reports.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

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PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Domestic water piping specialties intended to convey or dispense water for human consumption are to comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or to be certified in compliance with NSF 61 and NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers <**ASSE 1001>**:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
   b. FEBCO; A WATTS Brand.
   c. WATTS; A Watts Water Technologies Company.
   d. Zurn Industries, LLC.

2. Standard: ASSE 1001.
3. Size: 1/4 to 3 inches, as required to match connected piping.
4. Body: Bronze.
5. Inlet and Outlet Connections: Threaded.
6. Finish: Rough bronze.

B. Hose-Connection Vacuum Breakers <**ASSE 1011>**:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
   b. WATTS; A Watts Water Technologies Company.
   c. Woodford Manufacturing Company.
   d. Zurn Industries, LLC.
   e. Jay R. Smith Mfg Co; a division of Morris Group International.

2. Standard: ASSE 1011.

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3. Body: Bronze, nonremovable, with manual drain.
4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
5. Finish: Chrome or nickel plated.

C. Pressure Vacuum Breakers <**ASSE 1020**>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
   b. FEBCO; A WATTS Brand.
   c. WATTS; A Watts Water Technologies Company.
   d. Zurn Industries, LLC.

2. Standard: ASSE 1020.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 5 psig maximum, through middle third of flow range.
5. Size: see contract documents.
6. Design Flow Rate: see contract documents.
7. Selected Unit Flow Range Limits: see contract documents.
8. Pressure Loss at Design Flow Rate: see contract documents.
9. Accessories:

   a. Valves: Ball type, on inlet and outlet.

D. Spill-Resistant Vacuum Breakers <**ASSE 1056**>

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
   b. WATTS; A Watts Water Technologies Company.
   c. Zurn Industries, LLC.

2. Standard: ASSE 1056.
3. Operation: Continuous-pressure applications.
4. Size: 1/2 inch.
5. Accessories:

   a. Valves: Ball type, on inlet and outlet.

2.4 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers <**ASSE 1013**>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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a. Ames Fire & Waterworks; A Watts Water Technologies Company.
b. Apollo Valves; a part of Aalberts Integrated Piping Systems.
c. FEBCO; A WATTS Brand.
d. WATTS; A Watts Water Technologies Company.
e. Zurn Industries, LLC.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle third of flow range.
5. Size: 1-inch.
6. Design Flow Rate: 15 gpm.
7. Selected Unit Flow Range Limits: 0-20 gpm.
8. Pressure Loss at Design Flow Rate: 12 psig.
9. Body: Bronze, cast silicon copper alloy or stainless steel for 2 inch and smaller.
10. End Connections: Threaded for 2 inch and smaller.
11. Configuration: Designed for horizontal, straight-through flow.
12. Accessories:

a. Valves 2 inch and Smaller: Ball type with threaded ends on inlet and outlet.
b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

B. Backflow-Preventer Test Kits

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ames Fire & Waterworks; A Watts Water Technologies Company.
b. Apollo Valves; a part of Aalberts Integrated Piping Systems.
c. FEBCO; A WATTS Brand.
d. WATTS; A Watts Water Technologies Company.
e. Zurn Industries, LLC.

2. Description: Factory calibrated, with gauges, fittings, hoses, and carrying case with test-procedure instructions.

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2.5 BALANCING VALVES

A. Memory-Stop Balancing Valves

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
b. Crane Fluid Systems; Crane Co.
c. Hammond Valve.
d. Jenkins Valves; a Crane Co. brand.
e. Milwaukee Valve Company.

f. NIBCO INC.
g. Stockham; a Crane Co. brand.

2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
3. Pressure Rating: 400-psig minimum CWP.
4. Size: 2 inch or smaller.
5. Body: Copper alloy.
6. Port: Standard or full port.
7. Ball: Chrome-plated brass or stainless steel.
8. Seats and Seals: Replaceable.
9. End Connections: Solder joint or threaded.
10. Handle: Vinyl-covered steel with memory-setting device.

2.6 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Keckley Company.
b. Titan Flow Control, Inc.
c. WATTS; A Watts Water Technologies Company.
d. Zurn Industries, LLC.
e. Caleffi North America.

2. Pressure Rating: 125 psig minimum unless otherwise indicated.
3. Body: Bronze for 2 inch and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for 2-1/2 inch and larger.
4. End Connections: Threaded for 2 inch and smaller; flanged for 2-1/2 inch and larger.
5. Screen: Stainless steel with round perforations unless otherwise indicated.
6. Perforation Size:

a. Strainers 2 inch and Smaller: 0.020 inch.
b. Strainers 2-1/2 to 4 inch: 0.045 inch.
c. Strainers 5 inch and Larger: 0.10 inch.

7. Drain: Factory-installed, hose-end drain valve.

2.7 HOSE BIBBS

A. Hose Bibbs <**HB**>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Jay R. Smith Mfg Co; a division of Morris Group International.

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b. MIFAB, Inc.
c. WATTS; A Watts Water Technologies Company.
d. Woodford Manufacturing Company.
e. Zurn Industries, LLC.
f. Josam Company.

2. Standard: ASME A112.18.1 for sediment faucets.
3. Body Material: Bronze.
4. Seat: Bronze, replaceable.
5. Supply Connections: 1/2 or 3/4 inch threaded or solder-joint inlet.
6. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
7. Pressure Rating: 125 psig.
8. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
9. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
10. Finish for Service Areas: Rough bronze.
11. Finish for Finished Rooms: Chrome or nickel plated.
12. Operation for Equipment Rooms: Wheel handle or operating key.
13. Operation for Service Areas: Wheel handle.
14. Operation for Finished Rooms: Wheel handle.
15. Include operating key with each operating key hose bibb.
16. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.8 WALL HYDRANTS

A. Nonfreeze Wall Hydrants <WH>

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Jay R. Smith Mfg Co; a division of Morris Group International.
b. MIFAB, Inc.
c. WATTS; A Watts Water Technologies Company.
d. Woodford Manufacturing Company.
e. Zurn Industries, LLC.
f. Josam Company.

2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: 3/4 or 1 inch.
7. Outlet, Concealed: With integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounted with cover.
9. Box and Cover Finish: Polished nickel bronze.

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10. Nozzle and Wall-Plate Finish: Polished nickel bronze.
11. Operating Keys(s): One with each wall hydrant.

2.9 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: 3/4 inch.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.10 TRAP-SEAL PRIMER SYSTEMS

A. Trap-Seal Primer Systems <**TYPE A**>

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Precision Plumbing Products.
    b. Sioux Chief Manufacturing Company, Inc.
    c. Zurn Industries, LLC.
    d. Jay R. Smith Mfg Co; a division of Morris Group International.

2. Standard: ASSE 1044.
3. Inlet Size: ¾ inch, ASTM B88, Type L; copper, water tubing.
4. Cabinet: Surface-mounted steel box with stainless steel cover.
5. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120 V ac power.

    a. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

6. Vacuum Breaker: ASSE 1001.
7. Number Outlets: Eight.
8. Size Outlets: 1/2 inch.

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2.11 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flex-Hose Co., Inc.
2. Mason Industries, Inc.
3. Metraflex Company (The).

B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections 2 inch and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections 2-1/2 inch and Larger: Flanged copper alloy.

C. Stainless Steel-Hose Flexible Connectors: Corrugated stainless steel tubing with stainless steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections 2 inch and Smaller: Threaded steel-pipe nipple.
3. End Connections 2-1/2 inch and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES

A. Backflow Preventers: Install in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Balancing Valves: Install in locations where they can easily be adjusted. Set at indicated design flow rates.

C. Y-Pattern Strainers: For water, install on supply side of each water pressure-reducing valve and pump. Support strainers at pumps independent of piping system.

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D. Trap-Seal Primer Systems: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.2 PIPING CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.

3.3 ELECTRICAL CONNECTIONS

A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

3.4 IDENTIFICATION

A. Plastic Labels for Equipment: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Vacuum breakers.
2. Backflow preventers.
3. Balancing valves.
4. Wall hydrants.
5. Trap-seal primer systems.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.5 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

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D. Adjust each pressure vacuum breaker, reduced-pressure-principle backflow preventer, double-check, backflow-prevention assembly, and double-check, detector-assembly backflow preventer in accordance with manufacturer's written instructions, authorities having jurisdiction and the device's reference standard.

3.6 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. Test each pressure vacuum breaker, reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 221119

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SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hub-and-spigot, cast-iron soil pipe and fittings.
2. Hubless, cast-iron soil pipe and fittings.
3. Specialty pipe fittings.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Hub-and-spigot, cast-iron soil pipe and fittings.
2. Hubless, cast-iron soil pipe and fittings.
3. Specialty pipe fittings.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 WARRANTY

A. Listed manufacturers to provide labeling and warranty of their respective products.

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PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation are capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10 ft. head of water.

2.2 PIPING MATERIALS

A. Piping materials to bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AB & I Foundry; a part of the McWane family of companies.
2. Charlotte Pipe and Foundry Company.
3. Tyler Pipe; a part of McWane family of companies.

B. Pipe and Fittings:

1. Marked with CISPI collective trademark.
2. ASTM A74, service or extra-heavy cast iron.

C. Gaskets: ASTM C564, rubber.

D. Caulking Materials: ASTM B29, pure lead and oakum or hemp fiber.

2.4 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AB & I Foundry; a part of the McWane family of companies.
2. Charlotte Pipe and Foundry Company.
3. Tyler Pipe; a part of McWane family of companies.

B. Pipe and Fittings:

1. Marked with CISPI collective trademark.
2. ASTM A888 or CISPI 301.

C. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AB & I Foundry; a part of the McWane family of companies.
b. ANACO-Husky.
c. Charlotte Pipe and Foundry Company.
d. Clamp-All Corp.
e. Dallas Specialty & Mfg. Co.
f. Ideal Tridon Group.

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g. Mission Rubber Company, LLC; a division of MCP Industries.
h. Tyler Pipe; a subsidiary of McWane Inc.

2. Standards: ASTM C1540.
3. Description: Stainless steel shield with stainless steel bands and tightening devices; and ASTM C564, rubber sleeve with integral, center pipe stop.
4. Couplings shall have visual torque indicator to ensure proper torque is being applied.

2.5 SPECIALTY PIPE FITTINGS

A. Dielectric Fittings:

1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) A.Y. McDonald Mfg. Co.
2) Capitol Manufacturing Company.
3) GF Piping Systems: Georg Fischer LLC.
4) HART Industrial Unions, LLC.
5) Jomar Valve.
6) Matco-Norca.
7) WATTS; A Watts Water Technologies Company.
8) Wilkins.
9) Zurn Industries, LLC.

b. Description:

1) Standard: ASSE 1079.
2) Pressure Rating: 125 psig minimum at 180 deg F.
3) End Connections: Solder-joint copper alloy and threaded ferrous.

3. Dielectric Flanges:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Capitol Manufacturing Company.
2) GF Piping Systems: Georg Fischer LLC.
3) Matco-Norca.
4) WATTS; A Watts Water Technologies Company.
5) Zurn Industries, LLC.

b. Description:

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1) Standard: ASSE 1079.
2) Factory-fabricated, bolted, companion-flange assembly.
3) Pressure Rating: 125 psig minimum at 180 deg F.
4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

4. Dielectric-Flange Insulating Kits:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Advance Products & Systems, LLC.
2) CALPICO, Inc.
3) GF Piping Systems: Georg Fischer LLC.
4) GPT; a division of EnPRO Industries.

b. Description:

1) Nonconducting materials for field assembly of companion flanges.
2) Pressure Rating: 150 psig.
3) Gasket: Neoprene or phenolic.
4) Bolt Sleeves: Phenolic or polyethylene.
5) Washers: Phenolic with steel backing washers.

5. Dielectric Nipples:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Anvil International/Smith-Cooper International; Tailwind Capital, LLC.
2) Elster Perfection; Honeywell.
3) Matco-Norca.
4) Precision Plumbing Products.
5) Victaulic Company.

b. Description:

1) Standard: IAPMO PS 66.
2) Electroplated steel nipple.
3) Pressure Rating: 300 psig at 225 deg F.
4) End Connections: Male threaded or grooved.
5) Lining: Inert and noncorrosive, propylene.

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PART 3 - EXECUTION

3.1 EARTH MOVING

A. Excavating, trenching, and backfilling are specified in Section 220500 "Common Work Results for Plumbing."

3.2 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.

1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
2. Use long-turn, double Y-branch, and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.

a. Straight tees, elbows, and crosses may be used on vent lines.

3. Do not change direction of flow more than 90 degrees.

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4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

    a. Reducing size of waste piping in direction of flow is prohibited.

K. Lay buried building waste piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

L. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Waste: Two percent downward in direction of flow for.
2. Horizontal Sanitary Waste Piping: Two percent downward in direction of flow.
3. Vent Piping: One percent down toward vertical fixture vent or toward vent stack.

M. Install cast-iron soil piping in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

N. Install steel piping in accordance with applicable plumbing code.

O. Plumbing Specialties:

1. Install backwater valves in sanitary waster gravity-flow piping.

    a. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."

2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.

    a. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."

3. Install drains in sanitary waste gravity-flow piping.

    a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors.

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1. Comply with requirements for sleeves specified in Section 220500 "Common Work Results for Plumbing."

R. Install sleeve seals for piping penetrations of concrete walls and slabs.

1. Comply with requirements for sleeve seals specified in Section 220500 "Common Work Results for Plumbing."

S. Install escutcheons for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for escutcheons specified in Section 220500 "Common Work Results for Plumbing."

3.3 JOINT CONSTRUCTION

A. Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Hub-and-Spigot, Cast-Iron Soil Piping Caulked Joints: Join in accordance with CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum caulked joints.

C. Hubless, Cast-Iron Soil Piping Coupled Joints:

1. Join hubless, cast-iron soil piping in accordance with CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

D. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1.

1. Cut threads full and clean using sharp dies.
2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
   b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
   c. Do not use pipe sections that have cracked or open welds.

E. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

F. Joint Restraints and Sway Bracing:

1. Provide joint restraints and sway bracing for sanitary drainage piping joints to comply with the following conditions:

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a. Provide axial restraint for pipe and fittings 5 inches and larger, upstream and downstream of all changes in direction, branches, and changes in diameter greater than two pipe sizes.
b. Provide rigid sway bracing for pipe and fittings 4 inches and larger, upstream and downstream of all changes in direction 45 degrees and greater.
c. Provide rigid sway bracing for pipe and fittings 5 inches and larger, upstream and downstream of all changes in direction and branch openings.

3.4 INSTALLATION OF SPECIALTY PIPE FITTINGS

A. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for 2 inch and Smaller: Use dielectric unions.
3. Dielectric Fittings for 2-1/2 to 4 inch: Use dielectric flanges.
4. Dielectric Fittings for 5 inch and Larger: Use dielectric flange kits.

3.5 INSTALLATION OF VALVES

A. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Standpipes: Drain outlet backwater valves unless drain has integral backwater valve.
2. Install backwater valves in accessible locations.
3. Comply with requirements for backwater valve specified in Section 221319 "Sanitary Waste Piping Specialties."

3.6 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment"

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42 clamps.
6. Install individual, straight, horizontal piping runs:

   a. 100 Ft. and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Ft.: MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Ft. if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Ft. or Longer: MSS Type 44 pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52 spring hangers.

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B. Install hangers for cast-iron soil piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

D. Support vertical runs of cast-iron soil piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect waste and vent piping to the following:

1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Comply with requirements for backwater valves, cleanouts, and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
5. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
6. Install horizontal backwater valves with cleanout cover flush with floor.
7. Equipment: Connect waste piping as indicated.

    a. Provide shutoff valve if indicated and union for each connection.
    b. Use flanges instead of unions for connections 2-1/2 inch and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections in accordance with the following unless otherwise indicated:

1. Install unions, in piping 2 inch and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping 2-1/2 inch and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

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B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.9 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary waste and vent piping in accordance with procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

   a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.

   a. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.

   a. Close openings in piping system and fill with water to point of overflow, but not less than 10 ft. head of water.
   b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
   c. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.

   a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1 inch wg.
   b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.

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c. Air pressure must remain constant without introducing additional air throughout period of inspection.
d. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.10 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Repair damage to adjacent materials caused by waste and vent piping installation.

3.11 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping 10 inch and smaller are to be the following:

1. Service cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

C. Aboveground, vent piping 10 inch and smaller is to be the following:

1. Service cast iron, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

D. Underground, soil, waste, and vent piping less than 10 feet of cover are to be the following:

1. Service cast-iron soil piping; gaskets; and gasketed joints.
2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

E. Underground, soil and waste piping 10 feet of cover or greater are to be the following:

1. Extra-heavy, cast-iron soil piping; gaskets; and gasketed joints.
2. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

END OF SECTION 221316

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SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backwater valves.
2. Cleanouts.
3. Miscellaneous sanitary drainage piping specialties.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sanitary waste piping specialties to include in emergency, operation, and maintenance manuals.

NOT FOR BIDDING PURPOSES

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTIONS

A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

2.2 BACKWATER VALVES

A. Drain-Outlet Backwater Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Jay R. Smith Mfg Co; a division of Morris Group International.
b. Josam Company.

c. WATTS; A Watts Water Technologies Company.
d. Zurn Industries, LLC.

2. Size: Same as floor drain outlet.
3. Body: Cast iron or bronze; made for vertical installation in bottom outlet of floor drain.
4. Check Valve: Removable ball float.
5. Inlet: Threaded.
6. Outlet: Threaded or spigot.

2.3 CLEANOUTS

A. Cast-Iron Exposed Cleanouts

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Jay R. Smith Mfg Co; a division of Morris Group International.
b. Josam Company.
c. MIFAB, Inc.
d. Tyler Pipe; a subsidiary of McWane Inc.
e. WATTS; A Watts Water Technologies Company.
f. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M.
3. Size: Same as connected drainage piping
4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Exposed Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Jay R. Smith Mfg Co; a division of Morris Group International.
b. Josam Company.
c. MIFAB, Inc.
d. Sioux Chief Manufacturing Company, Inc.
e. WATTS; A Watts Water Technologies Company.
f. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M for cast-iron soil pipe with cast-iron ferrule, heavy-duty, adjustable housing cleanout.
3. Size: Same as connected branch.
4. Type: Cast-iron soil pipe with cast-iron ferrule, Heavy-duty, adjustable housing.

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5. Body or Ferrule: Cast iron.
6. Clamping Device: Not required.
7. Outlet Connection: as required to connect to adjacent piping.
8. Closure: Brass plug with straight threads and gasket.
9. Adjustable Housing Material: Cast iron with threads.
10. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
11. Frame and Cover Shape: Round.
12. Top-Loading Classification: Extra Heavy Duty.
13. Riser: ASTM A74, Extra-Heavy Class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Jay R. Smith Mfg Co; a division of Morris Group International.
    b. Josam Company.
    c. MIFAB, Inc.
    d. WATTS; A Watts Water Technologies Company.
    e. Zurn Industries, LLC.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure Plug:

    a. Cast iron.
    b. Countersunk head.
    c. Drilled and threaded for cover attachment screw.
    d. Size: Same as or not more than one size smaller than cleanout size.

6. Wall Access, Cover Plate: Round, flat, chrome-plated brass or stainless steel cover plate with screw.
7. Wall Access, Frame and Cover: Round, nickel-bronze, copper-alloy, or stainless steel wall-installation frame and cover.

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2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A74, Service Class, hub-and-spigot, cast-iron soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C564 rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with 1/2 inch side inlet.

C. Air-Gap Fittings

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

D. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device that forms sleeve for pipe floor penetrations of floor membrane. Includes galvanized-steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

E. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backwater valves in building drain piping.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to 4 inch. Use 4 inch for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping 4 inch and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

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D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Assemble open drain fittings and install with top of hub 1 inch above floor.

F. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

G. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

H. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.

I. Install wood-blocking reinforcement for wall-mounting-type specialties.

J. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 PIPING CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment, to allow service and maintenance.

3.3 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

1. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

NOT FOR BIDDING PURPOSES

END OF SECTION 221319

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SECTION 22 13 19.13 - SANITARY DRAINS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Floor drains.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 DRAIN ASSEMBLIES

A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains <**FD-1**>:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Jay R. Smith Mfg Co; a division of Morris Group International.
b. Josam Company.
c. MIFAB, Inc.
d. WATTS; A Watts Water Technologies Company.
e. Zurn Industries, LLC.

2. Standard: ASME A112.6.3.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Anchor Flange: Required.
6. Clamping Device: Required.
7. Outlet: Bottom.
8. Coating on Interior and Exposed Exterior Surfaces: Not required.
9. Sediment Bucket: Not required.
10. Top or Strainer Material: Bronze.
11. Top of Body and Strainer Finish: Nickel bronze.

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12. Top Shape: Round.
13. Dimensions of Top or Strainer: 10-inch.
14. Top Loading Classification: Heavy Duty.
15. Funnel: Not required.
16. Inlet Fitting: Not required.
17. Trap Material: Cast iron.
18. Trap Pattern: Standard P-trap.
19. Trap Features: Trap-seal primer valve drain connection.

NOT FOR BIDDING PURPOSES

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
3. Set with grates depressed according to the following drainage area radii:

    a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

4. Install floor-drain flashing collar or flange, so no leakage occurs between drain and adjoining flooring.

    a. Maintain integrity of waterproof membranes where penetrated.

5. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

B. Install open drain fittings with top of hub 1 inch above floor.

3.2 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Comply with requirements in Section 221319 "Sanitary Waste Piping Specialties" for backwater valves and miscellaneous sanitary drainage piping specialties.

C. Install piping adjacent to equipment to allow service and maintenance.

3.3 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319.13

NOT FOR BIDDING PURPOSES

SECTION 22 14 14 – STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. Specialty pipe fittings.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Copper tube and fittings.
2. Specialty pipe fittings.

1.3 INFORMATIONAL SUBMITTALS

A. Field Quality-Control Reports: Inspection reports signed by authorities having jurisdiction.

1.4 QUALITY ASSURANCE

A. Provide materials bearing label, stamp, or other markings of specified testing agency.

1.5 WARRANTY

A. Listed manufacturers to provide labeling and warranty of their respective products

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PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation are to be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Storm Drainage Piping: 10-foot head of water.

2.2 PIPING MATERIALS

A. Piping materials to bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 COPPER TUBE AND FITTINGS

A. Copper Tube:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Cambridge-Lee Industries, LLC.
    b. Cerro Flow Products, LLC.
    c. Wieland Copper Products, LLC.

2. Copper Type DWV Tube: ASTM B306, drainage tube, drawn temper.
3. Copper Tube, Drawn Temper: ASTM B88, Type L and Type M.
4. Copper Tube, Annealed Temper: ASTM B88, Type L.

B. Copper Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. NIBCO INC.

2. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
3. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
4. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
5. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.

    a. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
    b. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder: ASTM B32, lead free with ASTM B813, water-flushable flux.

2.4 SPECIALTY PIPE FITTINGS

A. Dielectric Fittings:

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1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
2. Dielectric Unions:

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) A.Y. McDonald Mfg. Co.
        2) Capitol Manufacturing Company.
        3) GF Piping Systems: Georg Fischer LLC.
        4) HART Industrial Unions, LLC.
        5) Jomar Valve.
        6) Matco-Norca.
        7) WATTS; A Watts Water Technologies Company.
        8) Wilkins.
        9) Zurn Industries, LLC.

    b. Description:

        1) Standard: ASSE 1079.
        2) Pressure Rating: 150 psig minimum at 180 deg F.
        3) End Connections: Solder-joint copper alloy and threaded ferrous.

3. Dielectric Flanges:

    a. Manufacturers: Subject to compliance with requirements, provide products by the following:

        1) Capitol Manufacturing Company.
        2) GF Piping Systems: Georg Fischer LLC.
        3) Matco-Norca.
        4) WATTS; A Watts Water Technologies Company.
        5) Zurn Industries, LLC.

    b. Description:

        1) Standard: ASSE 1079.
        2) Factory-fabricated, bolted, companion-flange assembly.
        3) Pressure Rating: 150 psig minimum at 180 deg F.
        4) End Connections: Solder-joint copper alloy and threaded ferrous.

4. Dielectric-Flange Insulating Kits:

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) Advance Products & Systems, LLC.
        2) CALPICO, Inc.

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3) GF Piping Systems: Georg Fischer LLC.
4) GPT; a division of EnPRO Industries.

b. Description:

1) Nonconducting materials for field assembly of companion flanges.
2) Pressure Rating: 150 psig.
3) Gasket: Neoprene or phenolic.
4) Bolt Sleeves: Phenolic or polyethylene.
5) Washers: Phenolic with steel-backing washers.

5. Dielectric Nipples:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Anvil International/Smith-Cooper International; Tailwind Capital, LLC.
2) Elster Perfection; Honeywell.
3) Matco-Norca.
4) Precision Plumbing Products.
5) Victaulic Company.

b. Description: Electroplated steel nipple.
c. Standards: ASTM F492, ASME B1.20.1.
d. Pressure Rating: 300 psig at 225 deg F.
e. End Connections: Male threaded or grooved.
f. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Excavating, trenching, and backfilling are specified in Section 220500 "Common Work Results for Plumbing."

3.2 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

B. Install piping as indicated unless deviations from layout are approved on coordination drawings.

C. Install piping in concealed locations.

1. Piping installed in equipment rooms, service areas, and where indicated may be exposed.

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D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Make changes in direction for piping using appropriate branches, bends, and long-sweep bends.

1. Do not change direction of flow more than 90 degrees.
2. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

    a. Reducing size of drainage piping in direction of flow is prohibited.

L. Lay buried building piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

M. Install piping at the following minimum slopes unless otherwise indicated.

1. Building Storm Drain: 1/4 inch per foot (2 percent) downward in direction of flow.
2. Horizontal Storm Drainage Piping: 1/4 inch per foot (2 percent) downward in direction of flow.

N. Install aboveground copper tubing in accordance with CDA's "Copper Tube Handbook."

O. Plumbing Specialties:

1. Install cleanouts in storm drainage gravity-flow piping in accessible locations.

    a. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping.
    b. Comply with requirements for cleanouts specified in Section 221423 "Storm Drainage Piping Specialties."

2. Install drains in storm drainage gravity-flow piping.

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a. Comply with requirements for drains specified in Section 221423 "Storm Drainage Piping Specialties."

P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for sleeves specified in Section 220500 "Common Work Results for Plumbing."

R. Install sleeve seals for piping penetrations of concrete walls and slabs.

1. Comply with requirements for sleeve seals specified in Section 220500 "Common Work Results for Plumbing."

S. Install escutcheons for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for escutcheons specified in Section 220500 "Common Work Results for Plumbing."

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3.3 JOINT CONSTRUCTION

A. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1.

1. Cut threads full and clean using sharp dies.
2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

a. Apply appropriate tape or thread compound to external pipe threads unless dry-seal threading is specified.
b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
c. Do not use pipe sections that have cracked or open welds.

B. Join copper tube and fittings with soldered joints in accordance with ASTM B828. Use ASTM B813, water-flushable, lead-free flux and ASTM B32, lead-free-alloy solder.

C. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

3.4 INSTALLATION OF SPECIALTY PIPE FITTINGS

A. Dielectric Fittings:

1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
2. Dielectric Fittings for 2 inch and Smaller: Use dielectric unions.
3. Dielectric Fittings for 2-1/2 to 4 inch: Use dielectric flanges.
4. Dielectric Fittings for 5 inch and Larger: Use dielectric flange kits.

3.5 INSTALLATION OF VALVES.

A. Check Valves: Install swing-check valve, between pump and shutoff valve, on each condensate pump discharge.

3.6 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for hangers, supports, and anchor devices specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install hangers for cast-iron and copper soil tubing and piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

D. Support vertical cast-iron and copper tubing and piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent, but as a minimum at base and at each floor.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

NOT FOR BIDDING PURPOSES

C. Make connections in accordance with the following unless otherwise indicated:

1. Install unions, in piping 2 inch and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping 2-1/2 inch and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.8 IDENTIFICATION

A. Identify exposed storm drainage piping.

B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.9 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage piping in accordance with procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.

    a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

3. Test Procedure:

    a. Test storm drainage piping**,** except outside leaders, on completion of roughing-in.

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b. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
c. From 15 minutes before inspection starts until completion of inspection, water level must not drop.
d. Inspect joints for leaks.

4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.10 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

3.11 PROTECTION

A. Protect piping and drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of day and when work stops.

C. Repair damage to adjacent materials caused by storm drainage piping installation.

3.12 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Air Conditioning Condensate and Condensate Pump Discharge:

1. Underground: Hard copper tube, Type L; wrought-copper pressure fittings; and soldered joints.
2. Aboveground: Hard copper tube, Type L copper pressure fittings, and soldered joints.

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END OF SECTION 221414

SECTION 22 14 23 - STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cleanouts.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Cleanouts.

1.3 QUALITY ASSURANCE

A. Provide drainage piping specialties are to bear label, stamp, or other markings of specified testing agency.

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PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Cast-Iron Cleanouts:

1. Cast-Iron Exposed Cleanouts.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Jay R. Smith Mfg Co; a division of Morris Group International.
2) MIFAB, Inc.
3) WATTS; A Watts Water Technologies Company.
4) Wade; a subsidiary of McWane Inc.
5) Zurn Industries, LLC.
6) Josam Company.

b. Standard: ASME A112.36.2M.
c. Size: Same as connected branch.
d. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch or No-hub, cast-iron soil pipe test tee as required to match connected piping.

e. Closure: Countersunk brass plug.
f. Closure Plug Size: Same as, or not more than, one size smaller than cleanout size.

2. Cast-Iron Exposed Floor Cleanouts

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Jay R. Smith Mfg Co; a division of Morris Group International.
2) Sioux Chief Manufacturing Company, Inc.
3) WATTS; A Watts Water Technologies Company.
4) Wade; a subsidiary of McWane Inc.
5) Zurn Industries, LLC.

b. Standard: ASME A112.36.2M.
c. Size: Same as connected branch.
d. Type: Cast-iron soil pipe with cast-iron ferrule, Heavy-duty, adjustable housing.
e. Body or Ferrule: Cast iron.
f. Outlet Connection: as required to connect to adjacent piping.
g. Closure: Brass plug with straight threads and gasket.
h. Adjustable Housing Material: Cast iron with threads.
i. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
j. Frame and Cover Shape: Round.
k. Top Loading Classification: Extra-Heavy Duty.
l. Riser: ASTM A74, Extra-Heavy Class, cast-iron drainage pipe fitting and riser to cleanout.
m. Options:

1) Clamping device.

3. Cast-Iron Wall Cleanouts.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Jay R. Smith Mfg Co; a division of Morris Group International.
2) MIFAB, Inc.
3) WATTS; A Watts Water Technologies Company.
4) Wade; a subsidiary of McWane Inc.
5) Zurn Industries, LLC.
6) Josam Company.

b. Standard: ASME A112.36.2M. Include wall access.
c. Size: Same as connected drainage piping.
d. Body: Hub-and-spigot, cast-iron soil pipe T-branch or No-hub, cast-iron soil pipe test tee as required to match connected piping.
e. Closure Plug:

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1) Material: Cast iron.
2) Head: Countersunk.
3) Drilled and threaded for cover attachment screw.
4) Size: Same as, or not more than, one size smaller than cleanout size.

f. Wall-Access Cover Plate: Round, flat, chrome-plated brass or stainless steel cover plate with screw.
g. Wall-Access Frame and Cover: Round, nickel-bronze, copper-alloy, or stainless steel wall-installation frame and cover.

4. Cast-Iron Test Tees

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Jay R. Smith Mfg Co; a division of Morris Group International.
2) MIFAB, Inc.
3) WATTS; A Watts Water Technologies Company.
4) Zurn Industries, LLC.
5) Josam Company.

b. Standard: ASME A112.36.2M and ASTM A74, ASTM A888, or CISPI 301.
c. Size: Same as connected drainage piping.
d. Body Material: Hub-and-spigot, cast-iron soil-pipe T-branch or no-hub, cast-iron soil-pipe test tee as required to match connected piping.
e. Closure Plug: Countersunk, brass.
f. Closure Plug Size: Same as, or not more than, one size smaller than cleanout size.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping in accordance with the following instructions unless otherwise indicated:

1. Use cleanouts the same size as drainage piping up to 4 inch. Use 4 inch for larger drainage piping unless larger cleanout is indicated.
2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
3. Locate cleanouts at minimum intervals of 50 ft. for piping 4 inch and smaller and 100 ft. for larger piping.
4. Locate cleanouts at base of each vertical storm piping conductor.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

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D. Install test tees in vertical conductors and near floor.

E. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 221414 "Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 CLEANING

A. Clean piping specialties during installation and remove dirt and debris as work progresses.

3.4 PROTECTION

A. Protect piping specialties during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of each day and when work stops.

END OF SECTION 221423

NOT FOR BIDDING PURPOSES

SECTION 22 31 00 - DOMESTIC WATER SOFTENERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Water softeners.
2. Chemicals.
3. Water-testing sets.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water softeners.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.3 INFORMATIONAL SUBMITTALS

A. Source quality-control reports.

B. Field quality-control reports.

C. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For water softeners to include in emergency, operation, and maintenance manuals.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of water softeners that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures of mineral and brine tanks.
b. Faulty operation of controls.

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c. Deterioration of metals, metal finishes, and other materials beyond normal use.
d. Attrition loss of resin exceeding 3 percent per year.
e. Mineral washed out of system during service run or backwashing period.
f. Effluent turbidity greater and color darker than incoming water.
g. Fouling of underdrain system, gravel, and resin with turbidity or by dirt, rust, or scale from water softener or soft water, while operating according to manufacturer's written operating instructions.

2. Water Softeners, Warranty Period: From date of Substantial Completion.

a. Mineral Tanks: Five years.
b. Brine Tanks: 10 years.
c. Control Valve: One year(s).

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Drinking Water System Components - Health Effects and Drinking Water System Components - Lead Content Compliance: NSF 61 and NSF 372.

B. Capacities and Characteristics:

1. Confirm all requirements with well provider.

2. Water Analysis:
a. Iron: 1 mg/L.
b. Dissolved Solids: 750 mg/L.
c. Concentration: 6 to 10 pH.
d. Inlet Water Pressure: 25 psig.
e. Water Temperature: 60 deg F.

3. Continuous Service Flow Rate: 53 gpm at 15-psig pressure drop.
4. Peak Service Flow Rate: 69 gpm at 25-psig pressure drop.
5. Manifold Pipe Size: 2 inch.
6. Backwash-to-Drain Pipe Size: 1 inch.
7. Number of Mineral Tanks: One.
8. Mineral Quantity, Each Tank: 5 cu. ft.
9. Mineral Exchange Capacity: 150,000 grains/cu. ft. per lb of salt.
10. Electrical Characteristics:

a. Volts: 115 V.
b. Phases: 1.
c. Hertz: 60 Hz.
d. Full-Load Amperes: 2.7 A.

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11. Salt Capacity: 75 lb.
12. Mineral Tank Size 18-inches diameter by 65 inches high.
13. Brine Tank Size: 24-inches diameter by 41-inches high.

2.2 WATER SOFTENERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M.
2. Aquion, Inc.
3. Culligan International Company.
4. Diamond Water Conditioning; a Griesbach company.
5. Ecodyne Limited.
6. Hungerford & Terry, Inc.
7. Kinetico Incorporated.
8. Marlo Incorporated.
9. Parker Boiler.
10. Springsoft International, Inc.
11. WATTS; A Watts Water Technologies Company.
12. Water King.
13. WaterSoft.

B. Basis of Design: Watts CWS-200 Model M4548W.

C. Description: Factory-assembled, pressure-type water softener.

1. Configuration: Single unit with one mineral tank and one brine tank.
2. Mounting: On skids.
3. Wetted Components: Suitable for water temperatures from 40 to at least 100 deg F.
4. Mineral Tanks, FRP: Pressure-vessel quality.
    a. Construction: Non-ASME code.
    b. Pressure Rating: 100 psig minimum.
    c. Freeboard: 50 percent minimum for backwash expansion above normal resin bed level.
    d. Support Legs or Skirt: Constructed of structural steel, welded to tank
    e. Upper Distribution System: Single, point type, fabricated from galvanized-steel pipe and fittings.
    f. Lower Distribution System: Hub and radial-arm or header-lateral type; fabricated from nonmetallic pipe and fittings with individual, fine-slotted, nonclogging plastic strainers, and arranged for even flow distribution through resin bed.
    g. Liner: PE, ABS, or other material suitable for potable water.
5. Mineral Tanks, Steel: Electric welded; pressure-vessel quality.
    a. Construction: Non-ASME code.
    b. Pressure Rating: 100 psig minimum.

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c. Freeboard: 50 percent minimum for backwash expansion above normal resin bed level.
d. Support Legs or Skirt: Constructed of structural steel, welded to tank.
e. Finish:

1) Hot-dip galvanized on exterior and interior of tank after fabrication unless tank is stainless steel.

f. Upper Distribution System: Single, point type, fabricated from galvanized-steel pipe and fittings.
g. Lower Distribution System: Hub and radial-arm or header-lateral type; fabricated from PVC pipe and fittings with individual, fine-slotted, nonclogging PE strainers, and arranged for even flow distribution through resin bed.
h. Liner: PE, ABS, or other material suitable for potable water.

6. Controls, Automatic: 120 V; factory wired and factory mounted on unit.

a. Adjustable duration of various regeneration steps.
b. Push-button start and complete manual operation.
c. Electric time clock and switch for automatic operation except for manual return to service.
d. Sequence of Operation: Multiport pilot-control valve automatically pressure-actuates main operating valve through steps of regeneration.
e. Pointer on pilot-control valve shall indicate cycle of operation.
f. Includes means of manual operation of pilot-control valve if power fails.

7. Flow Control: Automatic, to control backwash and flush rates over wide variations in operating pressure; does not require field adjustments.

a. Meter Control: Each mineral tank is equipped with signal-register-head water meter that produces electrical signal indicating need for regeneration on reaching hand-set total in gallons. Signal will continue until reset.
b. Demand-Initiated Control:

1) Single mineral tank is equipped with automatic-reset-head water meter that electrically activates cycle controller to initiate regeneration at preset total in gallons. Head automatically resets to preset total in gallons for next service run.

8. Brine Tank: Combination measuring and wet-salt storing system.

a. Tank and Cover Material: Fiberglass, 3/16 inch thick; or molded PE, 3/8 inch thick.
b. Brine Valve: Float operated and plastic fitted for automatic control of brine withdrawal and freshwater refill.
c. Size: Large enough for at least four regenerations at full salting.

9. Factory-Installed Accessories:

NOT FOR BIDDING PURPOSES

a. Piping, valves, tubing, and drains.
b. Sampling cocks.
c. Main-operating-valve position indicators.
d. Water meters.

2.3 CHEMICALS

A. Mineral: High-capacity, sulfonated-polystyrene, ion-exchange resin that is stable over entire pH range with good resistance to bead fracture from attrition or shock.

1. Exchange Capacity: 150,000 grains/cu. ft. of calcium carbonate of resin when regenerated with 75 lb of salt.

B. Salt for Brine Tanks: High-purity sodium chloride, free of dirt and foreign material. Rock and granulated forms are unacceptable.

1. Form: Processed, food-grade salt pellets.

2.4 WATER-TESTING SETS

A. Description: Manufacturer's standard water-hardness testing apparatus and chemicals with testing procedure instructions. Include metal container suitable for wall mounting.

2.5 SOURCE QUALITY CONTROL

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

B. ASME Compliance for Steel Tanks: Fabricate and label mineral tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, where indicated.

C. ASME Compliance for FRP Tanks: Fabricate and label mineral tanks to comply with ASME Boiler and Pressure Vessel Code: Section X, where indicated.

D. UL Compliance: Fabricate and label water softeners to comply with UL 979, "Water Treatment Appliances."

E. Hydrostatically test mineral tanks before shipment to a minimum of one and one-half times the pressure rating.

F. Prepare test and inspection reports.

NOT FOR BIDDING PURPOSES

PART 3 - EXECUTION

3.1 INSTALLATION OF WATER SOFTENERS

A. Install brine lines and fittings furnished by equipment manufacturer, but not specified to be factory installed.

B. Prepare mineral-tank distribution system and underbed for minerals and place specified mineral into mineral tanks.

C. Install water-testing sets mounted on wall, unless otherwise indicated, and near water softeners.

3.2 PIPING CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to equipment, allow space for service and maintenance.

C. Install shutoff valves on raw-water inlet and soft-water outlet piping of each mineral tank.

1. Metal general-duty valves are specified in Section 220523 "General Duty Valves for Plumbing Piping,"
2. Plastic valves are specified in Section 221116 "Domestic Water Piping."
3. Exception for water softeners with factory-installed shutoff valves at locations indicated.

D. Install pressure gauges on raw-water inlet and soft-water outlet piping of each mineral tank. Pressure gauges are specified in Section 220500 "Common Work Results for Plumbing."

1. Exception for water softeners with factory-installed pressure gauges at locations indicated.

E. Install valved bypass in water piping around water softeners.

1. Metal general-duty valves are specified in Section 220523 "General Duty Valves for Plumbing Piping."
2. Plastic valves are specified in Section 221116 "Domestic Water Piping."
3. Water piping is specified in Section 221116 "Domestic Water Piping."

F. Install indirect wastes to spill into open drains or pit with drain.

3.3 ELECTRICAL CONNECTIONS

A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

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B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

3.4 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections with the assistance of a factory-authorized service representative.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Water softeners will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.6 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

B. Add water to brine tanks and fill with the following form of salt:

1. Water Softeners: Processed, plain salt pellets.

C. Sample water softener effluent after startup and at three consecutive seven-day intervals (total of four samples), and prepare certified test reports for required water performance characteristics. Comply with the following:

1. ASTM D859, "Test Method for Silica in Water."
2. ASTM D1067, "Test Methods for Acidity or Alkalinity of Water."
3. ASTM D1068, "Test Methods for Iron in Water."
4. ASTM D1126, "Test Method for Hardness in Water."
5. ASTM D1129, "Terminology Relating to Water."

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6. ASTM D3370, "Practices for Sampling Water from Closed Conduits."

3.7 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of water softener Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, cleaning, and adjusting as required for proper water softener operation at rated capacity. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain domestic water softeners.

END OF SECTION 223100

NOT FOR BIDDING PURPOSES

SECTION 22 42 00 - COMMERCIAL PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Commercial showers.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for plumbing fixtures.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Plans, elevations, sections, mounting and attachment details.
2. Details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Diagrams for power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. For shower valves to include in maintenance manuals

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Shower Valve Washers and O-Rings: Equal to one of each type and size installed.
2. Shower Valve Cartridges and O-Rings: Equal to one of each type and size installed.

NOT FOR BIDDING PURPOSES

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Shower valves, and spray heads intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 COMMERCIAL SHOWERS

A. Showers, Outdoor:

1. Showers, Outdoor - Steel: **P-1A**

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Acorn Engineering Company; a Division of Morris Group International.
2) Bradley Corporation.
3) Most Dependable Fountains, Inc.
4) Zurn Industries, LLC.

b. Basis of Design: Most Dependable Fountains, Inc Model 500 SMSS

c. Source Limitations: Obtain showers from single source from single manufacturer.
d. Description: Freestanding, steel, shower fixture.
e. Nozzles: Fixed, on column.
f. Control: Push button and timer.
g. Maximum Flow: 1.5 gpm for each shower head.
h. Flow-Control Fitting: 2.0 gpm for each shower head.
i. EPA WaterSense: Required.
j. Material: Powder-coated steel.
k. Color: Blue.
l. Internal Piping: Factory installed.
m. Mounting: Base flange with bolt holes.

2. Foot Showers, Outdoor - Steel: **P-1B**

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Acorn Engineering Company; a Division of Morris Group International.

NOT FOR BIDDING PURPOSES

2) Bradley Corporation.
3) Most Dependable Fountains, Inc.
4) Zurn Industries, LLC.

b. Basis of Design: Most Dependable Fountains, Inc Model 525 SMSS One Footspray.
c. Source Limitations: Obtain showers from single source from single manufacturer.
d. Description: Freestanding, steel, shower fixture.
e. Nozzles: Fixed, on column.
f. Control: Push button and timer.
g. Maximum Flow: 1.5 gpm for each foot shower head.
h. Flow-Control Fitting: 2.0 gpm for each shower head.
i. EPA WaterSense: Required.
j. Material: Powder-coated steel.
k. Color: Blue.
l. Internal Piping: Factory installed.
m. Mounting: Base flange with bolt holes.

3.

B. Grout:

1. Standard: ASTM C1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
2. Characteristics: Nonshrink; recommended for interior and exterior applications.
3. Design Mix: 5000 psi, 28-day compressive strength.
4. Packaging: Premixed and factory packaged.

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water-supply piping and sanitary drainage and vent piping systems to verify actual locations of piping connections before plumbing fixture installation.

B. Examine walls and floors for suitable conditions where plumbing fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF COMMERCIAL PLUMBING FIXTURES

A. Shower Installation:

1. Assemble shower components in accordance with manufacturers' written instructions.
2. Install showers level and plumb in accordance with roughing-in drawings.
3. Install ball valves in water-supply piping to the shower if supply stops are specified with the shower valve. Comply with ball valve requirements specified in Section 220523

"General Duty Valves for Plumbing Piping." Install valves in locations that are accessible for ease of operation.

4. Install shower flow-control fittings with specified maximum flow rates in shower arms.
5. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."

3.3 INSTALLATION OF PIPING CONNECTIONS

A. Connect plumbing fixtures with water supplies and soil, waste, and vent piping. Use size fittings required to match plumbing fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil, waste, and vent piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust plumbing fixtures and controls. Replace damaged and malfunctioning plumbing fixtures, fittings, and controls.

B. Adjust water pressure at shower valves to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After completing installation of plumbing fixtures, inspect and repair damages finishes. Replace any fixtures unable to be repaired to the satisfaction of the Owner.

B. Clean plumbing fixtures and associated faucets, valves, and fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed plumbing fixtures and associated faucets, valves, and fittings.

D. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224200

NOT FOR BIDDING PURPOSES

SECTION 22 47 00 - DRINKING FOUNTAINS AND WATER COOLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Drinking fountains.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
b. Include operating characteristics, and furnished specialties and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, and mounting details.
2. Include details of fixture assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power wiring.

NOT FOR BIDDING PURPOSES

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For drinking fountains to include in maintenance manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's written instructions for delivery, storage, and handling.

1.5 WARRANTY

A. Manufacturer Warranty: Manufacturer and Installer agree to repair or replace drinking fountains that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty operation of compressor and controls.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

B. Warranty Period: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Standards:

1. Drinking fountains intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), requirements of the authority having jurisdiction, and with NSF 61 or NSF 372, or be certified in compliance with NSF 61 or NSF 372 by an ANSI-accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.2 DRINKING FOUNTAINS

A. Drinking Fountains - Pedestal, Stainless Steel: **P-2**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Haws Corporation.
b. Most Dependable Fountains, Inc.
c. Murdock Manufacturing; A Division of Morris Group International.
d. Stern-Williams Products, LLC.

2. Basis of Design: Most Dependable Fountains, Inc Model 493 SM
3. Source Limitations: Obtain pedestal, stainless steel drinking fountains from single source from single manufacturer.
4. Standards:

a. NSF 61.
b. NSF 372.
c. ASME A112.19.3/CSA B45.4.

5. Pedestal: Round.
6. Receptor(s):

a. Shape: Round.
b. Bubbler: One for each receptor, with adjustable stream regulator, located on deck.
c. Bottle Filler: Push-button activation.
d. Drain: Grid type with 1-1/4 inch tailpiece.

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7. Maximum Water Flow: 0.5 gpm.
8. Controls: Push button.
9. Access to Internal Components: Panel in pedestal.
10. Supply: 1/2 inch with shutoff valve.
11. Filter: One or more water filters with capacity sized for unit peak flow rate.

    a. Standards:

        1) NSF 42.
        2) NSF 53.

12. Drain Piping: 1-1/2 inch minimum trap and waste.
13. Drinking Fountain Height: High/low - standard/accessible in accordance with ICC A117.1.

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.

B. Examine walls and floors for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fixtures level and plumb in accordance with roughing-in drawings.

B. Set pedestal drinking fountains on flat surface in accordance with manufacturer's written installation instructions.

C. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 220523 "General-Duty Valves for Plumbing Piping."

D. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

E. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220500 "Common Work Results for Plumbing."

3.3 PIPING CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Install ball shutoff valve on water supply to each fixture. Comply with valve requirements specified in Section 220523 "General-Duty Valves for Plumbing Piping."

D. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

3.5 CLEANING

A. After installing fixtures, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, in accordance with manufacturer's written instructions.

C. Provide protective covering for installed fixtures.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224700

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SECTION 23 05 00 - COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete.
2. Motors.
3. Sleeves without waterstop.
4. Sleeves with waterstop.
5. Stack-sleeve fittings.
6. Grout.
7. Silicone sealants.
8. Escutcheons.
9. Site examination.
10. Permits
11. Cleaning of systems.
12. Excavation and backfill.

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1.2 DEFINITIONS

A. “Approve” - To permit use of material, equipment or methods conditional upon compliance with contract document requirements.

B. “Concealed” - Hidden from normal sight; includes work in crawl spaces, above ceilings, and in building shafts.

C. “Directed” - Directed by Engineer.

D. “Equal, equivalent” - Possessing the same performance qualities and characteristics and fulfilling the same utilitarian function.

E. “Existing Piping to Remain” - Existing piping that is not to be removed and that is not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

F. “Exposed” - Not concealed.

G. “Furnish” - Supply and deliver to project site, ready for unloading, unpacking, assembly, installation, and similar operations.

H. “Indicated” - Indicated in Contract Documents.

I. "Install" - Operations at project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimensions, finishing, curing, protecting, cleaning and similar operations.

J. "Piping" - Includes pipe, fittings, valves, supports and accessories comprising a system.

K. "Provide" - Furnish and install, complete and ready for the intended use.

L. "Removable" - Detachable from the structure or system without physical alteration of materials or equipment and without disturbance to other construction.

M. "Review" - Limited observation or checking to ascertain general conformance with design concept of the work and with information given in contract documents. Such action does not constitute a waiver or alteration of the contract requirements.

1.3 ACTION SUBMITTALS

A. Product Data:

1. For each type of product, excluding motors which are included in Part 1 of HVAC equipment Sections.

a. Include construction details, material descriptions, and dimensions of individual components, and finishes.
b. Include operating characteristics and furnished accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

B. Pipe and Pressure-Vessel Welding Qualifications: Qualify procedures and operators in accordance with 2021 ASME Boiler and Pressure Vessel Code, Section IX.

C. Contract drawings for mechanical work are diagrammatic, intended to convey scope and general arrangement.

D. Refer questions involving document interpretation or discrepancies to Engineer for review and direction.

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E. Correct faulty work due to resolving discrepancies without proper approval.

F. Specifications establish quality of materials, equipment, workmanship and methods of construction.

G. Follow drawings and specifications in laying out work. Consult other applicable contract drawings and specifications, become familiar with conditions affecting work.

H. Regulations: Comply with regulations of NFPA, state, county, and municipal building ordinances, and other applicable codes and regulations.

I. Provide UL label on electric powered equipment or certification that equipment has been tested by a testing agency approved by the local authority as equivalent in safety to UL labeled equipment.

J. Material and Equipment Requirements

1. Use products of one manufacturer where two or more items of same kind of equipment are required.
2. Materials and equipment shall have a record of one-year successful field use.
3. For certain items of equipment, the specification and the project design are based upon the specified manufacturer's product. Other manufacturers' names are listed. Contractor may purchase, conditional upon meeting project requirements, equipment from the listed manufacturers.
4. Only the manufacturer's equipment upon which the specification and the project design has been based, has been checked for this project. Check allocated space and structure for suitability of equipment of other listed manufacturers, including parts replacement and servicing.
5. Basis of Design Products: Where the Specifications or Drawings name a specific manufacturer's product accompanied by the words “Basis of Design,” including make or model number or other designation, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Naming of a Basis of Design product is intended to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification. The drawings indicate the general size, configuration, location, connections and/or support for equipment or systems specified with relation to the other building systems.

K. Workmanship

1. Remove and replace, at no extra cost, work not in conformance with contract requirements.
2. Coordinate work and cooperate with other trades to facilitate execution of work.

L. Coordination with Other Trades

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1. Contractor shall give full cooperation and coordination with other trades and shall furnish any information necessary to permit the work of all trades to be installed satisfactorily with the least possible interference or delay.
2. The Contractor shall furnish to other trades, as required, all necessary templates, patterns, setting plans and shop details for the proper installation of the work and for the purpose of coordination adjacent work.
3. Contractor shall coordinate with Pre-Fabricated Buildings. Review all Pre-Fabricated Building drawings. Contractor shall be responsible for providing all components not provided by Pre-Fabricated Building Manufacturer to make complete functioning systems.

M. Asbestos or asbestos-containing materials shall not be utilized or allowed on this project. The Contractor shall be rigorous in ensuring that all materials, equipment, systems, and components do not contain asbestos. Any deviations from this exclusion shall be remedied at the Contractor's expense without regard to prior submittal approvals.

N. Access: The Contractor shall specifically consider all materials and equipment installations and shall coordinate with the work of all trades to ensure easy and unobstructed accessibility of all systems for operations, maintenance, repairs, and replacement. Installation of all specified materials and equipment including but not limited to, equipment, supports, pipe, electrical conduit and controls shall be in a manner which will allow complete unobstructed access to all panels, access doors, filter racks, control boxes, controls actuators, sensors, valves, and all other items requiring access for operations or maintenance. All items such as controls, actuators and valves which require servicing or manual operations for system use shall be located such as to be accessible without standing on other equipment, whenever it is possible or practical. Any installation of new equipment or materials which causes problems related to access of new equipment shall be disapproved by the Engineer and re-accomplished by the Contractor.

1.6 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

B. References

1. References to standards, codes, catalogs and recommendations are latest edition in effect on date of invitation to bid.
2. Refer to applicable contract drawings and specifications pertaining to other Divisions for conditions affecting work.
3. Refer to Division 01 for description of alternates.
4. Refer to Division 01 for description of base bid items.

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PART 2 - PRODUCTS

2.1 CONCRETE WORK

A. Compressive Strength: 3000-psi minimum after 28 days.

B. Reinforcing Steel: Yield strength as determined by structural design.

C. Grout: Non-shrink, non-metallic, pre-mixed, equivalent to Nordbak Fast-set, U.S. Grout Five-star, or Polymeric.

2.2 MOTORS

A. Motor Requirements, General:

1. Content includes motors for use on alternating-current power systems of up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.
2. Comply with requirements in this Section except when stricter requirements are specified in equipment schedules or Sections.
3. Comply with NEMA MG 1 unless otherwise indicated.

B. Motor Characteristics:

1. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 ft. above sea level.
2. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

C. Single-Phase Motors:

1. Motors larger than 1/20 hp must be one of the following, to suit starting torque and requirements of specific motor application:

a. Permanent-split capacitor.
b. Split phase.
c. Capacitor start, inductor run.
d. Capacitor start, capacitor run.

2. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
3. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
4. Motors 1/20 hp and Smaller: Shaded-pole type.
5. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of

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motor insulation. Thermal-protection device will automatically reset when motor temperature returns to normal range.

D. Electronically Commutated Motors:

1. Microprocessor-Based Electronic Control Module: Converts 120 V or 240 V single-phase AC power to three-phase DC power to operate the brushless DC motor.
2. Three-phase power motor module with permanent magnet rotor.
3. Circuit board or digital speed controller/LED display.

2.3 SLEEVES

A. Sleeves without Waterstop:

1. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron, with plain ends.
2. Steel Pipe Sleeves: ASTM A53, Type E, Grade B, Schedule 40, hot-dip galvanized, with plain ends.
3. Steel Sheet Sleeves: ASTM A653, 24 gauge minimum thickness; hot-dip galvanized, round tube closed with welded longitudinal joint.

B. Sleeves with Waterstop:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advance Products & Systems, LLC.
b. CALPICO, Inc.
c. GPT; a division of EnPRO Industries.
d. Metraflex Company (The).

2. Description: Manufactured galvanized-steel, sleeve-type, waterstop assembly, made for imbedding in concrete slab or wall.

C. Stack-Sleeve Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Jay R. Smith Mfg Co; a division of Morris Group International.
b. Wade; a subsidiary of McWane Inc.
c. Zurn Industries, LLC.

2. Description: Manufactured, galvanized cast-iron sleeve with integral cast flashing flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.

a. Underdeck Clamp: Clamping ring with setscrews.

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D. Grout:

1. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.
2. Standard: ASTM C1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
3. Design Mix: 5000 psi, 28-day compressive strength.
4. Packaging: Premixed and factory packaged.

E. Silicone Sealants:

1. Silicone Sealant, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant.

   a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

      1) GE Construction Sealants; Momentive Performance Materials Inc.
      2) ITW Polymers Sealants North America.
      3) Polymeric Systems, Inc.
      4) Sherwin-Williams Company (The).
      5) Sika Corporation.
      6) The Dow Chemical Company.
      7) Tremco Incorporated.

   b. Standard: ASTM C920, Type S, Grade NS, Class 25, Use NT.

2. Silicone Foam Sealant: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

   a. Manufacturers: Subject to compliance with requirements, provide products by the following:

      1) Smooth-On.

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2.4 ESCUTCHEONS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. BrassCraft Manufacturing Co.; a Masco company.
2. Dearborn Brass.
3. Jones Stephens Corp.
4. Keeney Manufacturing Company (The).
5. Mid-America Fittings, LLC; A Midland Industries Company.
6. ProFlo; a Ferguson Enterprises, Inc. brand.

B. Escutcheon Types:

1. One-Piece, Steel Type: With polished, chrome-plated or polished brass finish and setscrew fastener.
2. One-Piece, Stainless Steel Type: With polished stainless steel finish.
3. One-Piece, Cast-Brass Type: With polished, chrome-plated or polished brass finish and setscrew fastener.
4. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel or brass with polished, chrome-plated finish and spring-clip fasteners.
5. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.
6. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed and exposed-rivet hinge; and spring-clip fasteners.

C. Floor Plates:

1. Split Floor Plates: Steel with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION OF SLEEVES - GENERAL

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes except as required for wet areas below.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
2. Cut sleeves to length for mounting flush with both surfaces.
    a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
3. Using grout or silicone sealant, seal space outside of sleeves in floors/slabs/walls without sleeve-seal system. Select to maintain fire resistance of floor/slab/wall.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.

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3. Seal annular space between sleeve and piping or piping insulation; use joint sealants that joint sealant manufacturer's literature indicates is appropriate for size, depth, and location of joint.

3.2 INSTALLATION OF SLEEVES WITH WATERSTOP

A. Install sleeve with waterstop as new walls and slabs are constructed.

B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange centered across width of concrete slab or wall.

C. Secure nailing flanges to wooden concrete forms.

D. Using grout or silicone sealant, seal space around outside of sleeves.

3.3 INSTALLATION OF STACK-SLEEVE FITTINGS

A. Install stack-sleeve fittings in new slabs as slabs are constructed.

1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing.
3. Install section of cast-iron soil pipe to extend sleeve to 3 inches above finished floor level.
4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
5. Using silicone sealant, seal space between top hub of stack-sleeve fitting and pipe.

3.4 INSTALLATION OF ESCUTCHEONS

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

3.12 INSTALLATION OF EQUIPMENT PADS

A. Concrete Equipment Pads

1. Provide concrete pads not less than 4 inches high and projecting not less than 3 inches on all sides beyond equipment for floor mounted equipment.
2. Place anchor bolts in steel pipe sleeves, with a plate at bottom end of sleeve to hold bolts.
3. Grout between base plate and foundation.

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3.5 FIELD QUALITY CONTROL

A. Sleeves:

1. Perform the following tests and inspections:

a. Leak Test: After allowing for a full cure, test sleeves for leaks. Repair leaks and retest until no leaks exist.
b. Sleeves will be considered defective if they do not pass tests and inspections.

2. Prepare test and inspection reports.

B. Escutcheons:

1. Using new materials, replace broken and damaged escutcheons and floor plates.

3.6 SLEEVES APPLICATION

A. Use sleeves for the following piping-penetration applications:

1. Exterior Concrete Walls above and below Grade:

a. Sleeves with waterstops.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

2. Concrete Slabs-on-Grade:

a. Sleeves with waterstops.

1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs above Grade:

a. Sleeves with waterstops or stack-sleeve fittings.

4. Interior Walls and Partitions:

a. Sleeves without waterstops.

3.7 ESCUTCHEONS APPLICATION

A. Escutcheons for New Piping:

1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.

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2. Chrome-Plated Piping: One piece, steel, cast brass or split-plate steel with polished, chrome-plated finish.
3. Insulated Piping:

    a. One piece, steel with polished, chrome-plated or polished brass finish to match adjacent finish.

4. Bare Piping at Wall and Floor Penetrations in Finished Spaces:

    a. One piece, steel with polished, chrome-plated or polished brass finish to match adjacent finish.

5. Bare Piping at Ceiling Penetrations in Finished Spaces:

    a. One piece, steel with polished, chrome-plated or polished brass finish to match adjacent finish.

6. Bare Piping in Unfinished Service Spaces:

    a. One piece, steel with polished, chrome-plated finish.

7. Bare Piping in Equipment Rooms:

    a. One piece, steel with polished, chrome-plated finish.

B. Install floor plates for piping penetrations of equipment-room floors.

C. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: Split floor plate.

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3.8 SITE EXAMINATION

A. Failure to visit site and become familiar with local conditions prior to bidding will not relieve the Contractor of their responsibility for complying with the Contract Documents.

3.9 PERMITS

A. Obtain and pay for required permits.

3.10 PROTECTION

A. Protect mechanical and associated electrical material and equipment from the elements or other injury as soon as delivered on premises. Protect mechanical fixtures as soon as they are set.

1. Accept in original packaging.

2. Store in clean, dry space.
3. Protect from dirt, water, construction debris, and traffic.
4. Handle in accordance with manufacturer's written instructions.

B. Cap or plug openings in equipment, piping, and conduit systems, to exclude dirt and other foreign material. Do not use rags, wool, cotton, paper, waste or similar materials for plugging.

3.11 CLEANING OF SYSTEMS

A. Thoroughly clean systems after satisfactory completion of pressure tests and before permanently connecting equipment, strainers, and other accessory items. Blow out and flush piping until interior are free of foreign matter.

B. Pay for labor and materials required to locate and remove obstructions from systems clogged with construction refuse after acceptance. Replace and repair work disturbed during removal of obstructions.

C. Leave systems clean, and in complete running order.

3.12 EXCAVATION AND BACKFILL

A. Excavate and backfill as required to install underground mechanical work.

B. Establish required lines and grade.

C. Excavate to sufficient depth to give 30-inch minimum cover, unless otherwise indicated.

D. Keep excavation drained and pumped out.

E. Remove excavated materials not required or suitable for backfill.

F. Protection

1. Protect existing utilities and underground work by shoring and bracing.
2. Provide guardrail, lamps, flags, and other safeguards at temporary walk and road crossings.
3. Provide shoring, sheet piling and bracing for protection of work and safety of personnel. Timber sheeting below top of pipe shall not be removed.
4. Protect trees, structures, and other property from injury during work.
5. Prevent debris and other materials from entering piping and drains.

G. Trenching

1. Excavate to depth and width required for proper installation of item to be buried with a minimum clearance of 8 inches and a maximum of 12 inches on each side of the pipe and

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to the top of the pipe with a minimum overdepth of 4 inches. If cinders are encountered at bottom of trench, increase overdepth to 10 inches.

2. Sides shall be vertical unless otherwise required by governing safety regulations.
3. Provide manholes and similar structures with a minimum of 2-inch and a maximum of 24-inch clearance on each side.

H. Backfill

1. Use only backfill material free of organic matter, cinders, frozen earth, clay, and rocks exceeding 6 inches in any dimension.
2. Provide bed of firmly compacted sand, gravel, or crushed stone of proper grade to form a uniform support. Hollow out for bells. Backfill excessive overdepth with firmly compacted sand or gravel.
3. Provide a structurally suitable reinforced concrete beam supported by the structure and undisturbed earth to support piping where a properly compacted bed is difficult to obtain, because of fill conditions, such as may occur adjacent to building walls.
4. As items to be buried are laid, backfill with layer of sand, crushed stone, or gravel bedding material to centerline of pipe or 6 inches deep, whichever is less, and tamp.
5. After tests and inspections are complete, backfill with fine earth or sand in 6-inch layers until buried item has 1-foot of cover. Carefully tamp each layer. Compact to at least 95 percent of the maximum dry density as determined by ASTM D 1557.
6. Deposit remainder of backfill material in 8-inch layers and tamp each layer. Compact to at least 95 percent of the maximum dry density as determined by ASTM D 1557.
7. Backfill with sand, graded crushed stone, or washed gravel, inside building under or within 3 feet of equipment and under roadways. Compact to at least 95 percent of the maximum dry density as determined by ASTM D 1557.

I. Restoring

1. Restore existing pavement, curbs, sidewalks, fences, sod, shrubs, and other appurtenances removed or damaged in connection with work to original condition.
2. Replace sod with sod and replace trees, which are damaged, with trees of similar type and size.

J. Warning Tape: Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

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END OF SECTION 230500

SECTION 23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Equipment stands.
9. Equipment supports.

B. Related Requirements:

1. Section 230548.13 "Vibration Controls for HVAC" for vibration isolation devices.
2. Section 233113 "Metal Ducts" for duct hangers and supports.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Fiberglass strut systems.
4. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Include design calculations for designing trapeze hangers.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

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1.4 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code, Section IX.

C. All hangers and supports within Equipment Building shall be corrosion resistant.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design trapeze pipe hangers and equipment supports.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated, or epoxy powder-coated.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel or stainless steel.

B. Stainless Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

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C. Copper Pipe and Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-plated steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-plated steel or stainless steel.

2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.4 FIBERGLASS PIPE HANGERS

A. Clevis-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 1, factory-fabricated steel pipe hanger except hanger is made of fiberglass or fiberglass-reinforced resin.
2. Hanger Rods: Continuous-thread rod, washer, and nuts made of stainless steel.
3. Flammability: ASTM D635, ASTM E84, and UL 94.

B. Strap-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 9 or Type 10, steel pipe hanger except hanger is made of fiberglass-reinforced resin.

    a. Flammability: ASTM D635, ASTM E84, and UL 94.

2. Hanger Rod and Fittings: Continuous-thread rod, washer, and nuts made of stainless steel.

2.5 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. ABB, Electrification Business.
    b. Cooper B-line; brand of Eaton, Electrical Sector.
    c. Flex-Strut Inc.
    d. G-Strut.
    e. Gripple Inc.
    f. Unistrut; Atkore International.

NOT FOR BIDDING PURPOSES

2. Description: Shop- or field-fabricated, pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
4. Channels: Continuous slotted carbon-steel channel with inturned lips.
5. Channel Width: Selected for applicable load criteria.
6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
7. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel or stainless steel.
8. Paint Coating: Green epoxy, acrylic, or urethane.

2.6 FIBERGLASS STRUT SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Champion Fiberglass, Inc.
2. Fabco Plastics Wholesale Limited.
3. G-Strut.
4. Seasafe, Inc.; AMICO, a Gibraltar Industries Company.
5. Unistrut; Atkore International.

B. Description: Structural-grade, factory-formed, glass-fiber-resin channels and angles for supporting multiple parallel pipes.

1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
2. Channels: Continuous slotted fiberglass-reinforced plastic channel with inturned lips.
3. Channel Width: Selected for applicable load criteria.
4. Fittings and Accessories: Products provided by channel and angle manufacturer and designed for use with those items.
5. Fitting and Accessory Materials: Same as those for channels and angles, except metal items may be stainless steel.
6. Rated Strength: Selected to suit applicable load criteria.
7. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

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2.7 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Buckaroos, Inc.
2. CADDY; brand of nVent Electrical plc.
3. Carpenter & Paterson, Inc.
4. KB Enterprise.
5. National Pipe Hanger Corporation.

6. Pipe Shields Inc.
7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C552, Type II cellular glass with 100-psi or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psi minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C533, Type I calcium silicate with 100-psi. ASTM C552, Type II cellular glass with 100-psi or ASTM C591, Type VI, Grade 1 polyisocyanurate with 125-psi minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.8 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Hilti, Inc.
b. ITW Ramset/Red Head; Illinois Tool Works, Inc.
c. MKT Fastening, LLC.

B. Mechanical Expansion Anchors: Insert-wedge-type anchors for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cooper B-line; brand of Eaton, Electrical Sector.
b. Hilti, Inc.
c. ITW Ramset/Red Head; Illinois Tool Works, Inc.
d. MKT Fastening, LLC.

2. Indoor Applications: Zinc-coated or stainless steel.
3. Outdoor Applications: Stainless steel.

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2.9 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.10 OUTDOOR EQUIPMENT STANDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. MIRO Industries Inc.
2. RectorSeal HVAC; a CSW Industrials Company.

2.11 MATERIALS

A. Aluminum: ASTM B221.

B. Carbon Steel: ASTM A1011.

C. Structural Steel: ASTM A36, carbon-steel plates, shapes, and bars; galvanized.

D. Stainless Steel: ASTM A240.

E. Threaded Rods: Continuously threaded. Zinc-plated or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar materials as rods.

F. Grout: ASTM C1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

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PART 3 - EXECUTION

3.1 APPLICATION

A. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 HANGER AND SUPPORT INSTALLATION

A. Do not support pipes or equipment from ducts, pipes, etc.

B. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

C. Metal Trapeze Pipe-Hanger Installation: This is a delegated design to be completed by the contractor. Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A36, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1.

D. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-58. Install hangers and attachments as required to properly support piping from building structure.

E. Metal and Fiberglass Framing System Installation: This is a delegated design to be completed by the contractor. Arrange for grouping of parallel runs of piping, and support together on field-assembled strut systems.

F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

G. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

H. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

I. Equipment Support Installation: Fabricate from welded-structural-steel shapes. This is a delegated design to be completed by the contractor.

J. Install lateral bracing with pipe hangers and supports to prevent swaying.

K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, 2-1/2 inch and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

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N. Insulated Piping:

1. Attach clamps and spacers to piping.

   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe 4 inch and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe 4 inch and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. 1/4 to 3-1/2 inches: 12 inches long and 0.048 inch thick.
   b. 4 inches: 12 inches long and 0.06 inch thick.

5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. This is a delegated design to be completed by the contractor.

C. Grouting: Place grout under supports for equipment and make bearing surface smooth.

D. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

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B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1 procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

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3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use **s**tainless steel pipe hangers and fiberglass pipe hangers and fiberglass strut systems and stainless steel or corrosion-resistant attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes 1/2 to 30 inches.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes 4 to 24 inches, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes 3/4 to 36 inches, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes 1/2 to 24 inches if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes 1/2 to 4 inches, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes 3/4 to 8 inches.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes 1/2 to 8 inches.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes 1/2 to 8 inches.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes 1/2 to 8 inches.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes 3/8 to 8 inches.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes 3/8 to 3 inches.
12. U-Bolts (MSS Type 24): For support of heavy pipes 1/2 to 30 inches.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes 4 to 36 inches, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes 4 to 36 inches, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes 2-1/2 to 36 inches if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes 1 to 30 inches, from two rods if longitudinal movement caused by expansion and contraction might occur.

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18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes 2-1/2 to 24 inches, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes 2 to 42 inches if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is unnecessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes 2 to 24 inches if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is unnecessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes 2 to 30 inches if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers 3/4 to 24 inches.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers 3/4 to 24 inches if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.

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10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

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a. Horizontal (MSS Type 54): Mounted horizontally.
b. Vertical (MSS Type 55): Mounted vertically.
c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

P. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

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SECTION 23 05 48 - VIBRATION CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Spring hangers.
2. Snubbers.
3. Post-installed concrete anchors.
4. Concrete inserts.

1.2 DEFINITIONS

A. IBC: International Building Code.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device.
3. Annotate to indicate application of each product submitted and compliance with requirements.
4. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal:

1. Product Listing, Preapproval, and Evaluation Documentation: By an agency acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and basis for approval (tests or calculations).
2. Design Calculations for Vibration Isolation Devices: Calculate static and dynamic loading due to equipment weight and operating forces required to select proper vibration isolators, and to design vibration isolation bases.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

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C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct testing indicated, be an NRTL as defined by OSHA in 29 CFR 1910.7 and be acceptable to authorities having jurisdiction.

B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Schedule of Isolation is included in this specification section.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design system.

C. Consequential Damage: Provide additional restraints for suspended HVAC components or anchorage of floor-, roof-, or wall-mounted HVAC components as indicated in ASCE/SEI 7-16 so that failure of a non-essential or essential HVAC component will not cause the failure of any other essential architectural, mechanical, or electrical building component.

D. Fire/Smoke Resistance: All components that are not constructed of ferrous metals must have a maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested by an NRTL in accordance with ASTM E84 or UL 723, and be so labeled.

E. Component Supports:

1. Load ratings, features, and applications of all reinforcement components must be based on testing standards of a nationally recognized testing agency.

F. Select isolators for uniform static deflections according to distribution of weight and to meet requirements shown elsewhere in the Contract Documents.

G. Select isolators for not less than the deflections indicated on the Schedule.

H. Select vibration isolation for stable operation during starting and stopping of equipment without excessive movement of equipment.

I. Corrosion Resistance: All springs and associated metal hardware shall be designed or treated for resistance to corrosion. Steel components shall be PVC coated, or phosphated and painted with industrial grade enamel. All nuts, bolts and washers shall be zinc electroplated. Structural steel bases and exposed steel components of concrete inertia bases shall be cleaned of welding

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slag and primed with zinc-chromate or metal etching primer. A finish coat of industrial grade enamel shall be applied over the primer.

J. Outdoor Locations: Steel parts PVC coated, hot-dip galvanized, zinc-electroplated plus coating of neoprene, bitumastic paint, or powdered coating. Aluminum components for outdoor installation shall be etched and painted with industrial grade enamel. Nuts, bolts, and washers may be zinc-electroplated.

K. Springs: all springs shall be fully color-coded to indicate capacity, color striping is not considered adequate.

2.2 SPRING HANGERS

A. TYPE G

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Kinetics Noise Control, Inc.
   b. Mason Industries, Inc.
   c. VMC GROUP.
   d. Vibration Eliminator Co., Inc.

2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Minimum deflection as scheduled.
7. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
8. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
9. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

2.3 SNUBBERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Kinetics Noise Control, Inc.
2. Mason Industries, Inc.
3. VMC GROUP.

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B. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Post-Installed Concrete Anchor Bolts: Secure to concrete surface with post-installed concrete anchors. Anchors to be prequalified in accordance with ACI 355.2 testing and designated in accordance with ACI 318-14 Ch. 17 for 2015 or 2018 IBC.
2. Preset Concrete Inserts: Prequalified in accordance with ICC-ES AC446 testing.
3. Anchors in Masonry: Design in accordance with TMS 402.
4. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
5. Resilient Cushion: Maximum 1/4-inch air gap, and minimum 1/4 inch thick.

2.4 POST-INSTALLED CONCRETE ANCHORS

A. Mechanical Anchor Bolts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cooper B-line; brand of Eaton, Electrical Sector.
b. Hilti, Inc.
c. Mason Industries, Inc.
d. Unistrut; Atkore International.

2. Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength for anchor and as tested according to ASTM E488.

B. Adhesive Anchor Bolts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cooper B-line; brand of Eaton, Electrical Sector.
b. Hilti, Inc.
c. Mason Industries, Inc.
d. Unistrut; Atkore International.

2. Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E488.

C. Provide post-installed concrete anchors that have been prequalified for use in wind-load applications. Post-installed concrete anchors must comply with all requirements of ASCE/SEI 7-05, Ch. 13.

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1. Prequalify post-installed anchors in concrete in accordance with ACI 355.2 or other approved qualification testing procedures.
2. Prequalify post-installed anchors in masonry in accordance with approved qualification procedures.

D. Expansion-type anchor bolts are not permitted for equipment in excess of 10 hp that is not vibration isolated.

1. Undercut expansion anchors are permitted.

2.5 CONCRETE INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-line; brand of Eaton, Electrical Sector
2. Hilti, Inc.
3. Mason Industries, Inc.
4. Unistrut; Atkore International.

B. Provide preset concrete inserts that are prequalified in accordance with ICC-ES AC466 testing.

C. Comply with ANSI/MSS SP-58.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation and wind-load control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Strength of Support Assemblies: The minimum static deflection of the first three hangers shall equal that of the isolators supporting the equipment. Thereafter, provide isolators with 1/2 the static deflection capabilities of the isolation system of the equipment to which it is connected.

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3.3 INSTALLATION OF VIBRATION DEVICES

A. Provide vibration devices for systems and equipment as scheduled in this section, where Specifications indicate they are to be installed on specific equipment and systems, and where required by applicable codes.

B. Coordinate location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 230500 "Common Work Results for HVAC."

C. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

D. Install isolators in locations to permit inspection and adjustment, and to provide proper operation. Install isolators as high as possible in hanger rod assembly, but clear of structure. Maintain 2-inch clearance between isolated equipment and walls, ceilings and other equipment. Maintain side clearance for hanger housings to allow a full 360-degree hanger rotation about the rod axis without contacting any object. Isolated systems shall be independently supported.

E. Equipment Restraints:

1. Install snubbers or thrust restraint isolation on HVAC equipment mounted on vibration isolators to prevent movement in excess of ¼-inch dur to dynamic forces. Locate snubbers or thrust restraints as close as possible to vibration isolators and bolt to equipment base and supporting structure.
2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.

F. Piping Restraints:

1. Comply with requirements in MSS SP-127.
2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
3. Brace a change of direction longer than 12 feet.

G. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

H. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

I. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members. Provide structural base plate under isolator where isolator is wider than supporting structural member. Tack weld plate to structural member.

J. Post-Installed Concrete Anchors:

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1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge-Type Anchor Bolts: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive-Type Anchor Bolts: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

NOT FOR BIDDING PURPOSES

3.4 ACCOMMODATION OF DIFFERENTIAL MOTION

A. Provide flexible connections in piping systems where they cross structural joints and other point where differential movement may occur. Provide adequate flexibility to accommodate differential movement as determined in accordance with ASCE/SEI 7.

3.5 EQUIPMENT ISOLATION SCHEDULE

A. If the mount baseplate is bolted to structure or framework rigidly connected to the structure, elastomeric grommets shall be used between each bolt and the baseplate to prevent rigid connection. These additional neoprene washers and bushings may be omitted if the baseplate and friction pad incorporate neoprene elements that eliminate rigid contact between bolts and the baseplate. Bolt holes shall be properly sized to allow for bushing sleeve. The anchor bolt shall incorporate steel washers to distribute load evenly over neoprene washers.

B. Equipment Isolation Schedule

TYPE OF EQUIPMENT	SUPPORTING STRUCTURE			
	FLOOR SLAB ON EARTH		OTHER FLOOR AND ROOF	
	ISOLATION BASE TYPE	MIN. STATIC DEFLECTION IN INCHES	ISOLATION BASE TYPE	MIN. STATIC DEFLECTION IN INCHES
In-line Centrifugal Fans				
Suspended (Note 2)				
225-349 rpm	-	-	G	3.5
350-499 rpm	-	-	G	2.5
500 rpm and Over	-	-	G	1.5
Unit Heaters –	-	-	G	1.0 Note 1

TYPE OF EQUIPMENT	SUPPORTING STRUCTURE			
	FLOOR SLAB ON EARTH		OTHER FLOOR AND ROOF	
	ISOLATION BASE TYPE	MIN. STATIC DEFLECTION IN INCHES	ISOLATION BASE TYPE	MIN. STATIC DEFLECTION IN INCHES
Suspended				
Fan Coil Units – Suspended	-	-	G	1.0 Note 1

NOTES:
1) Spring Deflection
2) When fan is suspended, the specified isolation shall be provided in the suspension framework.

3.6 ADJUSTING

A. Adjust isolators after system is at operating weight.

B. Adjust leveling bolts and hanger rod bolts so that isolated equipment is level and in proper alignment with connecting ducts and pipes. All vibration isolators shall be aligned squarely above or below mounting points of supported equipment.

3.7 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections with the assistance of a factory-authorized service representative.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.
3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
5. Test to 90 percent of rated proof load of device.
6. Measure isolator restraint clearance.
7. Measure isolator deflection.
8. Verify snubber minimum clearances.

D. Remove and replace malfunctioning units and retest as specified above.

NOT FOR BIDDING PURPOSES

E. Prepare test and inspection reports.

END OF SECTION 230548

NOT FOR BIDDING PURPOSES

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING, DUCTWORK AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Warning tape.
4. Pipe labels.
5. Duct labels.
6. Warning tags.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Equipment-Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

NOT FOR BIDDING PURPOSES

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Brady Corporation.
   b. Craftmark Pipe Markers.
   c. Seton Identification Products; a Brady Corporation company.

2. Material and Thickness: Brass, 0.032-inch minimum thickness, with predrilled or stamped holes for attachment hardware.
3. Letter and Background Color: As indicated for specific application under Part 3.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

6. Fasteners: Stainless steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

2.2 WARNING SIGNS AND LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation.
2. Craftmark Pipe Markers.
3. Seton Identification Products; a Brady Corporation company.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, with predrilled holes for attachment hardware.

C. Letter and Background Color: As indicated for specific application under Part 3.

D. Maximum Temperature: Able to withstand temperatures of up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless steel rivets or self-taping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Arc-Flash Warning Signs: Provide arc-flash warning signs in locations and with content in accordance with requirements of OSHA and NFPA70E and other applicable codes and standards.

J. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 WARNING TAPE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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1. Brady Corporation.
2. Craftmark Pipe Markers.
3. Seton Identification Products; a Brady Corporation company.

B. Material: Vinyl.

C. Minimum Thickness: 0.005 inch.

D. Letter, Pattern, and Background Color: As indicated for specific application under Part 3.

E. Waterproof Adhesive Backing: Suitable for indoor or outdoor use.

F. Maximum Temperature: 160 deg F.

G. Minimum Width: 2 inches.

2.4 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation.
2. Craftmark Pipe Markers.
3. Seton Identification Products; a Brady Corporation company.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color coded, with lettering indicating service and showing flow direction in accordance with ASME A13.1.

C. Letter and Background Color: As indicated for specific application under Part 3.

D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings. Also include:

1. Pipe size.
2. Flow-Direction Arrows: Include flow-direction arrows on distribution piping. Arrows may be either integral with label or applied separately.
3. Lettering Size: At least 1/2 inch for viewing distances of up to 72 inches and proportionately larger lettering for greater viewing distances.

2.5 DUCT LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation.
2. Craftmark Pipe Markers.

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3. Seton Identification Products; a Brady Corporation company.

B. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.

C. Letter and Background Color: As indicated for specific application under Part 3.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings. Also include the following:

1. Duct size.
2. Flow-Direction Arrows: Include flow-direction arrows on distribution ducts. Arrows may be either integral with label or may be applied separately.
3. Lettering Size: At least 1/2 inch for viewing distances of up to 72 inches and proportionately larger lettering for greater viewing distances.

2.6 WARNING TAGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Brady Corporation.
2. Craftmark Pipe Markers.
3. Seton Identification Products; a Brady Corporation company.

B. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.

1. Size: 3 by 5-1/4 inches minimum.
2. Fasteners: Reinforced grommet and wire or string.
3. Nomenclature: Large-size primary caption, such as "DANGER," "CAUTION," or "DO NOT OPERATE."
4. Letter and Background Color: As indicated for specific application under Part 3.

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PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping, ductwork and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 INSTALLATION, GENERAL REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

D. Locate identifying devices so that they are readily visible from the point of normal approach.

3.3 INSTALLATION OF EQUIPMENT LABELS, WARNING SIGNS, AND LABELS

A. Permanently fasten labels on each item of mechanical equipment.

B. Sign and Label Colors:

1. White letters on an ANSI Z535.1 safety-blue background.

C. Locate equipment labels where accessible and visible.

D. Arc-Flash Warning Signs: Provide arc-flash warning signs on electrical disconnects and other equipment where arc-flash hazard exists, as indicated on Drawings, and in accordance with requirements of OSHA and NFPA 70E, and other applicable codes and standards.

E. Equipment requiring identification is all equipment specified in Division 23.

3.4 INSTALLATION OF WARNING TAPE

A. Warning Tape Color and Pattern: Yellow background with black diagonal stripes.

B. Install warning tape on pipes and ducts, with cross-designated walkways providing less than 6 ft. of clearance.

C. Locate tape so as to be readily visible from the point of normal approach.

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3.5 INSTALLATION OF PIPE LABELS

A. Install pipe labels showing service and flow direction with permanent adhesive on pipes.

B. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. At access doors and similar access points that permit view of concealed piping.
2. Within 3 ft. of equipment items and other points of origination and termination.
3. Spaced at maximum intervals of 25 ft. along each run. Reduce intervals to 10 ft. in areas of congested piping, ductwork, and equipment.

C. Do not apply plastic pipe labels or plastic tapes directly to bare pipes conveying fluids at temperatures of 125 deg F or higher. Where these pipes are to remain uninsulated, use a short section of insulation or use stenciled labels.

D. Flow-Direction Arrows: Use arrows to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

E. Pipe-Label Color Schedule:

1. Refrigerant Piping: White letters on an ANSI Z535.1 safety-blue background.

3.6 INSTALLATION OF DUCT LABELS

A. Install self-adhesive duct labels showing service and flow direction with permanent adhesive on air ducts.

1. Provide labels in the following color codes:

a. For air supply ducts: White letters on blue background.
b. For air return ducts: White letters on blue background.
c. For exhaust-, outside-, relief-, return-, and mixed-air ducts: White letters on blue background.

B. Locate label near each point where ducts enter into and exit from concealed spaces and at maximum intervals of 20 ft. where exposed or are concealed by removable ceiling system.

C. Stenciled Access Panels and Door Labels, Equipment Labels, and Similar Operational Instructions:

1. Black letters on White background.

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3.7 INSTALLATION OF WARNING TAGS

A. Warning Tag Color: Black letters on an ANSI Z535.1 safety-yellow background.

B. Attach warning tags, with proper message, to equipment and other items where indicated on Drawings and scheduled.

END OF SECTION 230553

NOT FOR BIDDING PURPOSES

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Testing, Adjusting, and Balancing of Air Systems:

a. Constant-volume air systems.

2. Testing, adjusting, and balancing of equipment.

1.2 DEFINITIONS

A. NEBB: National Environmental Balancing Bureau.

B. TAB: Testing, adjusting, and balancing.

C. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report, as specified in Part 3.

C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures, as specified in "Preparation" Article.

D. System Readiness Checklists: Within 30 days of Contractor's Notice to Proceed, submit system readiness checklists, as specified in "Preparation" Article.

E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.

F. Certified TAB reports.

G. Sample report forms.

H. Instrument calibration reports, to include the following:

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1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.4 QUALITY ASSURANCE

A. TAB Specialists Qualifications, Certified by NEBB:

1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB.
2. TAB Technician: Employee of the TAB specialist and certified by NEBB.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

D. Code and AHJ Compliance: TAB is required to comply with governing codes and requirements of authorities having jurisdiction.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine equipment performance data, including fan curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

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2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

F. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

G. Examine test reports specified in individual system and equipment Sections.

H. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

I. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

J. Examine operating safety interlocks and controls on HVAC equipment.

K. Examine control dampers for proper installation for their intended function of isolating, throttling, diverting, or mixing air flows.

L. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes the following:

1. Equipment and systems to be tested.
2. Strategies and step-by-step procedures for balancing the systems.
3. Instrumentation to be used.
4. Sample forms with specific identification for all equipment.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
b. Duct systems are complete with terminals installed.
c. Volume dampers are open and functional.
d. Clean filters are installed.
e. Fans are operating, free of vibration, and rotating in correct direction.
f. Ceilings are installed.
g. Windows and doors are installed.
h. Suitable access to balancing devices and equipment is provided.

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3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system in accordance with the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.

B. Cut insulation, ducts, pipes, and equipment casings for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
2. Where holes for probes are required in piping or hydronic equipment, install pressure and temperature test plugs to seal systems.
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish in accordance with Section 230713 "Duct Insulation."

C. Mark equipment and balancing devices, including damper-control positions, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 TESTING, ADJUSTING, AND BALANCING OF HVAC EQUIPMENT

A. Test, adjust, and balance HVAC equipment indicated on Drawings, including, but not limited to, the following:

1. Motors.
2. Fans.
3. Split-system heat pumps.
4. Variable Refrigerant Flow (VRF) Systems.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' Record drawings duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

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F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling-unit components.

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Set outside-air and return-air dampers for proper position that simulates minimum outdoor-air conditions.
b. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses close to the fan and prior to any outlets, to obtain total airflow.
c. Where duct conditions are unsuitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.

2. Measure fan static pressures as follows:

a. Measure static pressure directly at the fan outlet or through the flexible connection.
b. Measure static pressure directly at the fan inlet or through the flexible connection.
c. Measure static pressure across each component that makes up the air-handling system.
d. Report artificial loading of filters at the time static pressures are measured.

3. Review Contractor-prepared shop drawings and Record drawings to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
4. Obtain approval from Engineer for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

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1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, speed, volts, amps, and static profile.
4. Mark all final settings.
5. Measure and record all operating data.
6. Record final fan-performance data.

3.7 PROCEDURES FOR MOTORS

A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Phase and hertz.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter size and thermal-protection-element rating.
8. Service factor and frame size.

3.8 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Supply and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

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3.9 PROGRESS REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for system-balancing devices. Recommend changes and additions to system-balancing devices, to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance-measuring and -balancing devices.

B. Status Reports: Prepare biweekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.10 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents, including the following:

    a. Indicated versus final performance.

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b. Notable characteristics of systems.
c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans performance forms, including the following:

a. Settings for outdoor-, return-, and exhaust-air dampers.
b. Conditions of filters.
c. Cooling coil, wet- and dry-bulb conditions.
d. Heating coil, dry-bulb conditions.
e. Fan drive settings, including settings and percentages of maximum pitch diameter.
f. Settings for pressure controller(s).
g. Other system operating conditions that affect performance.

D. Fan Test Reports: For supply and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and speed.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan speed.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

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E. Round and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System fan and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F.
d. Duct static pressure in inches wg.
e. Duct size in inches.
f. Duct area in sq. ft.
g. Indicated airflow rate in cfm.
h. Indicated velocity in fpm.
i. Actual airflow rate in cfm.
j. Actual average velocity in fpm.
k. Barometric pressure in psig.

F. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

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3.11 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Commissioning Authority.

B. Commissioning Authority shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to the lesser of either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the TAB shall be considered incomplete and shall be rejected.

E. If recheck measurements find the number of failed measurements noncompliant with requirements indicated, proceed as follows:

1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection. All changes shall be tracked to show changes made to previous report.
2. If the second final inspection also fails, Owner may pursue others Contract options to complete TAB work.

F. Prepare test and inspection reports.

3.12 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

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SECTION 23 07 13 - DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
4. Indoor, exposed exhaust between isolation damper and penetration of building exterior.

B. Related Requirements:

1. Section 230719 "HVAC Piping Insulation."
2. Section 233113 "Metal Ducts" for duct liners.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or craft training program.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers are to be marked with the manufacturer's name, appropriate ASTM standard designation, type and grade, and maximum use temperature.

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1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84 or UL723, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.

1. All Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General" and "Indoor Duct and Plenum Insulation Schedule" articles for where insulating materials are to be applied.

B. Products do not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

D. Insulation materials for use on austenitic stainless steel are qualified as acceptable in accordance with ASTM C795.

E. Foam insulation materials do not use CFC or HCFC blowing agents in the manufacturing process.

F. Glass-Fiber Blanket: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to 450 deg F in accordance with ASTM C411. Comply with ASTM C553,

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Type II, and ASTM C1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. CertainTeed; SAINT-GOBAIN.
    b. Johns Manville; a Berkshire Hathaway company.
    c. Knauf Insulation.
    d. Manson Insulation Inc.
    e. Owens Corning.

G. Glass-Fiber Board Insulation: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature between 35 deg F and 250 deg F for jacketed and between 35 deg F and 450 deg F for unfaced in accordance with ASTM C411. Comply with ASTM C612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. CertainTeed; SAINT-GOBAIN.
    b. Johns Manville; a Berkshire Hathaway company.
    c. Knauf Insulation.
    d. Manson Insulation Inc.
    e. Owens Corning.

H. Glass-Fiber, Pipe and Tank: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature between 35 deg F and 850 deg F, in accordance with ASTM C411. Comply with ASTM C1393.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. CertainTeed; SAINT-GOBAIN.
    b. Johns Manville; a Berkshire Hathaway company.
    c. Knauf Insulation.
    d. Manson Insulation Inc.
    e. Owens Corning.

2. Semirigid board material with factory-applied FSK jacket.
3. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.3 ADHESIVES

A. Materials are compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

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B. Glass-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Eagle Bridges - Marathon Industries.
c. Foster Brand; H. B. Fuller.
d. Mon-Eco Industries, Inc.

C. FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Eagle Bridges - Marathon Industries.
c. Foster Brand; H. B. Fuller.
d. Mon-Eco Industries, Inc.

2.4 MASTICS AND COATINGS

A. Materials are compatible with insulation materials, jackets, and substrates.

B. Vapor-Retarder Mastic, Water Based, Interior Use: Suitable for indoor use on below ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller.
c. Knauf Insulation.
d. Vimasco Corporation.

2. Water-Vapor Permeance: Comply with ASTM C755, Section 7.2.2, Table 2, for insulation type and service conditions.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Comply with MIL-PRF-19565C, Type II, for permeance requirements.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.

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b. Eagle Bridges - Marathon Industries.
c. Foster Brand; H. B. Fuller.
d. Knauf Insulation.
e. Mon-Eco Industries, Inc.
f. Vimasco Corporation.

2. Water-Vapor Permeance: ASTM E96, greater than 1.0 perm at manufacturer's recommended dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A, and are compatible with insulation materials, jackets, and substrates.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller.
c. Vimasco Corporation.

2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
3. Service Temperature Range: 0 to plus 180 deg F.
4. Color: White.

B. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C1136, Type II.

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2.6 FIELD-APPLIED JACKETS

A. Field-applied jackets comply with ASTM C921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Mesh: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. in. for covering ducts.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Foster Brand; H. B. Fuller.

B. Woven Polyester Mesh: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for ducts.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Foster Brand; H. B. Fuller.
    c. Vimasco Corporation.

2.8 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Cloth: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Alpha Associates, Inc.

2.9 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C1136.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. 3M Industrial Adhesives and Tapes Division.
    b. Avery Dennison Corporation, Specialty Tapes Division.
    c. Ideal Tape Co., Inc., an American Biltrite Company.
    d. Knauf Insulation.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

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1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. 3M Industrial Adhesives and Tapes Division.
    b. Avery Dennison Corporation, Specialty Tapes Division.
    c. Ideal Tape Co., Inc., an American Biltrite Company.
    d. Knauf Insulation.
    e. Sekisui Voltek, LLC.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.10 SECUREMENTS

A. Bands:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Johns Manville; a Berkshire Hathaway company.
    b. RPR Products, Inc.

2. Stainless Steel: ASTM A240, Type 316; 0.015 inch thick, 1/2 inch wide with wing seal.
3. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

    a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

        1) AGM Industries, Inc.
        2) CL WARD & Family Inc.
        3) Gemco.
        4) Midwest Fasteners, Inc.
        5) Nelson Stud Welding.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

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D. Wire: 0.062-inch soft-annealed, stainless steel.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. C & F Wire Products.
b. Johns Manville; a Berkshire Hathaway company.
c. RPR Products, Inc.

2.11 CORNER ANGLES

A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum in accordance with ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

B. Stainless Steel Corner Angles: 0.024 inch thick, minimum 2 by 1 inch, stainless steel in accordance with ASTM A240, Type 316.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

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E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with Contract Documents.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Vapor barrier installation: seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory applied jackets as follows:

1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
    a. Apply vapor-barrier mastic over staples.
4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

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N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

3.5 INSTALLATION OF GLASS-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

B. Comply with manufacturer's written installation instructions.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

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4. For ducts and plenums, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 60 deg F at 18-foot intervals. Vapor stops consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

C. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-

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inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
b. Install vapor stops for ductwork and plenums operating below 60 deg F at 18-foot intervals. Vapor stops consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.6 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

3.7 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

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C. Do not field paint aluminum or stainless steel jackets.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect ductwork, randomly selected by Owner, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection is limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
4. Indoor, exposed exhaust between isolation damper and penetration of building exterior.

B. Plenums and Ducts Requiring Vapor Barrier:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
4. Indoor, exposed exhaust between isolation damper and penetration of building exterior.

C. Items Not Insulated:

1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
2. Factory-insulated flexible ducts.
3. Factory-insulated plenums and casings.
4. Flexible connectors.
5. Vibration-control devices.
6. Factory-insulated access panels and doors.

3.10 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, round, supply-air duct insulation is the following:

1. Glass-Fiber Blanket: 2-3/16 inches thick and 0.75 lb/cu. ft. nominal density.

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B. Concealed, round, outdoor-air duct insulation is the following:

1. Glass-Fiber Blanket: 3 inches thick and 0.75 lb/cu. ft. nominal density.

C. Concealed, rectangular, supply-air duct insulation is the following:

1. Glass-Fiber Blanket: 2-3/16 inches thick and 0.75 lb/cu. ft. nominal density.

D. Concealed, rectangular, outdoor-air duct insulation is the following:

1. Glass-Fiber Blanket: 3 inches thick and 0.75 lb/cu. ft. nominal density.

E. Concealed, supply-air plenum insulation is the following:

1. Glass-Fiber Blanket: 2-3/16 inches thick and 0.75 lb/cu. ft. nominal density.

F. Concealed, return-air plenum insulation is the following:

1. Glass-Fiber Blanket: 2-3/16 inches thick and 0.75 lb/cu. ft. nominal density.

G. Concealed, outdoor-air plenum insulation is the following:

1. Glass-Fiber Blanket: 3 inches thick and 0.75 lb/cu. ft. nominal density.

H. Concealed, exhaust-air plenum insulation is the following:

1. Glass-Fiber Blanket: 3 inches thick and 0.75 lb/cu. ft. nominal density.

I. Exposed, round, supply-air duct insulation is the following:

1. Glass-Fiber Pipe and Tank: 2 inches thick.

J. Exposed, round, outdoor-air duct insulation is the following:

1. Glass-Fiber Pipe and Tank: 3 inches thick.

K. Exposed, rectangular, supply-air duct insulation is the following:

1. Glass-Fiber Board: 1-1/2 inches thick and 1.6 lb/cu. ft. nominal density.

L. Exposed, rectangular, outdoor-air duct insulation is the following:

1. Glass-Fiber Board: 2 inches thick and 1.6 lb/cu. ft. nominal density.

M. Exposed, supply-air plenum insulation is the following:

1. Glass-Fiber Board: 1-1/2 inches thick and 1.6 lb/cu. ft. nominal density.

N. Exposed, return-air plenum insulation is the following:

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1. Glass-Fiber Board: 1-1/2 inches thick and 1.6 lb/cu. ft. nominal density.

O. Exposed, outdoor-air plenum insulation is the following:

1. Glass-Fiber Board: 2 inches thick and 1.6 lb/cu. ft. nominal density.

P. Exposed, exhaust-air plenum insulation is the following:

1. Glass-Fiber Board: 2 inches thick and 1.6 lb/cu. ft. nominal density.

3.11 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:

1. FSK

D. Ducts and Plenums, Exposed in mechanical equipment rooms:

1. Field-Applied Fabric-Reinforcing Mesh
2. Field-Applied Cloths

END OF SECTION 230713

NOT FOR BIDDING PURPOSES

SECTION 23 07 19 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulation for HVAC piping systems.

B. Related Requirements:

1. Section 230713 "Duct Insulation" for duct insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied, if any).

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or craft training program**,** certified by the Department of Labor, Bureau of Apprenticeship and Training.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation system materials are to be delivered to the Project site in unopened containers. The packaging is to include name of manufacturer, fabricator, type, description, and size, as well as ASTM standard designation, and maximum use temperature.

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1.6 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products in accordance with ASTM E84 or UL723 by a testing agency acceptable to authority having jurisdiction. Factory label insulation, jacket materials, adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.

1. All Insulation Installed Indoors and Outdoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2.2 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," and "Outdoor, Aboveground Piping Insulation Schedule" articles for where insulating materials are applied.

B. Products do not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come into contact with stainless steel have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

D. Insulation materials for use on austenitic stainless steel are qualified as acceptable in accordance with ASTM C795.

E. Foam insulation materials do not use CFC or HCFC blowing agents in the manufacturing process.

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F. Flexible Elastomeric: Closed-cell, or expanded-rubber materials; suitable for maximum use temperature between minus 70 deg F and 220 deg F. Comply with ASTM C534, Type I, for tubular materials, Type II for sheet materials.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Aeroflex USA.
b. Armacell LLC.
c. K-Flex USA.

G. Glass-Fiber, Preformed Pipe: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature up to 850 deg F in accordance with ASTM C411. Comply with ASTM C547.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Johns Manville; a Berkshire Hathaway company.
b. Knauf Insulation.
c. Manson Insulation Inc.
d. Owens Corning.

2. Preformed Pipe Insulation: Type I, Grade A with factory-applied ASJ.
3. Fabricated shapes in accordance with ASTM C450 and ASTM C585.
4. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

H. Glass-Fiber, Pipe and Tank: Glass fibers bonded with a thermosetting resin; suitable for maximum use temperature between 35 deg F and 850 deg F, in accordance with ASTM C411. Comply with ASTM C1393.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. CertainTeed; SAINT-GOBAIN.
b. Johns Manville; a Berkshire Hathaway company.
c. Knauf Insulation.
d. Manson Insulation Inc.
e. Owens Corning.

2. Semirigid board material with factory-applied ASJ jacket.
3. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.3 INSULATING CEMENTS

A. Glass-Fiber Insulating Cement: Comply with ASTM C195.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

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a. Ramco Insulation, Inc.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C196.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Ramco Insulation, Inc.

C. Glass-Fiber Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C449.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Ramco Insulation, Inc.

2.4 ADHESIVES

A. Materials are compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Solvent-based adhesive.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Aeroflex USA.
b. Armacell LLC.
c. K-Flex USA.

2. Flame-spread index is 25 or less and smoke-developed index is 50 or less as tested in accordance with ASTM E84.
3. Wet Flash Point: Below 0 deg F.
4. Service Temperature Range: 40 to 200 deg F.
5. Color: Black.

C. Glass-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller.
c. Mon-Eco Industries, Inc.

D. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A, for bonding insulation jacket lap seams and joints.

NOT FOR BIDDING PURPOSES

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Foster Brand; H. B. Fuller.
    c. Mon-Eco Industries, Inc.

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Johns Manville; a Berkshire Hathaway company.
    b. P.I.C. Plastics, Inc.
    c. Proto Corporation.
    d. Sekisui Voltek, LLC.
    e. Speedline Corporation.
    f. The Dow Chemical Company.

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2.5 MASTICS AND COATINGS

A. Materials are compatible with insulation materials, jackets, and substrates.

B. Vapor-Retarder Mastic, Water Based: Suitable for indoor use on below-ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Foster Brand; H. B. Fuller.
    c. Knauf Insulation.
    d. Mon-Eco Industries, Inc.
    e. Vimasco Corporation.

2. Water-Vapor Permeance: Comply with ASTM E96 or ASTM F1249.
3. Service Temperature Range: 0 to plus 180 deg F.
4. Comply with MIL-PRF-19565C, Type II, for permeance requirements, with supplier listing on DOD QPD - Qualified Products Database.
5. Color: White.

C. Vapor-Retarder Mastic, Solvent Based, Outdoor Use: Suitable for outdoor use on below-ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Childers Brand; H. B. Fuller Construction Products.
    b. Foster Brand; H. B. Fuller.

2. Water-Vapor Permeance: Comply with ASTM E96 or ASTM F1249.
3. Service Temperature Range: Minus 50 to plus 220 deg F.
4. Color: White.

D. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller.
c. Knauf Insulation.
d. Mon-Eco Industries, Inc.
e. Vimasco Corporation.

2. Water-Vapor Permeance: ASTM E96, greater than 1.0 perm at manufacturer's recommended dry film thickness.
3. Service Temperature Range: 0 to plus 180 deg F.
4. Color: White.

2.6 LAGGING ADHESIVES

A. Adhesives comply with MIL-A-3316C, Class I, Grade A, and are compatible with insulation materials, jackets, and substrates.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller.
c. Vimasco Corporation.

2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
3. Service Temperature Range: 20 to plus 180 deg F.
4. Color: White.

2.7 SEALANTS

A. Materials are as recommended by the insulation manufacturer and are compatible with insulation materials, jackets, and substrates.

B. Joint Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller.
c. Mon-Eco Industries, Inc.
d. Owens Corning.

2. Permanently flexible, elastomeric sealant.

a. Service Temperature Range: Minus 150 to plus 250 deg F.
b. Color: White or gray.

C. Metal Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller.
c. Mon-Eco Industries, Inc.

2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.

D. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller.

2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.

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2.8 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C1136, Type I.

2.9 FIELD-APPLIED JACKETS

A. Field-applied jackets comply with ASTM C1136, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Airex Manufacturing Inc.
b. Johns Manville; a Berkshire Hathaway company.
c. P.I.C. Plastics, Inc.
d. Proto Corporation.
e. Speedline Corporation.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

C. Metal Jacket:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Johns Manville; a Berkshire Hathaway company.
b. RPR Products, Inc.

2. Aluminum Jacket: Comply with ASTM B209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

a. Sheet and roll stock ready for shop or field sizing or factory cut and rolled to size.
b. Finish and thickness are indicated in field-applied jacket schedules.
c. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
d. Moisture Barrier for Outdoor Applications: 53-mil- thick, heat-bonded polyethylene and kraft paper.
e. Factory-Fabricated Fitting Covers:

1) Same material, finish, and thickness as jacket.
2) Preformed two-piece or gore, 45- and 90-degree, short- and long-radius elbows.
3) Tee covers.
4) Flange and union covers.
5) End caps.
6) Beveled collars.
7) Valve covers.

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8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.10 FIELD-APPLIED FABRIC REINFORCING MESH

A. Woven Glass-Fiber Mesh: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Childers Brand; H. B. Fuller Construction Products.

B. Woven Polyester Mesh: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Childers Brand; H. B. Fuller Construction Products.
b. Foster Brand; H. B. Fuller.
c. Vimasco Corporation.

2.11 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Cloth: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Alpha Associates, Inc.

2.12 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C1136.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. 3M Industrial Adhesives and Tapes Division.
b. Avery Dennison Corporation, Specialty Tapes Division.
c. Ideal Tape Co., Inc., an American Biltrite Company.
d. Knauf Insulation.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.

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5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. 3M Industrial Adhesives and Tapes Division.
   b. Ideal Tape Co., Inc., an American Biltrite Company.

2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. 3M Industrial Adhesives and Tapes Division.
   b. Avery Dennison Corporation, Specialty Tapes Division.
   c. Ideal Tape Co., Inc., an American Biltrite Company.
   d. Knauf Insulation.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

NOT FOR BIDDING PURPOSES

2.13 SECUREMENTS

A. Bands:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Johns Manville; a Berkshire Hathaway company.
   b. RPR Products, Inc.

2. Stainless Steel: ASTM A240, Type 316; 0.015 inch thick, 1/2 inch wide with wing seal.

3. Aluminum: ASTM B209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

A. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

B. Wire: 0.062-inch soft-annealed, stainless steel.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. C & F Wire Products.
b. Johns Manville; a Berkshire Hathaway company.
c. RPR Products, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, compress, or otherwise damage insulation or jacket.

NOT FOR BIDDING PURPOSES

D. Install insulation with longitudinal seams at top and bottom (12 o'clock and 6 o'clock positions) of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet during storage or in the installation process before being properly covered and sealed in accordance with the Contract Documents.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth, but not to the extent of creating wrinkles or areas of compression in the insulation.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 2 inches o.c.
4. For below-ambient services, apply vapor-barrier mastic over staples.
5. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.
6. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

NOT FOR BIDDING PURPOSES

M. Cut insulation in a manner to avoid compressing insulation.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.

NOT FOR BIDDING PURPOSES

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles below.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using prefabricated fitting insulation or mitered or routed fittings made from same material and density as that of adjacent pipe insulation. Each piece is butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with prefabricated fitting insulation or sectional pipe insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using prefabricated fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using prefabricated fitting insulation or sectional pipe insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges, mechanical couplings, and unions using a section of oversized preformed pipe insulation to fit. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket, except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.

NOT FOR BIDDING PURPOSES

C. Install removable insulation covers. Installation conforms to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Installation shall follow the manufacturer's installation instructions or ASTM C 1710.

B. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Flanges:

1. Slit tubular sections and apply onto piping or tubing. Alternatively, slide un-slit sections over the open ends of piping or tubing.
2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
3. Insulation must be installed in compression to allow for expansion and contraction.
4. Insulation shall be pushed onto the pipe, never pulled. Stretching of insulation may result in open seams and joints.
5. For below-ambient systems, adhere the insulation to the pipe at least every 18 feet using manufacturer's adhesive. Completely terminate joints at critical points such as flanges, T-sections, elbows, supports, and similar fittings.

D. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. Install sections of pipe insulation and miter if required in accordance with manufacturer's written instructions.
3. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

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E. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. Install pipe insulation to outer diameter of pipe flange.
3. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
4. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
5. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF GLASS-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install prefabricated pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with glass-fiber or mineral-wool blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

NOT FOR BIDDING PURPOSES

1. Install prefabricated sections of same material as that of straight segments of pipe insulation when available.
2. When prefabricated sections are not available, install fabricated sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 INSTALLATION OF FIELD-APPLIED JACKETS

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated and for horizontal applications, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches o.c. and at end joints.

3.9 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless steel jackets.

NOT FOR BIDDING PURPOSES

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections with the assistance of a factory-authorized service representative.

B. Tests and Inspections: Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection is limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.11 PIPING INSULATION SCHEDULE, GENERAL

A. Insulation conductivity and thickness per pipe size comply with schedules in this Section or with requirements of authorities having jurisdiction, whichever is more stringent.

B. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

C. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Underground piping.
2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.12 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F:

1. All Pipe Sizes: Insulation is one of the following:

a. Flexible Elastomeric: 1 inch thick.
b. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

B. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation is one of the following:

a. Flexible Elastomeric: 1 inch thick.
b. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

C. Refrigerant Suction and Hot-Gas Flexible Tubing:

NOT FOR BIDDING PURPOSES

1. All Pipe Sizes: Insulation is one of the following:

    a. Flexible Elastomeric: 2 inches thick.

D. Refrigerant Liquid Piping:

1. All Pipe Sizes: Insulation is one of the following:

    a. Flexible Elastomeric: 1 inch thick.
    b. Glass-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

3.13 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation is one of the following:

    a. Flexible Elastomeric: 2 inches thick.
    b. Glass-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

B. Refrigerant Suction and Hot-Gas Flexible Tubing:

1. All Pipe Sizes: Insulation is the following:

    a. Flexible Elastomeric: 2 inches thick.

C. Refrigerant Liquid Piping:

1. All Pipe Sizes: Insulation is one of the following:

    a. Flexible Elastomeric: 2 inches thick.

3.14 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. ASJ

D. Piping, Exposed in mechanical equipment rooms:

1. Field-Applied Fabric-Reinforcing Mesh
2. Field-Applied Cloths

NOT FOR BIDDING PURPOSES

3.15 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Exposed:

1. Aluminum, Smooth with Z-Shaped Locking Seam: 0.024 inch thick.

END OF SECTION 230719

NOT FOR BIDDING PURPOSES

SECTION 23 23 00 - REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper tube and fittings.
2. Valves and specialties.
3. Refrigerants.

1.2 ACTION SUBMITTALS

A. Product Data Submittals: For each non packaged DX system.

1. Submit data for each type of refrigerant piping, fitting, valve, piping specialty, and refrigerant.
2. Submit ASHRAE 15-2022 compliance statement.

B. Delegated Design Submittals: For refrigerant piping size and layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

1.3 INFORMATIONAL SUBMITTALS

A. Field Quality-Control Reports: For each field quality control test and inspection.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store piping with end caps in place to ensure that piping interior and exterior are clean when installed.

B. Prepare valves and specialties for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads and other end connections.

NOT FOR BIDDING PURPOSES

C. Use the following precautions during storage:

1. Maintain valve and specialty end protection.
2. Store valves and specialties indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," for refrigerant piping size and layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

B. For A2L refrigerants, comply with UL 484, UL/CSA 60335-2-40 or UL/CSA 60335-2-89.

C. Comply with ASHRAE 15-2022.
1. Manufacturer's Refrigerant Leak Detection System Requirements.
2. Mitigation Action Requirements.
3. Signs and Identification

D. Comply with ASME B31.5.

E. Test Pressure for A2L Refrigerants R-32 and R-454B:

1. Suction Tubing for Refrigeration and Air-Conditioning Applications Other than Heat Pumps: 300 psig.
2. Suction Tubing for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Tubing Lines: 535 psig.

F. Test Pressure for Refrigerant R-410A:

1. Suction Tubing for Refrigeration and Air-Conditioning Applications Other than Heat Pumps: 300 psig.
2. Suction Tubing for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Tubing Lines: 535 psig.

2.2 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B280, Type ACR.

B. Wrought-Copper Fittings, Solder Joint: ASME B16.22.

C. Wrought-Copper Fittings, Brazed Joint: ASME B16.50.

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D. Wrought-Copper Unions: ASME B16.22.

E. Solder Filler Metals: ASTM B32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

F. Brazing Filler Metals: AWS A5.8M/A5.8.

G. Flexible Connectors:

1. Body: Tin-bronze bellows with woven, flexible, tinned-bronze-wire-reinforced protective jacket.
2. End Connections: Socket ends.
3. Offset Performance: Capable of minimum 3/4-inch misalignment in minimum 7-inch-long assembly.
4. Working Pressure Rating: Factory test at minimum 535 psig.
5. Maximum Operating Temperature: 250 deg F.

2.3 VALVES AND SPECIALTIES

A. Service Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Danfoss, Inc.
b. Emerson Climate Technologies; Emerson Electric Co.
c. Henry Technologies Inc.; The Henry Group.
d. JB Industries.
e. Parker (Parker Hannifin).
f. RectorSeal HVAC; a CSW Industrials Company.
g. Refrigeration Sales, Inc.

2. Body: Forged brass with brass cap, including key end to remove core.
3. Core: Removable ball-type check valve with stainless steel spring.
4. Seat: Polytetrafluoroethylene.
5. End Connections: Copper spring.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

B. Service Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Danfoss, Inc.
b. Emerson Climate Technologies; Emerson Electric Co.
c. Henry Technologies Inc.; The Henry Group.
d. JB Industries.

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e. Parker (Parker Hannifin).
f. RectorSeal HVAC; a CSW Industrials Company.
g. Refrigeration Sales, Inc.

2. Body: Forged brass with brass cap, including key end to remove core.
3. Core: Removable ball-type check valve with stainless steel spring.
4. Seat: Polytetrafluoroethylene.
5. End Connections: Copper spring.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 275 deg F.

C. Refrigerant Locking Caps:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. C & D Valve, LLC.
b. JB Industries.
c. RectorSeal HVAC; a CSW Industrials Company.
d. Refrigeration Sales, Inc.

2. Description: Locking-type, tamper-resistant, threaded caps to protect refrigerant-charging ports from unauthorized refrigerant access and leakage.
3. Material: Brass, with protective shroud or sleeve.
4. Refrigerant Identification: Color-coded, refrigerant specific based on AHRI Guideline N design.
5. Special Tool: For installing and unlocking.

D. Safety Relief Valves: Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Danfoss, Inc.
b. Henry Technologies Inc.; The Henry Group.
c. Parker (Parker Hannifin).

2. Body and Bonnet: Ductile iron and steel, with neoprene O-ring seal.
3. Piston, Closing Spring, and Seat Insert: Stainless steel.
4. Seat: Polytetrafluoroethylene.
5. End Connections: Threaded.
6. Working Pressure Rating: 400 psig.
7. Maximum Operating Temperature: 240 deg F.

2.4 REFRIGERANTS

A. R-32, ASHRAE 34: Difluoromehtan (methylene fluoride)

NOT FOR BIDDING PURPOSES

B. R-410A, ASHRAE 34: Pentafluoroethane/Difluoromethane.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Arkema Inc.
b. DuPont Fluorochemicals Div.
c. Genetron Refrigerants; Honeywell International Inc.
d. Mexichem Fluor, Inc. (Koura).

C. R-454B, ASHRAE 34: R-32/1234yf, blend.

PART 3 - EXECUTION

3.1 PIPING APPLICATION SCHEDULES

A. Refrigerant: R-32, R-410A or R-454B.

B. Suction, Hot-Gas, and Liquid Tubing for Conventional Air-Conditioning (Cooling-Only) Applications, 1-1/2 inch and Smaller: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

C. Suction, Hot-Gas, and Liquid Tubing for Conventional Air-Conditioning (Cooling-Only) Applications, 2 to 4 inch: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

D. Safety-Relief-Valve Discharge Tubing for Conventional Air-Conditioning (Cooling-Only) Applications, Copper: Type ACR, drawn-temper or annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

E. Suction, Hot-Gas, and Liquid Tubing for Heat-Pump Applications, 1-1/2 inch and Smaller: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

F. Suction, Hot-Gas, and Liquid Tubing for Heat-Pump Applications, 2 to 4 inch: Copper, Type ACR, drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

G. Safety-Relief-Valve Discharge Tubing for Heat-Pump Applications, Copper: Type ACR, drawn-temper or annealed-temper tubing and wrought-copper fittings with brazed or soldered joints

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install valve and specialty applications as required by equipment manufacturers and as follows:

1. Stop Valves: Stop valves shall be installed in specified locations as follows:

a. Refrigeration system containing more than 6.6 pounds of refrigerant.

NOT FOR BIDDING PURPOSES

1) The suction inlet of each compressor, compressor unit or condensing unit.
2) The discharge outlet of each compressor, compressor unit or condensing unit.
3) The outlet of each liquid receiver.

b. Refrigeration systems containing more than 100 pounds of refrigerant.

1) The suction inlet of each compressor, compressor unit or condensing unit.
2) The discharge outlet of each compressor, compressor unit or condensing unit.
3) The outlet of each liquid receiver.
4) Each inlet of each liquid receiver.
5) Each inlet and each outlet of each condenser where more than on condenser is used in parallel.

B. Stop Valve Support: Stop valves shall be supported to prevent detrimental stress and strain on the refrigerant piping system. The piping system shall not be utilized to support stop valves on copper tubing 1-inch outside diameter or larger.

C. Identification: Stop valves shall be identified where their intended purpose is not obvious. Where valves are identified by a numbering or lettering system, legend(s) or key(s) for the valve identification shall be located in the room containing the indoor refrigeration equipment. The minimum height of lettering of the identification shall be ½-inch.

3.3 INSTALLATION OF PIPING, GENERAL

A. Install per manufacturers' requirements. Equipment manufacturers shall size all piping.

B. Equipment manufacturers shall size all piping.

C. Drawing plans, schematics, and diagrams indicate general location and arrangement of systems; indicated locations and. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

D. Install refrigerant piping in accordance with ASHRAE 15-2022.

E. Pipe Protection. The exterior of the pipe shall be protected from corrosion, degradation, galvanic corrosion and abrasion. Refrigerant pipe shall not be in contact with building materials that can abrade the pipe. Refrigerant pipe shall be installed as follows in accordance with ASHRAE 15-2022:
1. Piping installed in a wall or floor space or within a protective enclosure shall be protected as follows:
a. In concealed locations where copper tube is installed through holes or notches in studs, joists or similar member less than 1.5 inches from the nearest edge of the member, the tube shall be protected by steel shield plates with a minimum thickness of 0.0575 inch.

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b. Protective steel shield plates shall cover the area of the tube where the member is notched or bored and shall extend not less than 2 inches above sole plates and below top plates.

2. Piping exposed inside of a building shall be installed at an elevation that is more than 7 feet 3 inches above the finished floor or when the piping is within 6 feet of the appliance to which it connects. Otherwise install refrigerant piping in rigid or flexible conduit and in locations where exposed to mechanical injury.
3. Piping in an attic or crawl space, provided that copper tube is installed 1.5 inches from the nearest edge of the member, the tube shall be protected by steel shield plates having a minimum thickness of 0.0575 inch. Protective steel plates are not required in locations where the refrigerant piping is exposed.
4. Piping outside the building shall be installed in accordance with the following:
   a. Protected from damage from the weather, including but not limited to hail, ice and snow loads.
   b. Protected from damage where located in an expected foot or traffic path.
   c. Underground below the frost line and not less than 8 inches below finish grade.

F. Refrigerant piping shall not be installed in any of the following locations:
1. Exposed within a fire-resistance -rated exit access corridor.
2. Exposed within an interior exit stairway.
3. Within an interior exit ramp enclosure.
4. Within an exit passageway.
5. Inside an air duct or air duct plenum.

G. Refrigerant piping installed in concrete floors shall be encased in pipe, conduit or ducts. The refrigerant piping shall be protected to prevent damage from vibration, stress and corrosion.

H. Install refrigerant piping in protective conduit were installed below ground. The piping shall be protected to prevent damage from vibration, stress and corrosion.

I. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

J. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings. Refrigerant piping shall be installed so as to prevent strains and stresses that exceed the structural strength of the pipe.

K. Shield Plates: Shield plates shall be of steel material having a thickness of not less than 0.0575 inches.

L. Exposed piping having surface temperatures greater than 120 degrees F or less than 5 degrees F with ready access to non-authorized personnel shall be protected from contact or shall have thermal insulation that limits the exposed insulation surface temperature to a range of 5 degrees F to 120 degrees F.

M. Insulate all refrigerant piping in accordance with 230719 “HVAC Piping Insulation”.

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N. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

O. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

P. Install piping adjacent to equipment to allow service and maintenance.

Q. Install piping free of sags and bends.

R. Install fittings for changes in direction and branch connections.

S. Select system components with pressure rating equal to or greater than system operating pressure.

T. Slope refrigerant piping in accordance with equipment manufacturer requirements.

U. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

V. Before installation of steel refrigerant piping, clean pipe and fittings using the following procedures:

1. Shot blast the interior of piping.
2. Remove coarse particles of dirt and dust by drawing a clean, lintless cloth through tubing by means of a wire or electrician's tape.
3. Draw a clean, lintless cloth saturated with trichloroethylene through the tube or pipe. Continue this procedure until cloth is not discolored by dirt.
4. Draw a clean, lintless cloth, saturated with compressor oil, squeezed dry, through the tube or pipe to remove remaining lint. Inspect tube or pipe visually for remaining dirt and lint.
5. Finally, draw a clean, dry, lintless cloth through the tube or pipe.
6. Safety-relief-valve discharge piping is not required to be cleaned but is required to be open to allow unrestricted flow.

W. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

X. Identify refrigerant piping and valves in accordance with Section 230553 "Identification for HVAC Piping and Equipment." For Group A2L refrigerants, the identification shall also include the following statement: “WARNING-Risk of Fire. Flammable Refrigerant.”

Y. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230500 "Common Work Results for HVAC."

Z. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230500 "Common Work Results for HVAC."

AA. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230500 "Common Work Results for HVAC."

NOT FOR BIDDING PURPOSES

3.4 INSTALLATION OF COMPONENTS OTHER THAN PRESSURE VESSELS AND PIPING

A. Every pressure containing component of a refrigerating system, other than pressure vessels, piping, pressure gages and control mechanisms, shall be listed either individually or as part of a complete refrigerating system or a subassembly by a nationally recognized testing laboratory, or shall be designed, constructed and assembled to have an ultimate strength sufficient to withstand 3.0 times the design pressure for which it is rated.

1. Exception: Water-side components designed to operate at a temperature not exceeding 210 degrees F shall be exempted from the rules of ASME Boiler and Pressure Vessel Code, Section VIII and shall be designed, constructed and assembled to have an ultimate strength to withstand 150 psig or 2.0 times the design pressure for which it is rated, whichever is greater.

B. Liquid-level-gage glass columns shall have automatic closing shutoff valves. All such glass columns shall be protected against external damage and properly supported.

1. Exception: Liquid-level-gage glasses of the bull's-eye type.

C. When a pressure gage is permanently installed on the high side of a refrigerating system, its dial shall be graduated to at least 1.2 times the design pressure.

D. Liquid receivers, if used, or parts of a system designed to receive the refrigerant charge during pump down shall have sufficient capacity to receive the pump down charge. The liquid shall not occupy more than 90 percent of the volume when temperature of the refrigerant is 90 deg F.

3.5 INSTALLATION OF PRESSURE RELIEF DEVICES

A. Different refrigerants shall not be vented into a common relief piping system.

B. Pressure relief devices designed to discharge external to the refrigeration system shall be arranged to discharge outside of the building and comply with all of the following:
1. The point of vent discharge shall be located not less than 15 feet above the adjoining ground level.
2. The point of vent discharge shall be located not less than 20 feet from windows, building ventilation openings, pedestrian walkways above or below grade, pits, ramps or building exits. The discharge shall not discharge into an enclosed outdoor space such as a courtyard.
3. The termination point of a vent discharge line shall be made in a manner that prevents foreign material or debris

3.6 PIPE JOINT CONSTRUCTION

A. Pipe joint construction in accordance with ASHRAE 15-2022.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

NOT FOR BIDDING PURPOSES

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

E. Soldered Joints: Construct joints in accordance with ASTM B828 or CDA's "Copper Tube Handbook."

F. Brazed Joints: Construct joints in accordance with AWS BRH, "Brazing Handbook," Ch. 35, "Pipe and Tubing."

1. Use Type BCuP (copper-phosphorus) alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze or steel.

G. Steel pipe can be threaded, but threaded joints must be seal brazed or seal welded.

H. Welded Joints: Construct joints in accordance with AWS D10.12M/D10.12.

I. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.7 INSTALLATION OF HANGERS AND SUPPORTS

A. Installation and hangers shall be in accordance with ASHRAE 15-2022.

B. Comply with Section 230529 "Hangers and Supports for HVAC Piping and Equipment" for hangers, supports, and anchor devices.

C. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 ft. long.
2. Roller hangers and spring hangers for individual horizontal runs 20 ft. or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 ft. or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

D. Install hangers for copper tubing and steel piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

E. Support horizontal piping within 12 inches of each fitting.

F. Support vertical runs of copper tubing and steel piping to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

NOT FOR BIDDING PURPOSES

3.8 FIELD QUALITY CONTROL

A. Piping shall be tested in accordance with ASHRAE 15-2022.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Tests and Inspections:

1. General. Refrigerating systems fabricated, assembled, or erected on the premises shall be tested to the applicable requirements of this section. Tests shall include both the high sides and low sides of each system. System components that have been strength tested under pressure by the component manufacturer, fabricator, or assembler are not required to be strength tested again on the premises unless modified or repaired. Listed equipment not modified or repaired shall not be required to be strength tested on the premises. After installation and before being placed in operation, system components not previously strength tested shall be strength tested under pressure in accordance with Piping System Strength Test below. After successful completion of the required strength tests and before being placed in operation, system components and field installed connections shall be leak tested for tightness in accordance with Leakage Test below.
2. Refrigerant pipe and joints installed in the field shall be exposed for visual inspection and testing prior to being covered or enclosed.
3. The medium used for field pressure testing the refrigerant system shall be one of the following inert gases: oxygen-free nitrogen, helium, argon or premixed nonflammable oxygen-free nitrogen with a tracer gas of hydrogen or helium.
   a. Test Gases not Permitted. Oxygen, air, refrigerants other than those identified above, combustible gases and mixtures containing such gases shall not be used as the test medium.
4. Field Test Apparatus. The means used to pressurize the refrigerant piping system shall have either a pressure-limiting device or a pressure-reducing device and a test pressure measuring device on the outlet side. The tests pressure measuring device shall have an accuracy of +/-3 percent or less of the test pressure and shall have a resolution of 3 percent or less of the test pressure.
5. Piping System Strength Test. Refrigerating system components and refrigerant piping shall be tested in accordance with ASME B31.5 or this section. Separate tests for isolated portions of the system are permitted, provided that all required portions are tested at least once. Pressurize with test gas for a minimum of 10 minutes to not less than the lower of (a) the lowest design pressure for any system component or (b) the lowest value of set pressure for any pressure relief devices in the system. The design pressures for determination of test pressure shall be the pressure identified on the label nameplate of the condensing unit, compressor, compressor unit, pressure vessel or other system component with a nameplate. A passing test result shall have no rupture or structural failure of any system component or refrigerant piping. Pressure relief devices may need to be temporarily removed and replaced with plugs during the strength test.

6. Leakage Test. The leak test shall be in accordance with ASHRAE Standard 147, ASME B31.5, or this section.
   a. Leak Testing Protocol. After the time to complete the strength test, continue to pressure test in accordance with Piping System Strength Test above for a minimum period as specified in the following table, Duration of Leak Test. The system shall show no loss in pressure on the pressure measuring device during the pressure test.

NOT FOR BIDDING PURPOSES

Calculation of the pressure differential based on a change in ambient temperature shall be permitted. A vacuum of 0.0097 psi absolute or lower shall be achieved. After achieving a vacuum, the system shall be isolated from the vacuum pump. The system pressure shall not rise above 0.029 psi absolute for a minimum period as specified in the following table, Duration of Leak Test. The vacuum pump should gradually create a vacuum to avoid freezing of any moisture in the piping system.

Duration of Leak Test

Leak Test	Pipe Length, L (feet)	Maximum Pipe Size (inch)	Minimum Period of Test (hours)
Pressure Test	L <= 100	3/4 or less	0.25
		1 to 3	1
		greater than 3	24
	100 < L <= 200	3 or less	1
		greater than 3	24
	200 < L	any	24
Vacuum Test	L <= 100	3/4 or less	1
		1 to 3	8
		greater than 3	24
	100 < L <= 200	3 or less	8
		greater than 3	24
	200 < L	any	24

Note: The maximum pipe size is the largest interconnecting field piping installed.

7. Contractor Declaration. The installing contractor shall issue a certificate of test, verifying strength test in accordance with Piping System Strength Test, above and leakage test in accordance with Leakage Test, above, to the AHJ for all systems containing 55 lb or more of refrigerant. The certificate shall give the test date, photograph of the pressure gage at the test pressure, refrigerant designation, test medium, and the field test pressure applied to the high side and the low side of the system. The certification of test shall be signed by the installing contractor and shall be made part of the public record.

D. Service Provisions
   1. All serviceable components of refrigerating systems shall be provided with safe access.
   2. Condensing units or compressor units with enclosures shall be provided with safe access without the need to climb over or remove any obstacles or to use portable access devices to get to the equipment.
   3. All systems shall have provisions to handle the refrigerant charge for service purposes. When required, there shall be liquid and vapor transfer valves, a transfer compressor or pump and refrigerant storage tanks or appropriate valved connections for removal by a reclaim, recycle or recovery device.

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3.9 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.10 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning or chilled-water controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Open shutoff valves in condenser water circuit.
2. Verify that compressor oil level is correct.
3. Open compressor suction and discharge valves.
4. Open refrigerant valves but not bypass valves that are used for other purposes.
5. Check open compressor-motor alignment and verify lubrication for motors and bearings.

E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION 232300

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SECTION 23 31 13 - METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Double-wall rectangular ducts and fittings.
3. Single-wall round ducts and fittings.
4. Double-wall round ducts and fittings.
5. Sheet metal materials.
6. Sealants and gaskets.
7. Hangers and supports.

B. Related Requirements:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and Adhesives.
2. Sealants and gaskets.

B. Delegated Design Submittals:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations for selecting hangers and supports.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports.

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1.4 QUALITY ASSURANCE

A. All duct hangers, supports, etc within the Equipment Building shall be corrosion resistant.

B. Welding Qualifications: Qualify procedures and personnel in accordance with the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.

C. Duct Liner

1. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training. Preference will be given to those who have successfully completed a manufacturer's installation training program.
2. Inspection: A certified mechanical insulation shall be performed by inspectors who maintain current certification, by the National Insulation Association or other certified mechanical association, throughout the project to inspect and verify the materials and the total insulation system has been installed correctly in accordance with the specifications and material manufacturer's instructions.
3. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products listed and labeled in accordance with UL 723 or tested in accordance with ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

a. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
b. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

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PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and with performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports are to withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".

C. Airstream Surfaces: Surfaces in contact with airstream comply with requirements in ASHRAE 62.1.

D. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."

E. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

F. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

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2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

1. Construct ducts of galvanized sheet steel unless otherwise indicated.

B. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
2. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.

C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." All longitudinal seams are to be Pittsburgh lock seams unless otherwise specified for specific application.

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 DOUBLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. MKT Metal Manufacturing.

2. McGill AirFlow LLC.
3. SHAPE Manufacturing Inc.
4. Sheet Metal Connectors, Inc.
5. Ductmate Industries, Inc; a DMI company.

B. Source Limitations: Obtain double-wall rectangular ducts and fittings from single manufacturer.

C. Rectangular Ducts: Fabricate ducts with indicated dimensions for clear internal dimensions of the inner duct.

D. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

1. Construct ducts of galvanized sheet steel unless otherwise indicated.
2. For ducts exposed to weather, construct outer duct of Type 316 stainless steel indicated by manufacturer to be suitable for outdoor installation.

E. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
2. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.

F. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." All longitudinal seams are to be Pittsburgh lock seams unless otherwise specified for specific application.

G. Interstitial Insulation, Fibrous Glass: Duct liner complying with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
3. Coat insulation with antimicrobial coating.
4. Cover insulation with polyester film complying with UL 181, Class 1.

H. Inner Duct: Minimum 24-gauge perforated galvanized sheet steel having 3/32-inch- diameter perforations, with overall open area of 23 percent.

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2.4 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Construct ducts of galvanized sheet steel unless otherwise indicated.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Linx Industries; a DMI company (formerly Lindab).
    b. MKT Metal Manufacturing.
    c. McGill AirFlow LLC.
    d. SEMCO, LLC; part of FlaktGroup.
    e. SHAPE Manufacturing Inc.
    f. Sheet Metal Connectors, Inc.
    g. Ductmate Industries, Inc; a DMI company.

B. Source Limitations: Obtain single-wall round ducts and fittings from single manufacturer.

C. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

D. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

E. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.5 DOUBLE-WALL ROUND DUCTS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

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1. Linx Industries; a DMI company (formerly Lindab).
2. MKT Metal Manufacturing.
3. McGill AirFlow LLC.
4. SEMCO, LLC; part of FlaktGroup.
5. SHAPE Manufacturing Inc.
6. Sheet Metal Connectors, Inc.

B. Source Limitations: Obtain double-wall round ducts and fittings from single manufacturer.

C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.

1. Construct ducts of galvanized sheet steel unless otherwise indicated.
2. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

    a. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

3. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

    a. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.

4. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Inner Duct: Minimum 24-gauge perforated galvanized sheet steel having 3/32-inch- diameter perforations, with overall open area of 23 percent.

E. Interstitial Insulation, Fibrous Glass: Duct liner complying with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
3. Coat insulation with antimicrobial coating.

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4. Cover insulation with polyester film complying with UL 181, Class 1.

2.6 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials are to be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A653.

1. Galvanized Coating Designation: G60.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Stainless Steel Sheets: Comply with ASTM A480, Type 304 or 316, as indicated in "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish is to be No. 2B, No. 2D, No. 3, or No. 4 as indicated in "Duct Schedule" Article.

D. Reinforcement Shapes and Plates: ASTM A36, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

E. Tie Rods: Galvanized steel, 1/4 inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.7 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets are to be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 4 inches.
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10 inch wg, positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F.
9. Substrate: Compatible with galvanized sheet steel, stainless steel, or aluminum.

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C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10 inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel, stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:

1. Seal is to provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and is to be rated for10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

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2.8 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A603.

E. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

G. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless Steel Ducts: Stainless steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.

B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install ducts in maximum practical lengths with fewest possible joints.

D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

J. Install dampers and all other duct-mounted accessories in air ducts where indicated on Drawings.

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K. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

L. Elbows: Use long-radius elbows wherever they fit.

1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.
2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.

M. Branch Connections: Use lateral or conical branch connections.

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.

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2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 DUCTWORK CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:

    a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections totaling no less than 25 percent of total installed duct area for each designated pressure class.
    b. Supply Ducts with a Pressure Class of 3-Inch wg or Higher: Test representative duct sections totaling no less than 50 percent of total installed duct area for each designated pressure class.
    c. Return Ducts with a Pressure Class of 3-Inch wg or Higher: Test representative duct sections totaling no less than 50 percent of total installed duct area for each designated pressure class.

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d. Exhaust Ducts with a Pressure Class of 3-Inch wg or Higher: Test representative duct sections totaling no less than 50 percent of total installed duct area for each designated pressure class.
e. Outdoor-Air Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 50 percent of total installed duct area for each designated pressure class.

3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Testing of each duct section is to be performed with access doors, coils, filters, dampers, and other duct-mounted devices in place as designed. No devices are to be removed or blanked off so as to reduce or prevent additional leakage.
5. Test for leaks before applying external insulation.
6. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
7. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness in accordance with "Description of Method 3 - NADCA Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media is to not exceed 0.75 mg/100 sq. cm.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.7 STARTUP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.8 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.
2. All Ductwork within Equipment Building shall be stainless steel.

B. Supply Ducts:

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1. Ducts Connected to Fan Coil Units:

    a. Pressure Class: Positive 2- inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: 8.
    d. SMACNA Leakage Class for Round: 4.

C. Return Ducts:

1. Ducts Connected to Fan Coil Units:

    a. Pressure Class: Positive or negative 2- inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: 8.
    d. SMACNA Leakage Class for Round: 4.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

    a. Pressure Class: Negative 2- inch wg.
    b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
    c. SMACNA Leakage Class for Rectangular: 8.
    d. SMACNA Leakage Class for Round: 4.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Fan Coil Units:

    a. Pressure Class: Positive or negative 2- inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: 8.
    d. SMACNA Leakage Class for Round: 8.

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel or carbon steel coated with zinc-chromate primer.

G. Elbow Configuration:

1. Rectangular Duct - Requirements for All Velocities: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

    a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
    b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
    c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

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2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

    a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

        1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
        2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
        3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
        4) Radius-to Diameter Ratio: 1.5.

    b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
    c. Round Elbows, 14 Inches and Larger in Diameter: Welded.

H. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

    a. Rectangular Main to Rectangular Branch: 45-degree entry.
    b. Rectangular Main to Round Branch: Conical spin in.

2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

    a. Velocity 1000 fpm or Lower: 90-degree tap.
    b. Velocity 1000 to 1500 fpm: Conical tap.
    c. Velocity 1500 fpm or Higher: 45-degree lateral.

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END OF SECTION 233113

SECTION 23 33 00 - AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backdraft dampers.
2. Manual volume dampers.
3. Control dampers.
4. Turning vanes.
5. Duct-mounted access doors.
6. Flexible connectors.
7. Duct accessory hardware.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Source quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.5 QUALITY ASSURANCE

A. All duct accessories within the Equipment Building shall be corrosion resistant.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with NFPA 90A and NFPA 90B.

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise

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indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 BACKDRAFT DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc. Model CBD6/CD60
2. American Warming and Ventilating (AWV); Mestek, Inc.
3. Cesco Products; MESTEK, Inc.
4. Greenheck Fan Corporation.
5. Nailor Industries Inc.
6. Vent Products Co., Inc.

B. Description: Gravity balanced.

C. Performance:

1. Maximum Air Velocity: 2000 fpm.
2. Maximum System Pressure: 2 inches wg.
3. Leakage:

a. Class I: Leakage shall not exceed 4 cfm/sq. ft. against 1-inch wg differential static pressure.

D. Construction:

1. Frame:

a. Hat shaped.
b. 16-gauge- thick, galvanized sheet steel with welded or mechanically attached corners and mounting flange. Aluminum or stainless steel for the Equipment Building.

2. Blades:

a. Multiple single-piece blades.
b. Center pivoted, maximum 6-inch width, 0.050-inch- thick aluminum sheet with sealed edges.

3. Blade Action: Parallel.

E. Blade Seals: Felt or Neoprene, mechanically locked.

F. Blade Axles:

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1. Material: Galvanized steel. Stainless steel or aluminum for the Equipment Building.
2. Diameter: 0.20 inch.

G. Tie Bars and Brackets: Galvanized steel. Stainless steel or aluminum for the Equipment Building.

H. Return Spring: Adjustable tension.

I. Bearings: Steel ball or synthetic pivot bushings.

J. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Chain pulls.
4. Screen Mounting:

a. Rear mounted in sleeve.

1) Sleeve Thickness: 20 gauge minimum.
2) Sleeve Length: 6 inches minimum.

5. Screen Material: Galvanized steel.
6. Screen Type: Bird.
7. 90-degree stops.

2.3 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc. Model CD36
b. Air Balance; MESTEK, Inc.
c. American Warming and Ventilating (AWV); Mestek, Inc.
d. Arrow United Industries; Mestek, Inc.
e. Cesco Products; MESTEK, Inc.
f. Greenheck Fan Corporation.
g. McGill AirFlow LLC.
h. Nailor Industries Inc.
i. Vent Products Co., Inc.

2. Performance:

a. Leakage Rating Class III: Leakage not exceeding 40 cfm/sq. ft. against 1-inch wg differential static pressure.

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3. Construction:

    a. Linkage out of airstream.
    b. Suitable for horizontal or vertical airflow applications.

4. Frames:

    a. Hat-shaped, 16-gauge- thick, galvanized sheet steel.
    b. Mitered and welded corners.
    c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Stiffen damper blades for stability.
    d. Galvanized steel; 16 gauge thick.

6. Blade Axles: Galvanized steel.
7. Bearings:

    a. Oil-impregnated bronze.
    b. Dampers mounted with vertical blades to have thrust bearing at each end of every blade.

8. Tie Bars and Brackets: Galvanized steel.
9. Locking device to hold damper blades in a fixed position without vibration.

B. Standard, Aluminum, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc. Model CD51
    b. Air Balance; MESTEK, Inc.
    c. American Warming and Ventilating (AWV); Mestek, Inc.
    d. Arrow United Industries; Mestek, Inc.
    e. Cesco Products; MESTEK, Inc.
    f. Greenheck Fan Corporation.
    g. McGill AirFlow LLC.
    h. Nailor Industries Inc.
    i. Vent Products Co., Inc.

2. Performance:

    a. Leakage Rating Class III: Leakage not exceeding 40 cfm/sq. ft. against 1-inch wg differential static pressure.

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3. Construction:

    a. Linkage out of airstream.
    b. Suitable for horizontal or vertical airflow applications.

4. Frames:

    a. Hat-shaped, 0.10-inch- thick, aluminum sheet channels.
    b. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Stiffen damper blades for stability.
    d. Roll-Formed Aluminum Blades: 0.10-inch- thick aluminum sheet.

6. Blade Axles: Galvanized steel.
7. Bearings:

    a. Oil-impregnated bronze.
    b. Dampers mounted with vertical blades to have thrust bearing at each end of every blade.

8. Tie Bars and Brackets: Aluminum.
9. Locking device to hold damper blades in a fixed position without vibration.

2.4 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc. Model CD60
2. American Warming and Ventilating (AWV); Mestek, Inc.
3. Arrow United Industries; Mestek, Inc.
4. Cesco Products; MESTEK, Inc.
5. Greenheck Fan Corporation.
6. McGill AirFlow LLC.
7. Nailor Industries Inc.
8. Vent Products Co., Inc.
9. Young Regulator Company.

B. General Requirements:

1. Unless otherwise indicated, use parallel-blade configuration for two-position control, equipment isolation service, and when mixing two airstreams. For other applications, use opposed-blade configuration.

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2. Factory or field assemble multiple damper sections to provide a single damper assembly of size required by the application.

C. Performance:

1. AMCA Certification: Test and rate in accordance with AMCA 511.
2. Leakage:
    a. Class I: Leakage shall not exceed 4 cfm/sq. ft. against 1-inch wg differential static pressure.
3. Pressure Drop: 0.05 inch wg at 1500 fpm across a 24-by-24-inch damper when tested in accordance with AMCA 500-D, Figure 5.3.
4. Velocity: Up to 3000 fpm.
5. Temperature: Minus 25 to plus 180 deg F.
6. Pressure Rating: Damper close-off pressure equal to fan shutoff pressure with a maximum blade deflection of 1/200 of blade length.

D. Construction:

1. Linkage out of airstream.
2. Suitable for horizontal or vertical airflow applications.
3. Frames:
    a. Hat, U, or angle shaped.
    b. 16-gauge- thick galvanized sheet steel. Stainless steel or aluminum for the Equipment Building.
    c. Mitered and welded corners.
    d. Flanges for attaching to walls and flangeless frames for installing in ducts.
4. Blades:
    a. Multiple blade with maximum blade width of 8 inches.
    b. Opposed-blade design.
    c. Galvanized steel. Stainless steel or Aluminum for Equipment Building.
    d. 16-gauge- thick single skin or 14-gauge- thick air foil dual skin.
5. Blade Edging Seals:
    a. Replaceable Closed-cell neoprene.
6. Blade Jamb Seal: Flexible stainless steel, compression type.
7. Blade Axles: 1/2-inch diameter; galvanized steel.
8. Blade-Linkage Hardware: Zinc-plated steel and brass; ends sealed against blade bearings. Linkage mounted out of air stream.
9. Bearings:
    a. Oil-impregnated bronze.

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b. Dampers mounted with vertical blades to have thrust bearings at each end of every blade.

E. Damper Actuator - Electric:

1. Electric - 120 V ac.
2. UL 873, plenum rated.
3. Two position.

a. Sufficient motor torque to drive damper fully open and fully closed with adequate force to achieve required damper seal.
b. Minimum 90-degree drive rotation.

4. Clockwise or counterclockwise drive rotation as required for application.
5. Environmental Operating Range:

a. Temperature: Minus 40 to plus 130 deg F.
b. Humidity: 5 to 95 percent relative humidity noncondensing.

6. Environmental enclosure: NEMA 2.
7. Actuator to be factory mounted and provided with a single-point wiring connection.

F. Controllers, Electrical Devices, and Wiring:

1. Electrical Connection: 115 V, single phase, 60 Hz.

2.5 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Aero-Dyne Sound Control Co.
2. CL WARD & Family Inc.
3. Ductmate Industries, Inc; a DMI company.
4. Duro Dyne Inc.
5. DynAir; a Carlisle Company.
6. Elgen Manufacturing.
7. Ward Industries; a brand of Hart & Cooley, LLC.

B. Manufactured Turning Vanes for Metal Ducts: Fabricate curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

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C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

E. Vane Construction:

1. Single or double wall.
2. Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

2.6 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Arrow United Industries; Mestek, Inc.
2. Cesco Products; MESTEK, Inc.
3. Ductmate Industries, Inc; a DMI company.
4. Duro Dyne Inc.
5. Flexmaster U.S.A., Inc.
6. McGill AirFlow LLC.
7. Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.
8. Ventfabrics, Inc.
9. Ward Industries; a brand of Hart & Cooley, LLC.

B. Duct-Mounted Access Doors: Fabricate access panels in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figure 7-2, "Duct Access Doors and Panels," and Figure 7-3, "Access Doors - Round Duct."

1. Door:

a. Double wall, rectangular.
b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
c. 24-gauge- thick galvanized steel or 0.032-inch thick aluminum or 24-gauge- thick stainless steel door panel to match duct construction.
d. Vision panel.
e. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
f. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.

a. 24-gauge- thick galvanized steel or 0.032-inch- thick aluminum frame.

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3. Number of Hinges and Locks:

    a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
    b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
    c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches with outside and inside handles.
    d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.

2.7 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc; a DMI company.
2. Duro Dyne Inc.
3. Ventfabrics, Inc.
4. Ward Industries; a brand of Hart & Cooley, LLC.

B. Fire-Performance Characteristics: Adhesives, sealants, fabric materials, and accessory materials shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested in accordance with ASTM E84.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Materials: Flame-retardant or noncombustible fabrics.

E. Coatings and Adhesives: Comply with UL 181, Class 1.

F. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.

G. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

H. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.

1. Minimum Weight: 14 oz./sq. yd.
2. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.
3. Service Temperature: Minus 67 to plus 500 deg F.

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2.8 DUCT ACCESSORY HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. CL WARD & Family Inc.
2. Ductmate Industries, Inc; a DMI company.
3. Duro Dyne Inc.
4. DynAir; a Carlisle Company.
5. Elgen Manufacturing.
6. Hardcast; Carlisle Construction Materials.
7. United Enertech Corp.
8. Ventfabrics, Inc.
9. Ward Industries; a brand of Hart & Cooley, LLC.

B. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

C. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

2.9 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A653.

1. Galvanized Coating Designation: G60.
2. Exposed-Surface Finish: Mill phosphatized.

B. Stainless Steel Sheets: Comply with ASTM A480, Type 304, and having a No. 2 finish for concealed ducts and match installed duct finish for exposed ducts.

C. Aluminum Sheets: Comply with ASTM B209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, one-side bright finish for exposed ducts.

D. Extruded Aluminum: Comply with ASTM B221, Alloy 6063, Temper T6.

E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless steel ducts.

F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

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PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories in accordance with applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel ducts, stainless steel accessories in stainless steel ducts, and aluminum accessories in aluminum ducts.

C. Install control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Where multiple damper sections are necessary to achieve required dimensions, provide reinforcement to fully support damper assembly when fully closed at full system design static pressure.

E. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

F. Set dampers to fully open position before testing, adjusting, and balancing.

G. Install test holes at fan inlets and outlets and elsewhere as indicated and as needed for testing and balancing.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. Upstream and downstream from duct filters.
2. At outdoor-air intakes and mixed-air plenums.
3. At drain pans and seals.
4. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
5. Upstream and downstream from turning vanes.
6. Control devices requiring inspection.
7. Elsewhere as indicated.

I. Install access doors with swing against duct static pressure.

J. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.

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3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

K. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

L. Install flexible connectors to connect ducts to equipment.

M. Install duct test holes where required for testing and balancing purposes.

N. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors, and verify that size and location of access doors are adequate to perform required operation.
3. Inspect turning vanes for proper and secure installation, and verify that vanes do not move or rattle.

END OF SECTION 233300

NOT FOR BIDDING PURPOSES

SECTION 23 34 00 - HVAC FANS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fans, centrifugal, inline - square. TYPE C

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

a. Construction details, material descriptions, dimensions of individual components and profiles, and finishes for fans.
b. Rated capacities, furnished specialties, and accessories for each fan.
c. Fans:

1) Certified fan performance curves with system operating conditions indicated.
2) Certified fan sound-power ratings.
3) Fan construction and accessories.
4) Motor ratings and electrical characteristics, plus motor and electrical accessories.
5) Fan speed controllers.

d. Material thickness and finishes, including color charts.
e. Dampers, including housings, linkages, and operators.

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1.3 INFORMATIONAL SUBMITTALS

A. Startup service reports.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fans, include the following:

1. Operation in normal and emergency modes.
2. Operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of unit components.

C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

E. Fans shall be (1) catalog rated for 15 percent greater static pressure than specified at specified air volume, (2) selected so that the specified air volume is greater than that at the apex of the fan pressure volume curve, and (3) selected to provide stable operation down to 85 percent of design volume operating at the required speed for the specified conditions. Brake horsepower at specified duty for airfoil and backward inclined bladed centrifugal fans shall not exceed 78 percent of motor nameplate horsepower times the NEMA service factor and for forward curved bladed centrifugal fans shall not exceed 70 percent of motor nameplate horsepower times the NEMA service factor.

F. Service Conditions:

1. Ambient Temperature: 95 deg F.
2. Altitude: 100 feet above sea level.
3. Humidity: 78 deg F wet bulb.

2.2 FANS, CENTRIFUGAL, INLINE – SQUARE – TYPE C

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Acme Engineering & Manufacturing Corp.
2. Aerovent; a division of Twin City Fan Companies, Ltd.
3. American Coolair Corporation.
4. Carnes Company.
5. Greenheck Fan Corporation.
6. JencoFan.
7. Loren Cook Company.
8. PennBarry; division of Air System Components.
9. S & P USA Ventilation Systems, LLC.
10. Twin City Fan Company

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B. Source Limitations: Obtain square inline centrifugal fans from single manufacturer.

C. Description: Square-housing in-line centrifugal fans.

D. Standards: Comply with UL 705.

E. Housing:

1. Housing Material: Reinforced steel.
2. Housing Coating: Hot-dip galvanized.
3. Housing Construction: Side panels are to be easily removable for service. Include inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

F. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing**;** with wheel, inlet cone, and motor on swing-out service door.

G. Fan Wheels: Aluminum airfoil blades welded to aluminum hub.

H. Motor Enclosure: Open, dripproof.

I. Accessories:

1. Access for Inspection, Cleaning, and Maintenance: Comply with requirements in ASHRAE 62.1.
2. Companion Flanges: For inlet and outlet duct connections.
3. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
4. Motor: Epoxy-coated steel.

2.3 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230500 "Common Work Results for HVAC."

2.4 SOURCE QUALITY CONTROL

A. AMCA Certification for Fan Sound Performance Rating: Test, rate, and label in accordance with AMCA 311.

B. AMCA Certification for Fan Aerodynamic Performance Ratings: Test, rate, and label in accordance with AMCA 211.

C. AMCA Certification for Fan Energy Index (FEI): Test, rate, and label in accordance with AMCA 211.

D. Fan Operating Limits: Classify fans in accordance with AMCA 99, Section 14.

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PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install fans level and plumb.

B. Disassemble and reassemble units, as required for moving to the final location, in accordance with manufacturer's written instructions.

C. Lift and support units with manufacturer's designated lifting or supporting points.

D. Equipment Mounting:

1. Support duct-mounted and other hanging fans directly from the building structure, using suitable hanging systems as specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
2. Comply with requirements for vibration isolation devices specified in Section 230548 "Vibration Controls for HVAC."

E. Install units with adequate clearances for service and maintenance.

F. Label fans in accordance with requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 DUCTWORK CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

B. Where installing ducts adjacent to fans, allow space for service and maintenance.

3.3 ELECTRICAL CONNECTIONS

A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

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3.4 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.5 STARTUP SERVICE:

A. Perform startup service.

1. Complete installation and startup checks in accordance with manufacturer's written instructions.
2. Verify that shipping, blocking, and bracing are removed.
3. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
4. Verify that cleaning and adjusting are complete.
5. For direct-drive fans, verify proper motor rotation direction and verify fan wheel free rotation and smooth bearing operation.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and confirm proper motor rotation and unit operation, adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

NOT FOR BIDDING PURPOSES

3.6 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Lubricate bearings.

C. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.7 CLEANING

A. After completing system installation and testing, adjusting, and balancing and after completing startup service, clean fans internally to remove foreign material and construction dirt and dust.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections with the assistance of a factory-authorized service representative.

1. Fan Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Test and adjust controls and safeties.
3. Fans and components will be considered defective if they do not pass tests and inspections.
4. Prepare test and inspection reports.

3.9 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain HVAC fans.

END OF SECTION 233400

NOT FOR BIDDING PURPOSES

SECTION 23 37 13.13 - AIR DIFFUSERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sidewall registers.

B. Related Requirements:

1. Section 233300 "Air Duct Accessories" for volume control dampers not integral to diffusers.
2. Section 233713.23 "Air Registers and Grilles" for adjustable-bar register and grilles, fixed-face registers and grilles, and linear bar grilles.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

1.3 INFORMATIONAL SUBMITTALS

A. Source quality-control reports.

NOT FOR BIDDING PURPOSES

PART 2 - PRODUCTS

2.1 SIDE WALL REGISTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Krueger-HVAC; brand of Johnson Controls International plc, Global Products.
2. Nailor Industries Inc.
3. Price Industries Limited.
4. Titus; brand of Johnson Controls International plc, Global Products.
5. Tuttle & Bailey; brand of Johnson Controls International plc, Global Products.

B. Type D-1, Titus 300

1. Aluminum supply grilles (double deflection) of the sizes and mounting types shown on the plans and outlet schedule. The deflection blades shall be available parallel to the short dimension of the grille or register. Construction shall be with a 1¼-inch wide border on all sides. Sizes 24 x 24 inches and below shall have roll-formed borders with a minimum thickness of 0.032 inch. Larger sizes shall be constructed using continuous aluminum extrusions with a nominal thickness of 0.040 through 0.050 inch and shall be interlocked at the four corners and mechanically staked to form a rigid frame. Screw holes shall be countersunk for a neat appearance.
2. Deflection blades shall be contoured to a specifically designed and tested cross-section to meet published test performance data. Blades shall be spaced on ¾-inch centers. Blades shall have friction pivots on both sides to allow individual blade adjustment without loosening or rattling or be inserted through the frame and held tight with steel friction wire interlocked to the frame on both ends of each side. Plastic blade pivots are not acceptable.
3. Phosphate coating and baked enamel finish color as selected by the Architect.

2.2 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

2.3 CODES AND STANDARDS

A. ASHRAE Standard 70, Method of Testing the Performance of Air Outlets and Air Inlets, 2006

B. ASTM Standard E84, Standard Test Method for Surface Burning Characteristics of Building Materials, 2016

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers level and plumb.

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B. Install diffusers with airtight connections to ducts and to allow service and maintenance of dampers.

3.3 ADJUSTING

A. After installation, adjust diffusers to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.13

NOT FOR BIDDING PURPOSES

SECTION 23 37 13.23 - REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Registers

B. Related Requirements:

1. Section 233300 "Air Duct Accessories" for volume control dampers not integral to registers.
2. Section 233713.13 "Air Diffusers" for various types of air diffusers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Register and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

1.3 INFORMATIONAL SUBMITTALS

A. Source quality-control reports.

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PART 2 - PRODUCTS

2.1 REGISTERS

A. Adjustable Blade Face Register – Type R-1, Titus 350

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anemostat Air Distribution; Anemostat, Inc.; Mestek, Inc.
b. Carnes Company.
c. Krueger-HVAC; brand of Johnson Controls International plc, Global Products.
d. METALAIRE, Inc.
e. Nailor Industries Inc.

f. Price Industries Limited.
g. Titus; brand of Johnson Controls International plc, Global Products.
h. Tuttle & Bailey; brand of Johnson Controls International plc, Global Products.

2. Material: Aluminum.
3. Finish: Baked enamel, color selected by Architect.
4. Face Blade Arrangement: Horizontal spaced 3/4 inch apart.
5. Core Construction: Integral.
6. Rear-Blade Arrangement: Horizontal spaced 3/4 inch apart.
7. Frame: 1-1/4 inches wide.
8. Mounting Frame: 1-inch MERV 8 Filter.
9. Mounting: As required.
10. Damper Type: None.
11. Accessories:

a. Filter.

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2.2 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate registers and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where registers and grilles are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install registers and grilles level and plumb.

B. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713.23

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SECTION 23 81 26 - SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes split-system heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Include performance data in terms of capacities, outlet velocities, static pressures, sound power characteristics, motor requirements, and electrical characteristics.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For split-system air-conditioning units to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set(s) for each air-handling unit.
2. Gaskets: One set(s) for each access door.

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1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Procedures," and Section 7 - "Construction and System Start-up."

C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.

1.7 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork are specified in Section 230500 "Common Work Results for HVAC."

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. For Compressor: Five year(s) from date of Substantial Completion.
b. For Parts: Five year(s) from date of Substantial Completion.
c. For Labor: Five year(s) from date of Substantial Completion.

NOT FOR BIDDING PURPOSES

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carrier Global Corporation.
2. Daikin.
3. Friedrich Air Conditioning Company.
4. Lennox Industries, Inc.; Lennox International.

5. Mitsubishi Electric & Electronics USA, Inc.
6. Mitsubishi Electric Sales Canada Inc.
7. Mitsubishi Heavy Industries America, Inc.
8. Rheem Manufacturing Company; Heating and Cooling Products.

2.2 INDOOR UNITS (5 TONS OR LESS)

A. Concealed Evaporator-Fan Components:

1. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
2. Insulation: Faced, glass-fiber duct liner.
3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
4. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
5. Fan Motors:

    a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 23 05 00 "Common Work Results for HVAC."
    b. Multitapped, multispeed with internal thermal protection and permanent lubrication.
    c. Wiring Terminations: Connect motor to chassis wiring with plug connection.

6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
7. Filters: Permanent, cleanable.
8. Condensate Drain Pans:

    a. Fabricated with two percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends), and to direct water toward drain connection.

        1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
        2) Depth: A minimum of 2 inches deep.

    b. Double-wall, stainless-steel sheet with space between walls filled with foam insulation and moisture-tight seal.
    c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.

        1) Minimum Connection Size: as required by manufacturer.

    d. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

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2.3 OUTDOOR UNITS (5 TONS OR LESS)

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

    a. Compressor Type: Scroll.
    b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
    c. Refrigerant: R-32, R-410A, or R-454B.
    d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.

3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
4. Fan: Aluminum-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.
6. Low Ambient Kit: Permits operation down to 45 deg F.
7. Mounting Base: Polyethylene.

2.4 ACCESSORIES

A. Thermostat: Low voltage with subbase to control compressor and evaporator fan.

B. Thermostat: Wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:

1. Compressor time delay.
2. 24-hour time control of system stop and start.
3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
4. Fan-speed selection including auto setting.

C. Automatic-reset timer to prevent rapid cycling of compressor.

D. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

E. Drain Hose: For condensate.

F. Monitoring:

1. Monitor constant and variable motor loads.

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2. Monitor variable-frequency-drive operation.
3. Monitor economizer cycle.
4. Monitor cooling load.
5. Monitor air distribution static pressure and ventilation air volumes.

2.5 REFRIGERANT

A. R-32, R-410A, or R-454B.

B. See Specification Section 232300 “Refrigerant Piping” for more information.

2.6 CAPACITIES AND CHARACTERISTICS

A. As scheduled on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Equipment Mounting:

1. Install ground-mounted, compressor-condenser components on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 230500 "Common Work Results for HVAC."
2. Comply with requirements for vibration isolation devices specified in Section 230548 "Vibration Controls for HVAC."

D. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

C. Duct Connections: Duct installation requirements are specified in Section 233113 "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to

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split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Section 233300 "Air Duct Accessories."

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.4 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 238126

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SECTION 23 81 29 - VARIABLE-REFRIGERANT-FLOW HVAC SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: VRF HVAC systems.

1. Indoor, exposed, wall-mounted units.
2. Outdoor, air-source heat-pump units.
3. System controls.
4. System refrigerant and oil.
5. System condensate drain piping.
6. System refrigerant piping.
7. Metal hangers and supports.
8. Metal framing systems.
9. Fastener systems.
10. Pipe stands.
11. Outdoor equipment stands.
12. Miscellaneous support materials.
13. Piping and tubing insulation.
14. System control cable.

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1.2 DEFINITIONS

A. Air-Conditioning System Operation: System capable of operation with all zones in cooling only.

B. Heat-Pump System Operation: System capable of operation with all zones in either heating or cooling, but not with simultaneous heating and cooling zones that transfer heat between zones.

C. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

D. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.

E. VRF: Variable refrigerant flow.

1.3 ACTION SUBMITTALS

A. Product Data: For VRF HVAC system components.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for indoor and outdoor units.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
3. Include operating performance at design conditions and at extreme maximum and minimum outdoor ambient conditions.
4. Include description of system controllers, dimensions, features, control interfaces and connections, power requirements, and connections.
5. Include system operating sequence of operation in narrative form for each unique indoor- and outdoor-unit control.
6. Include description of control software features.
7. Include total refrigerant required and a comprehensive breakdown of refrigerant required by each system installed.
8. Include refrigerant type and data sheets showing compliance with requirements indicated.
9. For system design software.
10. Indicate location and type of service access.

B. Delegated Design Submittals:

1. Include design calculations with corresponding diagram of refrigerant piping and tubing sizing for each system installed.
2. Include design calculations with corresponding floor plans indicating that refrigerant concentration limits are within allowable limits of ASHRAE 15 and governing codes.
3. Include calculations showing that system travel distance for refrigerant piping and controls cabling are within horizontal and vertical travel distances set by manufacturer. Provide a comparison table for each system installed.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For Installer: Certificate from VRF HVAC system manufacturer certifying that Installer has successfully completed prerequisite training administered by manufacturer for proper installation of systems, including but not limited to, equipment, piping, controls, and accessories indicated and furnished for installation.

    a. Retain copies of Installer certificates on-site and make available on request.

2. For VRF HVAC system manufacturer.
3. For VRF HVAC system provider.

B. Product Certificates: For VRF HVAC system components.

C. Product Test Reports: Where tests are required, for each product, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.

D. Source quality-control reports.

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E. Field quality-control reports.

F. Sample Warranties: For manufacturer's warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For VRF HVAC systems to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters:

a. One set(s) for each unit type and unique size of washable filters.

2. Indoor Units: One for each unique size and type installed.
3. Controllers for Indoor Units: One for each unique controller type installed.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Nationally recognized manufacturer of VRF HVAC systems and products.
2. Shipped VRF HVAC systems with similar requirements to those indicated for a continuous period of 10 years within time of bid.
3. VRF HVAC systems and products that have been successfully tested and in use on at least five completed projects.
4. Having complete published catalog literature, installation, and operation and maintenance manuals for all products intended for use.
5. Having full-time in-house employees for the following:

a. Product research and development.
b. Product and application engineering.
c. Product manufacturing, testing, and quality control.
d. Technical support for system installation training, startup, commissioning, and troubleshooting of installations.
e. Owner training.

B. Factory-Authorized Service Representative Qualifications:

1. Authorized representative of, and trained by, VRF HVAC system manufacturer.
2. In-place facility located within 50 miles of Project.

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3. Demonstrated past experience with products being installed for period within five consecutive years before time of bid.
4. Demonstrated past experience on five projects of similar complexity, scope, and value.

    a. Each person assigned to Project shall have demonstrated past experience.

5. Staffing resources of competent and experienced full-time employees that are assigned to execute work according to schedule.
6. Service and maintenance staff assigned to support Project during warranty period.
7. Product parts inventory to support ongoing system operation for a period of not less than five years after Substantial Completion.
8. VRF HVAC system manufacturer's backing to take over execution of Work if necessary to comply with requirements indicated. Include Project-specific written letter, signed by manufacturer's corporate officer, if requested.

C. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by VRF HVAC system manufacturer.

1. Each employee shall be certified by manufacturer for proper installation of systems, including, but not limited to, equipment, piping, controls, and accessories indicated and furnished for installation.
2. Installer certification shall be valid and current for duration of Project.
3. Retain copies of Installer certificates on-site and make available on request.
4. Each person assigned to Project shall have demonstrated past experience.

    a. Demonstrated past experience with products being installed for period within five consecutive years before time of bid.
    b. Demonstrated past experience on five projects of similar complexity, scope, and value.

D. ISO Compliance: System equipment and components furnished by VRF HVAC system manufacturer shall be manufactured in an ISO 9001 and ISO 14001 facility.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in a clean and dry place.

B. Comply with manufacturer's written rigging and installation instructions for unloading and moving to final installed location.

C. Handle products carefully to prevent damage, breaking, denting, and scoring. Do not install damaged products.

D. Protect products from weather, dirt, dust, water, construction debris, and physical damage.

1. Retain factory-applied coverings on equipment to protect finishes during construction and remove just prior to operating unit.

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2. Cover unit openings before installation to prevent dirt and dust from entering inside of units. If required to remover coverings during unit installation, reapply coverings over openings after unit installation and remove just prior to operating unit.

E. Replace installed products damaged during construction.

1.9 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace equipment and components that fail(s) in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Faulty operation.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period:

a. For Compressor: 10 year(s) from date of Substantial Completion.
b. For Parts, Including Controls: 10 year(s) from date of Substantial Completion.
c. For Labor: 2 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 VRF HVAC SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carrier Global Corporation.
2. Daikin Applied.
3. Johnson Controls, Inc. (Hitachi)
4. LG Electronics USA, Inc.; LG Electronics Inc.
5. Mitsubishi Electric & Electronics USA, Inc. (Trane)

B. Source Limitations: Obtain products from single source from single manufacturer including, but not limited to, the following:

1. Indoor and outdoor units, including accessories.
2. Controls and software.
3. Refrigerant isolation valves.
4. Specialty refrigerant pipe fittings.

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2.2 SYSTEM DESCRIPTION

A. Direct-expansion (DX) VRF HVAC system(s) with variable capacity in response to varying cooling and heating loads. System shall consist of multiple indoor units, outdoor unit(s), piping, controls, and electrical power to make complete operating system(s) complying with requirements indicated.

1. Two-pipe system design.
2. System(s) operation, heat pump as indicated on Drawings.
3. Each system with one refrigerant circuit shared by all indoor units connected to system.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. AHRI Compliance: System and equipment performance certified according to AHRI 1230 and products listed in AHRI directory.

D. ASHRAE Compliance:

1. ASHRAE 15: For safety code for mechanical refrigeration.
2. ASHRAE 62.1: For indoor air quality.
3. ASHRAE 135: For control network protocol with remote communication.
4. ASHRAE/IES 90.1 Compliance: For system and component energy efficiency.

E. UL Compliance: Comply with UL 1995.

2.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design complete and operational VRF HVAC system(s) complying with requirements indicated.

1. Provide system refrigerant calculations.

a. Refrigerant concentration limits shall be within allowable limits of ASHRAE 15 and governing codes.
b. Indicate compliance with manufacturer's maximum vertical and horizontal travel distances. Prepare a comparison table for each system showing calculated distances compared to manufacturer's maximum allowed distances.

2. System Refrigerant Piping and Tubing:

a. Arrangement and routing of piping is shown on the drawings. Arrange piping to interconnect indoor units and outdoor unit(s) in compliance with manufacturer requirements and requirements indicated. Conceal piping above ceilings and behind walls as indicated on the drawings.

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b. Sizing: Size piping system, using a software program acceptable to manufacturer, to provide performance requirements indicated. Consider requirements to accommodate future change requirements.

3. System Controls:

a. Network arrangement.
b. Network interface with other building systems.
c. Product selection.
d. Sizing.

B. Service Access:

1. Provide and document service access requirements.
2. Locate equipment, system isolation valves, and other system components that require service and inspection in easily accessible locations. Avoid locations that are difficult to access if possible.
3. Where serviceable components are installed behind walls and above inaccessible ceilings, provide finished assembly with access doors or panels to gain access. Properly size the openings to allow for service, removal, and replacement.
4. If less than full and unrestricted access is provided, locate components within an 18-inch reach of the finished assembly.
5. Where ladder access is required to service elevated components, provide an installation that provides for sufficient access within ladder manufacturer's written instructions for use.
6. Comply with OSHA regulations.

C. System Design and Installation Requirements:

1. Design and install systems indicated according to manufacturer's recommendations and written instructions.
2. Where manufacturer's requirements differ from requirements indicated, contact Architect for direction. The most stringent requirements should apply unless otherwise directed in writing by Architect.

D. Isolation of Equipment: Provide isolation valves to isolate each indoor unit and outdoor unit for service, removal, and replacement without interrupting system operation.

E. System Capacity Ratio: The sum of connected capacity of all indoor units shall be within the following range of outdoor-unit rated capacity:

1. Not less than 50 percent.
2. Not more than 130 percent.
3. Range acceptable to manufacturer.

F. System Turndown: Stable operation down to 20 percent of outdoor-unit capacity.

G. System Auto Refrigerant Charge: Each system shall have an automatic refrigerant charge function to ensure the proper amount of refrigerant is installed in system.

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H. Outdoor Conditions:

1. Suitable for outdoor ambient conditions encountered.

a. Design equipment and supports to withstand wind loads of governing code.
b. Design equipment and supports to withstand snow and ice loads of governing code.
c. Provide corrosion-resistant coating for components and supports where located in coastal or industrial climates that are known to be harmful to materials and finishes.

2. Maximum System Operating Outdoor Temperature: See Drawings.
3. Minimum System Operating Outdoor Temperature: See Drawings.

I. Thermal Movements: Allow for controlled thermal movements from ambient, surface, and system temperature changes.

J. Capacities and Characteristics: As indicated on Drawings.

2.4 INDOOR, EXPOSED, WALL-MOUNTED UNITS

A. Description: Factory-assembled complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.

B. Cabinet:

1. Material: Painted steel, or coated steel frame covered by a plastic cabinet, with an architectural acceptable finish suitable for tenant occupancy on exposed surfaces.
2. Insulation: Manufacturer's standard internal insulation**,** complying with ASHRAE 62.1, to provide thermal resistance and prevent condensation.
3. Mounting: Manufacturer-designed provisions for field installation.
4. Internal Access: Removable panels of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. DX Coil Assembly:

1. Coil Casing: Aluminum, galvanized, or stainless steel.
2. Coil Fins: Aluminum, mechanically bonded to tubes, with arrangement required by performance.
3. Coil Tubes: Copper, of diameter and thickness required by performance.
4. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
5. Unit Internal Tubing: Copper tubing with brazed joints.
6. Unit Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
7. Field Piping Connections: Manufacturer's standard.
8. Factory Charge: Dehydrated air or nitrogen.
9. Testing: Factory pressure tested and verified to be without leaks.

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D. Drain Assembly:

1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Gravity.

    a. If a floor drain is not available at unit, provide unit with field-installed condensate pump accessory.

3. Field Piping Connection: as required for connected piping specified elsewhere.

E. Fan and Motor Assembly:

1. Fan(s):

    a. Direct-drive arrangement.
    b. Single or multiple fans connected to a common motor shaft and driven by a single motor.
    c. Fabricated from non-ferrous components or ferrous components with corrosion protection finish.
    d. Wheels statically and dynamically balanced.

2. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
3. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
4. Speed Settings and Control: Two (low, high), three (low, medium, high), or more than three speed settings or variable speed with a speed range of least 50 percent.
5. Vibration Control: Integral isolation to dampen vibration transmission.

F. Filter Assembly:

1. Access: Front, to accommodate filter replacement without the need for tools.
2. Efficiency: MERV 8.
3. Washable Media: Manufacturer's standard filter with antimicrobial treatment.

G. Grille Assembly: Manufacturer's standard discharge grille mounted in top of unit cabinet.

H. Unit Controls:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Factory-Installed Sensors: Unit inlet air temperature, Coil entering refrigerant temperature, Coil leaving refrigerant temperature.
4. Field-Customizable I/O Capability:

    a. Analog Inputs: Two for use in customizable control strategies.
    b. Digital Inputs: Two for use in customizable control strategies.
    c. Digital Outputs: Two for use in customizable control strategies.

5. Features and Functions: Self-diagnostics, time delay, auto-restart**,** external static pressure control, auto operation mode, manual operation mode, filter service notification, power

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consumption display, drain assembly high water level safety shutdown and notification, run test switch.
6. Communication: Network communication with other indoor units and outdoor unit(s).
7. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
8. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

I. Unit Electrical:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in raceways to comply with NFPA 70.

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2.5 OUTDOOR, AIR-SOURCE HEAT-PUMP UNITS

A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.

1. Specially designed for use in systems with either all heating or all cooling demands, but not for use in systems with simultaneous heating and cooling.
2. Systems shall consist of one unit, or multiple unit modules that are designed by variable refrigerant system manufacturer for field interconnection to make a single refrigeration circuit that connects multiple indoor units.
3. All units installed shall be from the same product development generation.

B. Cabinet:

1. Galvanized steel and coated with a corrosion-resistant finish.

a. Coating with documented salt spray test performance of 1000 hours according ASTM B117 surface scratch test (SST) procedure.

2. Mounting: Manufacturer-designed provisions for field installation.
3. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

C. Compressor and Motor Assembly:

1. One or more positive-displacement, direct-drive and hermetically sealed scroll compressor(s) with inverter drive and turndown to 15 percent of rated capacity.
2. Protection: Integral protection against the following:

a. High refrigerant pressure.
b. Low oil level.
c. High oil temperature.
d. Thermal and overload.
e. Voltage fluctuations.
f. Phase failure and phase reversal.
g. Short cycling.

3. Speed Control: Variable to automatically maintain refrigerant suction and condensing pressures while varying refrigerant flow to satisfy system cooling and heating loads.
4. Vibration Control: Integral isolation to dampen vibration transmission.
5. Oil management system to ensure safe and proper lubrication over entire operating range.
6. Crankcase heaters with integral control to maintain safe operating temperature.
7. Fusible plug.

D. Condenser Coil Assembly:

1. Plate Fin Coils:

a. Casing: Aluminum, galvanized, or stainless steel.
b. Fins: Aluminum or copper, mechanically bonded to tubes, with arrangement required by performance.
c. Tubes: Copper, of diameter and thickness required by performance.

2. Aluminum Microchannel Coils:

a. Series of flat tubes containing a series of multiple, parallel-flow microchannels layered between refrigerant header manifolds.
b. Single- or multiple-pass arrangement.
c. Construct fins, tubes, and header manifolds of aluminum alloy.

3. Coating: Corrosion resistant.
4. Hail Protection: Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.

E. Condenser Fan and Motor Assembly:

1. Fan(s): Propeller type.

a. Direct-drive arrangement.
b. Fabricated from non-ferrous components or ferrous components with corrosion protection finish to match performance indicated for condenser coil.
c. Statically and dynamically balanced.

2. Fan Guards: Removable safety guards complying with OSHA regulations. If using metal materials, coat with corrosion-resistant coating to match performance indicated for condenser coil.
3. Motor(s): Brushless dc or electronically commutated with permanently lubricated bearings and rated for outdoor duty.

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4. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
5. Speed Settings and Control: Variable speed with a speed range of least 75 percent.
6. Vibration Control: Integral isolation to dampen vibration transmission.

F. Drain Pan: If required by manufacturer's design, provide unit with non-ferrous drain pan with bottom sloped to a low point drain connection.

G. Unit Controls:

1. Enclosure: Manufacturer's standard, and suitable for unprotected outdoor locations.
2. Factory-Installed Controller: Configurable digital control.
3. Factory-Installed Sensors:

   a. Refrigerant suction temperature.
   b. Refrigerant discharge temperature.
   c. Outdoor air temperature.
   d. Refrigerant high pressure.
   e. Refrigerant low pressure.
   f. Oil level.

4. Features and Functions: Self-diagnostics, time delay, auto-restart, fuse protection**,** auto operation mode, manual operation mode, night setback control, power consumption display, run test switch, equalize run time between multiple same components.
5. Communication: Network communication with indoor units and other outdoor unit(s).
6. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
7. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

H. Unit Electrical:

1. Enclosure: Metal, similar to enclosure, and suitable for unprotected outdoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls.
3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in [metal]raceways to comply with NFPA 70.

I. Unit Hardware: Zinc-plated steel, or stainless steel. Coat exposed surfaces with additional corrosion-resistant coating if required to prevention corrosion when exposed to salt spray test for 1000 hours according ASTM B117.

J. Unit Piping:

1. Unit Tubing: Copper tubing with brazed joints.

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2. Unit Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
3. Field Piping Connections: Manufacturer's standard.
4. Factory Charge: Dehydrated air or nitrogen.
5. Testing: Factory pressure tested and verified to be without leaks.

2.6 SYSTEM CONTROLS

A. General Requirements:

1. Network: Indoor units and outdoor units shall include integral controls and connect through a manufacturer-selected control network.
2. Network Communication Protocol: Manufacturer proprietary control communication between interconnected units.
3. Operator Interface:

    a. Operators shall interface with system and unit controls through the following:

        1) Operator interfaces integral to controllers.
        2) Web interface through web browser software.

    b. Users shall be capable of interface with controllers for indoor units control to extent privileges are enabled. Control features available to users shall include the following:

        1) On/off control.
        2) Temperature set-point adjustment.

B. Central Controllers:

1. Centralized control for all indoor and outdoor units from a single central controller location.

    a. Include multiple interconnected controllers as required.

2. Controls operation mode of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Operation modes available through central controller shall match those operation modes of controllers for indoor units.
3. Schedule operation of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.

    a. Sets schedule for daily, weekly, and annual events.
    b. Schedule options available through central controller shall at least include the schedule options of controllers for indoor units.

4. Changes operating set points of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.

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5. Optimized start feature to start indoor units before scheduled time to reach temperature set-point at scheduled time based on operating history.
6. Night setback feature to operate indoor units at energy-conserving heating and cooling temperature set-points during unoccupied periods.
7. Service diagnostics tool.
8. Able to disable and enable operation of individual controllers for indoor units.
9. Information displayed on individual controllers shall also be available for display through central controller.
10. Information displayed for outdoor units, including refrigerant high and low pressures.
11. Multiple RJ-45 ports for direct connection to a local PC and an Ethernet network switch.
12. Operator interface through a backlit, high-resolution color display touch panel and web accessible through standard web browser software.

C. Wired Controllers for Indoor Units:

1. Single controller capable of controlling multiple indoor units as group.
2. Auto Timeout Touch Screen LCD: Timeout duration shall be adjustable.
3. Multiple Language: English.
4. Temperature Units: Fahrenheit.
5. On/Off: Turns indoor unit on or off.
6. Hold: Hold operation settings until hold is released.
7. Operation Mode: Cool, Heat, Auto, Dehumidification, Fan Only, and Setback.
8. Temperature Display: 1-degree increments.
9. Temperature Set-Point: Separate set points for Cooling, Heating, and Setback. Adjustable in 1-degree increments.
10. Relative Humidity Display: 1 percent increments.
11. Relative Humidity Set-Point: Adjustable in 1 percent increments.
12. Fan Speed Setting: Select between available options furnished with the unit.
13. Airflow Direction Setting: If applicable to unit, select between available options furnished with the unit.
14. Seven-day programmable operating schedule with up to five events per day. Operations shall include On/Off, Operation Mode, and Temperature Set-Point.
15. Auto Off Timer: Operates unit for an adjustable time duration and then turns unit off.
16. Occupancy detection.
17. Service Notification Display: "Filter".
18. Service Run Tests: Limit use by service personnel to troubleshoot operation.
19. Error Code Notification Display: Used by service personnel to troubleshoot abnormal operation and equipment failure.
20. User and Service Passwords: Capable of preventing adjustments by unauthorized users.
21. Setting stored in nonvolatile memory to ensure that settings are not lost if power is lost. Battery backup for date and time only.
22. Low-voltage power required for controller shall be powered through non-polar connections to indoor unit.

2.7 SYSTEM REFRIGERANT AND OIL

A. Refrigerant:

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1. As required by VRF HVAC system manufacturer for system to comply with performance requirements indicated.
2. ASHRAE 34, Class A1 or A2L refrigerant classification.
3. R-32, R-410a, or R-454B.

B. Oil:

1. As required by VRF HVAC system manufacturer and to comply with performance requirements indicated.

2.8 SYSTEM CONDENSATE DRAIN PIPING

A. Comply with requirements in Section 221414 “Storm Drainage Piping” for system piping requirements.

2.9 SYSTEM REFRIGERANT PIPING

A. Comply with requirements in Section 232300 "Refrigerant Piping" for system piping requirements.

B. Divided-Flow Specialty Fittings: Where required by VRF HVAC system manufacturer for proper system operation, VRF HVAC system manufacturer shall furnish specialty fittings with identification and instructions for proper installation by Installer.

C. Refrigerant Isolation Ball Valves:

1. Description: Uni-body full port design, rated for maximum system temperature and pressure, and factory tested under pressure to ensure tight shutoff. Designed for valve operation without removing seal cap.
2. Seals: Compatible with system refrigerant and oil. Seal service life of at least 20 years.
3. Valve Connections: Flare or sweat depending on size.

2.10 METAL HANGERS AND SUPPORTS

A. Comply with requirement in Section 230529 “Hangers and Supports for HVAC Piping and Equipment.”

2.11 FASTENER SYSTEMS

A. Comply with requirement in Section 230529 “Hangers and Supports for HVAC Piping and Equipment.”

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2.12 PIPE STANDS

A. Comply with requirement in Section 230529 “Hangers and Supports for HVAC Piping and Equipment.”

2.13 OUTDOOR EQUIPMENT STANDS

A. Comply with requirement in Section 230529 “Hangers and Supports for HVAC Piping and Equipment.”

2.14 PIPING AND TUBING INSULATION

A. Comply with requirements in Section 230719 "HVAC Piping Insulation" for system piping insulation requirements.

B. Comply with requirements in Section 220719 “Plumbing Piping Insulation” for condensate drain piping insulation requirements:

2.15 SYSTEM CONTROL CABLE

A. Cable Rating: Listed and labeled for application according to NFPA 70.

1. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262, by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.

a. Flame Travel Distance: 60 inches or less.
b. Peak Optical Smoke Density: 0.5 or less.
c. Average Optical Smoke Density: 0.15 or less.

2. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.
3. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.

B. Low-Voltage Control Cabling:

1. Paired Cable: NFPA 70, Type CMG.

a. One pair, twisted, No. 16 AWG, stranded (19x29) or No. 18 AWG, stranded (19x30) tinned-copper conductors as required by VRF HVAC system manufacturer.
b. PVC insulation.
c. Braided or foil shielded.
d. PVC jacket.
e. Flame Resistance: Comply with UL 1685.

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2. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

    a. One pair, twisted, No. 16 AWG, stranded (19x29) or No. 18 AWG, stranded (19x30) tinned-copper conductors as required by VRF HVAC system manufacturer.
    b. PVC insulation.
    c. Braided or foil shielded.
    d. PVC jacket.
    e. NFPA 262 includes the standard flame-resistance test criteria in common use for cables and conductors.
    f. Flame Resistance: Comply with NFPA 262.

C. TIA-485A Network Cabling:

1. Standard Cable: NFPA 70, Type CMG.

    a. Paired, one pair, twisted, No. 22 AWG, stranded (7x30) tinned-copper conductors.
    b. PVC insulation.
    c. Unshielded.
    d. PVC jacket.
    e. Flame Resistance: Comply with UL 1685.

2. Plenum-Rated Cable: NFPA 70, Type CMP.

    a. Paired, one pair, No. 22 AWG, stranded (7x30) tinned-copper conductors.
    b. Fluorinated ethylene propylene insulation.
    c. Unshielded.
    d. Fluorinated ethylene propylene jacket.
    e. NFPA 262 includes the standard flame-resistance test criteria in common use for cables and conductors.
    f. Flame Resistance: NFPA 262.

D. Ethernet Network Cabling: TIA-568-C.2 Category 6 cable with RJ-45 connectors.

1. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of category cable indicated.
2. Conductors: 100-ohm, 23 AWG solid copper.
3. Shielding: Unshielded twisted pairs (UTP).
4. Cable Rating: By application.
5. Jacket: White thermoplastic.

E. Comply with requirements in Section 260533.13 "Conduits for Electrical Systems" for cable raceways.

2.16 MATERIALS

A. Steel:

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1. ASTM A36 for carbon structural steel.
2. ASTM A568 for steel sheet.

B. Stainless Steel:

1. Manufacturer's standard grade for casing.
2. Manufacturer's standard type, ASTM A240 for bare steel exposed to airstream or moisture.

C. Galvanized Steel: ASTM A653.

D. Aluminum: ASTM B209.

E. Corrosion-Resistant Coating: Coat with a corrosion-resistant coating capable of withstanding a 3000-hour salt-spray test according to ASTM B117.

1. Standards:

a. ASTM B117 for salt spray.
b. ASTM D2794 for minimum impact resistance of 100 in-lb.
c. ASTM B3359 for cross-hatch adhesion of 5B.

2. Application: Immersion.
3. Thickness: 1 mil.
4. Gloss: Minimum gloss of 60 on a 60-degree meter.

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2.17 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect factory-assembled equipment.

B. Equipment will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports for historical record. Submit reports only if requested.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine products before installation. Reject products that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for piping and tubing to verify actual locations of connections before equipment installation.

D. Examine roughing-in for wiring and conduit to verify actual locations of connections before equipment installation.

E. Examine walls, floors, roofs, and outdoor pads for suitable conditions where equipment will be installed.

F. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

G. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION, GENERAL

A. Clearance:

1. Maintain manufacturer's recommended clearances for service and maintenance.
2. Maintain clearances required by governing code.

B. Loose Components: Install components, devices, and accessories furnished by manufacturer, with equipment, that are not factory mounted.

1. Loose components shall be installed by manufacturer's service representative or system Installer under supervision of manufacturer's service representative.

3.3 INSTALLATION OF INDOOR UNITS

A. Install units to be level and plumb while providing a neat and finished appearance.

B. Unless otherwise required by VRF HVAC system manufacturer, support ceiling-mounted units from structure above using threaded rods; minimum rod size of 3/8 inch.

C. Adjust supports of exposed and recessed units to draw units tight to adjoining surfaces.

D. Protect finished surfaces of ceilings, floors, and walls that come in direct contact with units. Refinish or replaced damaged areas after units are installed.

E. In rooms with ceilings, conceal piping and tubing, controls, and electrical power serving units above ceilings.

F. In rooms without ceiling, arrange piping and tubing, controls, and electrical power serving units to provide a neat and finished appearance.

G. Provide lateral bracing if needed to limit movement of suspended units to not more than 0.25 inch.

H. For floor- and wall-mounted units that are exposed, conceal piping and tubing, controls, and electrical power serving units within walls.

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I. Attachment: Install hardware for proper attachment to supported equipment.

J. Grouting: Place grout under equipment supports and make bearing surface smooth.

3.4 INSTALLATION OF OUTDOOR UNITS

A. Install units to be level and plumb while providing a neat and finished appearance.

B. Pad-Mounted Installations: Install outdoor units on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 230500 "Common Work Results for HVAC."

1. Attachment: Install anchor bolts to elevations required for proper attachment to supported equipment.
2. Grouting: Place grout under equipment supports and make bearing surface smooth.

3.5 GENERAL REQUIREMENTS FOR PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping and tubing systems. Install piping and tubing as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping and tubing in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping and tubing at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping and tubing above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping and tubing to permit valve servicing.

F. Install piping and tubing at indicated slopes.

G. Install piping and tubing free of sags.

H. Install fittings for changes in direction and branch connections.

I. Install piping and tubing to allow application of insulation.

J. Install groups of pipes and tubing parallel to each other, spaced to permit applying insulation with service access between insulated piping and tubing.

K. Install sleeves for piping and tubing penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230500 "Common Work Results for HVAC."

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L. Install escutcheons for piping and tubing penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230500 "Escutcheons for HVAC Piping."

3.6 INSTALLATION OF SYSTEM CONDENSATE DRAIN PIPING

A. General Requirements for Drain Piping and Tubing:

1. Install a union in piping at each threaded unit connection.
2. Install an adjustable stainless steel hose clamp with adjustable gear operator on unit hose connections. Tighten clamp to provide a leak-free installation.
3. If required for unit installation, provide a trap assembly in drain piping to prevent air circulated through unit from passing through drain piping. Comply with more stringent of the following:

    a. Details indicated on Drawings.
    b. Manufacturer's requirements.

4. Extend drain piping from units with drain connections to drain receptors as indicated on Drawings. If not indicated on Drawings, terminate drain connection at nearest accessible location that is not exposed to view by occupants.
5. Provide each 90-degree change in direction with a Y- or T-fitting. Install a threaded plug connection in the dormant side of fitting or future use as a service cleanout.

B. Gravity Drains:

1. Slope piping from unit connection toward drain termination at a constant slope of not less than two percent.

C. Pumped Drains:

1. If unit condensate pump or lift mechanism is not included with an integral check valve, install a full-size check valve in each branch pipe near unit connection to prevent backflow into unit.

NOT FOR BIDDING PURPOSES

3.7 INSTALLATION OF REFRIGERANT PIPING

A. Refrigerant Tubing Kits:

1. Unroll and straighten tubing to suit installation. Deviations in straightness of exposed tubing shall be unnoticeable to observer.
2. Support tubing using hangers and supports indicated at intervals not to exceed 5 feet. Minimum rod size, 1/4 inch.
3. Prepare tubing ends and make mating connections to provide a pressure tight and leak-free installation.

B. Install refrigerant piping according to ASHRAE 15 and governing codes.

C. Select system components with pressure rating equal to or greater than system operating pressure.

D. Install piping as short and direct as possible, with a minimum number of joints and fittings.

E. Arrange piping to allow inspection and service of equipment. Install valves and specialties in accessible locations to allow for service and inspection.

F. Install refrigerant piping and tubing in protective conduit where installed belowground.

G. Install refrigerant piping and tubing in rigid or flexible conduit in locations where exposed to mechanical damage.

H. Unless otherwise required by VRF HVAC system manufacturer, slope refrigerant piping and tubing as follows:

1. Install horizontal hot-gas discharge piping and tubing with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps to entrain oil in vertical runs.
4. Liquid lines may be installed level.

I. When brazing, remove or protect components that could be damaged by heat.

J. Before installation, clean piping, tubing, and fittings to cleanliness level required by VRF HVAC system manufacturer.

K. Comply with requirements as specified in Section 232300 "Refrigerant Piping."

3.8 INSTALLATION OF METAL HANGERS AND SUPPORTS

A. Comply with requirements specified in Section 230529 “Hangers and Supports for HVAC Piping and Equipment and Section 220529 “Hangers and Support for Plumbing Piping and Equipment.”

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3.9 INSTALLATION OF PIPING AND TUBING INSULATION

A. Comply with requirements as specified in Section 230719 “HVAC Piping Insulation” and Section 220719 “Plumbing Piping Insulation.”

3.10 ELECTRICAL CONNECTIONS

A. Comply with requirements indicated on Drawings and in applicable Division 26 Sections.

B. To extent electrical power is required for system equipment, components, and controls, and is not indicated on Drawings and addressed in the Specifications, the design for such electrical power shall be delegated to VRF HVAC system provider.

1. Delegated design of electrical power to equipment, components and controls, and associated installation shall be included at no additional cost to Owner.

C. Connect field electrical power source to each separate electrical device requiring field electrical power. Coordinate termination point and connection type with Installer.

D. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

E. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems" for grounding connections.

F. Install nameplate or acrylic label with self-adhesive back for each electrical connection indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated phenolic layers of black with engraved white letters. Letters at least 1/2 inch high.
2. Locate nameplate or label where easily visible.

G. Comply with requirements in Section 260533.13 "Conduits for Electrical Systems" for raceway selection and installation requirements for conduits as supplemented or revised in this Section.

H. Comply with requirements in Section 260533.16 "Boxes and Covers for Electrical Systems" for box selection and installation requirements for boxes as supplemented or revised in this Section.

I. Comply with requirements in Section 260533.23 "Surface Raceways for Electrical Systems" for wireways selection and installation requirements for wireways as supplemented or revised in this Section.

1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.
2. Outlet boxes for cables shall be no smaller than 4 inches square by 1-1/2 inches deep with extension ring sized to bring edge of ring to within 1/8 inch of the finished wall surface.
3. Flexible metal conduit shall not be used.

J. Comply with TIA-569-D for pull-box sizing and length of conduit and number of bends between pull points.

K. Install manufactured conduit sweeps and long-radius elbows if possible.

L. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

3.11 INSTALLATION OF SYSTEM CONTROL CABLE

A. Comply with NECA 1.

B. Installation Method:

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1. Install cables in raceways except as follows:

    a. Within equipment and associated control enclosures.
    b. In accessible ceiling spaces where open cable installation method may be used.
    c. In gypsum board partitions where cable may be enclosed within wall cavity.

2. Conceal raceway and cables except in unfinished spaces.

C. General Requirements for Cabling:

1. Comply with TIA-568-C Series of standards.
2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems."
3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
4. Cables may not be spliced and shall be continuous from terminal to terminal. Do not splice cable.
5. Cables serving a common system may be grouped in a common raceway. Install control cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
6. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Install lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.
10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Monitor cable pull tensions.
11. Support: Do not allow cables to lie on removable ceiling tiles or access panels.
12. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
13. Provide strain relief.
14. Keep runs short. Allow extra length for connecting to terminals.
15. Do not bend cables in a radius less than 10 times the cable OD.
16. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.
17. Ground wire shall be copper, and grounding methods shall comply with IEEE C2. Demonstrate ground resistance.

D. Balanced Twisted-Pair Cable Installation:

1. Comply with TIA-568-C.2.
2. Do not untwist balanced twisted-pair cables more than 1/2 inch at the point of termination to maintain cable geometry.

E. Open-Cable Installation:

NOT FOR BIDDING PURPOSES

1. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 30 inches apart.
2. Cable shall not be run through or on structural members or in contact with pipes, ducts, or other potentially damaging items. Do not run cables between structural members and corrugated panels.

F. Separation from EMI Sources: Comply with BICSI TDMM and TIA-569-D recommendations for separating unshielded cable from potential EMI sources including electrical power wiring and equipment.

3.12 GROUNDING INSTALLATION

A. For data communication wiring, comply with TIA-607-B and with BICSI TDMM, "Bonding and Grounding (Earthing)" Chapter.

B. For low-voltage control cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.13 IDENTIFICATION

A. Identify system equipment, piping, tubing, and valves. Comply with requirements for identification specified in Section 230553 "Identification for HVAC Piping and Equipment."

B. Identify system electrical and control components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Identify each control cable on each end and at each terminal with a number-coded identification tag. Each cable shall have a unique tag.

3.14 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage VRF HVAC system manufacturer's service representative to advise and assist installers; witness testing; and observe and inspect components, assemblies, and equipment installations, including controls and connections.

1. Field service shall be performed by a factory-trained and -authorized service representative of VRF HVAC system manufacturer whose primary job responsibilities are to provide direct technical support of its products.

2. Manufacturer shall provide on-site visits during the course of construction at installation milestones indicated. System Installer shall coordinate each visit in advance to give manufacturer sufficient notice to plan the visit.

a. First Visit: Kick-off meeting.
b. Second Visit: At approximately 25 percent completion of system(s).

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c. Third Visit: At approximately 50 percent completion of system(s).
d. Fourth Visit: At approximately 75 percent completion of system(s).
e. Fifth Visit: Final inspection before system startup.

3. Kick-off Meeting:

a. Meeting shall include system Installer and other related trades with sole purpose of reviewing VRF HVAC system installation requirements and close coordination required to make a successful installation.
b. Meeting shall be held at Project site and scheduled at a mutually agreed to time that occurs before the start of any part of system installation.
c. Meeting shall cover the following as a minimum requirement:

1) Review of latest issue of Contract Documents, Drawings, and Specifications, relevant to VRF HVAC systems.
2) Manufacturer's installation requirements specific to systems being installed.
3) Review of all relevant VRF HVAC system submittals, including delegated design submittals.
4) Required field activities related installation of VRF HVAC system.
5) Project team communication protocol, contact information, and exchange of responsibilities for each party involved, including manufacturer, supplier, system Installer, and other related trades.

4. Site Visits: Activities for each site visit shall include the following:

a. Meet with VRF HVAC system Installer to discuss field activities, issues, and suggested methods to result in a successful installation.
b. Offer technical support to Installer and related trades as related to VRF system(s) being installed.
c. Review progress of VRF HVAC system(s) installation for strict compliance with manufacturer's requirements.
d. Advise and if necessary assist Installer with updating related refrigerant calculations and system documentation.
e. Issue a report for each visit, documenting the visit.

1) Report to include name and contact information of individual making the visit.
2) Date(s) and time frames while on-site.
3) Names and contact information of people meeting with while on-site.
4) Clearly identify and list each separate issue that requires resolution. For each issue, provide a unique identification number, relevant importance, specific location or equipment identification, description of issue, recommended corrective action, and follow-up requirements needed. Include a digital photo for clarification if deemed to be beneficial.

5. Final Inspection before Startup:

NOT FOR BIDDING PURPOSES

a. Before inspection, Installer to provide written request to manufacturer stating the system is fully installed according manufacturer's requirements and ready for final inspection.
b. All system equipment and operating components shall be inspected. If components are inaccessible for inspection, they shall be made accessible before the final inspection can be completed.
c. Manufacturer shall provide a comprehensive inspection of all equipment and each operating component that comprise the complete system(s). Inspection shall follow a detailed checklist specific to each equipment and operating component.
d. Inspection reports for indoor units shall include, but not be limited to, the following:

1) Unit designation on Drawings.
2) Manufacturer model number.
3) Serial number.
4) Network address, if applicable.
5) Each equipment setting.
6) Mounting, supports, and restraints properly installed.
7) Proper service clearance provided.
8) Wiring and power connections correct.
9) Line-voltage reading(s) within acceptable range.
10) Wiring and controls connections correct.
11) Low-voltage reading(s) within an acceptable range.
12) Controller type and model controlling unit.
13) Controller location.
14) Temperature settings and readings within an acceptable range.
15) Humidity settings and readings within an acceptable range.
16) Condensate removal acceptable.
17) Fan settings and readings within an acceptable range.
18) Unit airflow direction within an acceptable range.
19) If applicable, fan external static pressure setting.
20) Filter type and condition acceptable.
21) Noise level within an acceptable range.
22) Refrigerant piping properly connected and insulated.
23) Condensate drain piping properly connected and insulated.
24) If applicable, ductwork properly connected.
25) If applicable, external interlocks properly connected.
26) Remarks.

e. Inspection reports for outdoor units shall include, but not be limited to, the following:

1) Unit designation on Drawings.
2) Manufacturer model number.
3) Serial number.
4) Network address, if applicable.
5) Each equipment setting.
6) Mounting, supports, and restraints properly installed.
7) Proper service clearance provided.

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8) Wiring and power connections correct.
9) Line-voltage reading(s) within acceptable range.
10) Wiring and controls connections correct.
11) Low-voltage reading(s) within an acceptable range.
12) Condensate removal acceptable.
13) Noise level within an acceptable range.
14) Refrigerant piping properly connected and insulated.
15) Condensate drain piping properly connected and insulated.
16) Remarks.

f. Installer shall provide manufacturer with the requested documentation and technical support during inspection.
g. Installer shall correct observed deficiencies found by the inspection.
h. Upon completing the on-site inspection, manufacturer shall provide a written report with complete documentation describing each inspection step, the result, and any corrective action required.
i. If corrective action is required by Installer that cannot be completed during the same visit, provide additional visits, as required, until deficiencies are resolved and systems are deemed ready for startup.
j. Final report shall indicate the system(s) inspected are installed according to manufacturer's requirements and are ready for startup.

B. Perform the following tests and inspections with the assistance of manufacturer's service representative:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Refrigerant Tubing Positive Pressure Testing:

1. Comply with more stringent of VRF HVAC system manufacturer's requirements and requirements indicated.
2. After completion of tubing installation, pressurize tubing systems to a test pressure of not less than 1.2 times VRF HVAC system operating pressure, but not less than 600 psig, using dry nitrogen.
3. Successful testing shall maintain a test pressure for a continuous and uninterrupted period of 24 hours. Allowance for pressure changes attributed to changes in ambient temperature are acceptable.
4. Prepare test report to record the following information for each test:

a. Name of person starting test, company name, phone number, and e-mail address.
b. Name of manufacturer's service representative witnessing test, company name, phone number, and e-mail address.

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c. Detailed description of extent of tubing tested.
d. Date and time at start of test.
e. Test pressure at start of test.
f. Outdoor temperature at start of test.
g. Name of person ending test, company name, phone number, and e-mail address.
h. Date and time at end of test.
i. Test pressure at end of test.
j. Outdoor temperature at end of test.
k. Remarks:

5. Submit test reports for Project record.

D. Refrigerant Tubing Evacuation Testing:

1. Comply with more stringent of VRF HVAC system manufacturer's requirements and requirements indicated.
2. After completion of tubing positive-pressure testing, evacuate tubing systems to a pressure of 500 microns.
3. Successful testing shall maintain a test pressure for a continuous and uninterrupted period of one hour(s) with no change.
4. Prepare test report to record the following information for each test:

a. Name of person starting test, company name, phone number, and e-mail address.
b. Name of manufacturer's service representative witnessing test, company name, phone number, and e-mail address.
c. Detailed description of extent of tubing tested.
d. Date and time at start of test.
e. Test pressure at start of test.
f. Outdoor temperature at start of test.
g. Name of person ending test, company name, phone number, and e-mail address.
h. Date and time at end of test.
i. Test pressure at end of test.
j. Outdoor temperature at end of test.
k. Remarks:

5. Submit test reports for Project record.
6. Upon successful completion of evacuation testing, system shall be charged with refrigerant.

E. System Refrigerant Charge:

1. Using information collected from the refrigerant tubing evacuation testing, system Installer shall consult variable refrigerant system manufacturer to determine the correct system refrigerant charge.
2. Installer shall charge system following VRF HVAC system manufacturer's written instructions.
3. System refrigerant charging shall be witnessed by system manufacturer's representative.
4. Total refrigerant charge shall be recorded and permanently displayed at the system's outdoor unit.

NOT FOR BIDDING PURPOSES

F. Products will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports.

3.15 STARTUP SERVICE

A. Engage a VRF HVAC system manufacturer's service representative to perform system(s) startup service.

1. Service representative shall be a factory-trained and -authorized service representative of VRF HVAC system manufacturer.
2. Complete startup service of each separate system.
3. Complete system startup service according to manufacturer's written instructions.

B. Startup checks shall include, but not be limited to, the following:

1. Check control communications of equipment and each operating component in system(s).
2. Check each indoor unit's response to demand for cooling and heating.
3. Check each indoor unit's response to changes in airflow settings.
4. Check each indoor unit and outdoor unit for proper condensate removal.
5. Check sound levels of each indoor and outdoor unit.

C. Installer shall accompany manufacturer's service representative during startup service and provide manufacturer's service representative with requested documentation and technical support during startup service.

1. Installer shall correct deficiencies found during startup service for reverification.

D. System Operation Report

1. After completion of startup service, manufacturer shall issue a report for each separate system.
2. Report shall include complete documentation describing each startup check, the result, and any corrective action required.
3. Manufacturer shall electronically record not less than two hours of continuous operation of each system and submit with report for historical reference.

    a. All available system operating parameters shall be included in the information submitted.

E. Witness:

1. Invite Owner to witness startup service procedures.
2. Provide written notice not less than 20 business days before start of startup service.

NOT FOR BIDDING PURPOSES

3.16 ADJUSTING

A. Adjust equipment and components to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature and humidity set points. Adjust initial airflow settings and discharge airflow patterns.

C. Set field-adjustable switches and circuit-breaker trip ranges according to VRF HVAC system manufacturer's written instructions, and as indicated.

3.17 PROTECTION

A. Protect products from moisture and water damage. Remove and replace products that are wet, moisture damaged, or mold damaged.

B. Protect equipment from physical damage. Replace equipment with physical damage that cannot be repaired to new condition. Observable surface imperfections shall be grounds for removal and replacement.

C. Protect equipment from electrical damage. Replace equipment suffering electrical damage.

D. Cover and seal openings of equipment to keep inside of equipment clean. Do not remove covers until finish work is complete.

3.18 DEMONSTRATION

A. Engage a VRF HVAC system manufacturer's factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain entire system.

B. Instructor:

1. Instructor shall be factory trained and certified by VRF HVAC system manufacturer with current training on the system(s), equipment, and controls that are installed.
2. Instructor's credentials shall be submitted for review by Owner before scheduling training.
3. Instructor(s) primary job responsibility shall be Owner training.
4. Instructor(s) shall have not less than three years of training experience with VRF HVAC system manufacturer and past training experience on at least three projects of comparable size and complexity.

C. Schedule and Duration:

1. Schedule training with Owner at least 20 business days before first training session.
2. Training shall occur before Owner occupancy.
3. Training shall be held at mutually agreed date and time during normal business hours.

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4. Each training day shall not exceed eight hours of training. Daily training schedule shall allow time for one-hour lunch period and 15-minute break after every two hours of training.
5. Perform not less than eight total hours of training.

D. Location: Owner shall provide a suitable on-site location to host classroom training.

E. Training Attendees: Assume three people.

F. Training Attendance: For record purposes, document training attendees at the start of each new training session. Record attendee's name, signature, phone number, and e-mail address.

G. Training Format: Individual training modules shall include classroom training followed by hands-on field demonstration and training.

H. Training Materials: Provide training materials in electronic format to each attendee.

1. Include instructional videos showing general operation and maintenance that are coordinated with operation and maintenance manuals.
2. Video record each classroom training session and submit an electronic copy to Owner before requesting Owner acceptance of training.

I. Acceptance: Obtain Owner written acceptance that training is complete and requirements indicated have been satisfied.

END OF SECTION 238129

NOT FOR BIDDING PURPOSES

SECTION 23 82 39.16 - PROPELLER UNIT HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes propeller unit heaters with electric-resistance heating coils.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, and details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include location and size of each field connection.
4. Include details of anchorages and attachments to structure and to supported equipment.
5. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
6. Indicate location and arrangement of integral controls.
7. Wiring Diagrams: Power, signal, and control wiring.

NOT FOR BIDDING PURPOSES

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For propeller unit heaters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Airtherm; a Mestek company.
2. CCI Thermal Technologies, Inc.
3. Engineered Air.
4. Trane.

2.2 DESCRIPTION

A. Assembly including casing, coil, fan, and motor in vertical discharge configuration with adjustable discharge louvers.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with UL 2021.

2.3 PERFORMANCE REQUIREMENTS

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

B. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

2.4 HOUSINGS

A. Finish: Manufacturer's standard baked enamel applied to factory-assembled and -tested propeller unit heaters before shipping.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. Discharge Louver: Adjustable fin diffuser for horizontal units and conical diffuser for vertical units.

2.5 COILS

A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in steel or corrosion-resistant metallic sheath with fins no closer than 0.16 inch. Element ends shall be enclosed in terminal box. Fin surface temperature shall not exceed 550 deg F at any point during normal operation.

1. Circuit Protection: One-time fuses in terminal box for overcurrent protection and limit controls for high-temperature protection of heaters.
2. Wiring Terminations: Stainless-steel or corrosion-resistant material.

NOT FOR BIDDING PURPOSES

2.6 FAN AND MOTOR

A. Fan: Propeller type with aluminum wheel directly mounted on motor shaft in the fan venturi.

B. Motor: Permanently lubricated. Comply with requirements in Section 230500 "Common Work Results for HVAC."

2.7 CONTROLS

A. Control Devices:

1. Unit-mounted, fan-speed switch.
2. Wall-mounted thermostat.

2.8 CAPACITIES AND CHARACTERISTICS

A. As scheduled on the drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive propeller unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical connections to verify actual locations before unit-heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install propeller unit heaters to comply with NFPA 90A.

B. Install propeller unit heaters level and plumb.

C. Suspend propeller unit heaters from structure with all-thread hanger rods and spring hangers. Hanger rods and attachments to structure are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment." Vibration hangers are specified in Section 230548 "Vibration Controls for HVAC."

D. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

NOT FOR BIDDING PURPOSES

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Units will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust initial temperature set points.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain propeller unit heaters.

END OF SECTION 238239.16

NOT FOR BIDDING PURPOSES

SECTION 26 00 50 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Electrical equipment coordination and installation.
2. Common electrical installation requirements.

1.2 DESCRIPTION OF WORK

A. Requirements of this Section are applicable to work in Divisions 26 and 28.

B. Contract Documents

1. Contract drawings for electrical work are diagrammatic, intended to convey scope and general arrangement.
2. Refer questions involving document interpretation or discrepancies to Engineer for review and direction.
3. Correct faulty work due to resolving discrepancies without proper approval.
4. Specifications establish quality of materials, equipment, workmanship and methods of construction.
5. Follow drawings and specifications in laying out work. Consult other applicable contract drawings and specifications, become familiar with conditions affecting work.

C. Scope

1. Furnish and install the electrical work complete and ready for satisfactory service.

D. Definitions: The following are definitions of terms and expressions used in Divisions 26 and 28.

1. "Accessible" – Capable of being removed or exposed without damaging the building or structure or finish or not permanently closed in by other equipment or by the structure or finish of the building.
2. "Approve" - To permit use of material, equipment or methods conditional upon compliance with contract document requirements.
3. "Concealed" - Hidden from normal sight; includes work in crawl spaces, above ceilings, and in building shafts.
4. "Directed" - directed by Engineer.
5. "Equal, equivalent" - possessing the same performance qualities and characteristics and fulfilling the same utilitarian function.
6. "Exposed" - not concealed.
7. "Furnish" - Supply and deliver to project site, ready for unloading, unpacking, assembly, installation, and similar operations.

NOT FOR BIDDING PURPOSES

8. "Indicated" - indicated in Contract Documents.
9. "Install" - Operations at project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimensions, finishing, curing, protecting, cleaning and similar operations.
10. "Provide" - furnish and install, complete and ready for the intended use.
11. "Removable" - detachable from the structure or system without physical alteration of materials or equipment and without disturbance to other construction.
12. "Review" - limited observation or checking to ascertain general conformance with design concept of the work and with information given in contract documents. Such action does not constitute a waiver or alteration of the contract requirements.

NOT FOR BIDDING PURPOSES

1.3 QUALITY ASSURANCE

A. Regulations: Comply with regulations of IBC, NFPA, state, county, and municipal building ordinances, and other applicable codes and regulations.

B. Provide UL label on electric powered equipment or certification that equipment has been tested by a testing agency approved by the local authority as equivalent in safety to UL labeled equipment.

C. Material and Equipment Requirements

1. All materials and equipment shall be new and free from defects.
2. Use products of one manufacturer where two or more items of same kind of equipment are required.
3. For certain items of equipment, the specification and the project design are based upon the specified manufacturer's product. Other manufacturers' names are listed. Contractor may purchase, conditional upon meeting project requirements, equipment from the listed manufacturers.
4. Only the manufacturer's equipment upon which the specification and the project design has been based, has been checked for this project. Check allocated space and structure for suitability of equipment of other listed manufacturers, including parts replacement and servicing.

D. Workmanship

1. Remove and replace, at no extra cost, work not in conformance with contract requirements.
2. Coordinate with Other Trades

    a. Coordinate work and cooperate with other trades to facilitate execution of work.
    b. Give full cooperation and coordination with other trades and furnish information necessary to permit the work of all trades to be installed satisfactorily with the least possible interference or delay.
    c. Furnish to other trades, as required, necessary templates, patterns, setting plans and shop details for the proper installation of the work and for the purpose of coordinating adjacent work.

3. Accessible Equipment and Systems:

   a. Consider all materials and equipment installations and coordinate with the work of other trades to ensure equipment or systems are accessible for operations, maintenance, repairs, and replacement.
   b. Install materials and equipment, including but not limited to, supports and electrical conduit, to permit complete unobstructed access to panelboards, transformers, and other items requiring access for inspection, maintenance, and operations.
   c. Engineer will disapprove the installation of new equipment or materials which renders new or existing equipment inaccessible, and Contractor shall correct the Work.

1.4 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment as follows:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So that connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed.

D. Coordinate sleeve selection and application with selection and application of firestopping specified in [Division 7 Section "Penetration Firestopping."]

1.5 SHOP DRAWINGS AND SUBMITTALS

A. Refer to Division 01 for complete requirements.

B. Submit all products for a single specification section as a complete submittal. All products specified within a division shall be included, otherwise submittal will be returned as incomplete.

C. Clearly mark submittals to indicate actual intended products to be utilized. Marks may include highlighting, circling, boxing, checking, etc. Do not provide submittal data which lists multiple product's options and features without clearly indicating which data applies to the products intended to be used on project.

D. Coordinate drawings and data before submitting and certify that provisions of the contract documents have been met.

NOT FOR BIDDING PURPOSES

E. Call attention, in writing, to deviations from contract requirements.

F. Do not fabricate, deliver to site, or install items requiring shop drawing review, until the review has been completed by the Engineer and the shop drawing has been marked to indicate "No Exception Taken" or "Make Corrections Noted."

G. Use only final or corrected drawings and data for construction. This includes all Addendums, Architectural Supplemental Information (ASIs), and Change Bulletins.

H. The Engineer's review of submittals shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory. Approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work.

NOT FOR BIDDING PURPOSES

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounted items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Penetration Firestopping."

END OF SECTION 260050

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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 SUMMARY

A. Section Includes:

1. Copper building wire rated 600 V or less.
2. Metal-clad cable, Type MC, rated 600 V or less.
3. Photovoltaic cable, Type PV, rated 2000 V or less.
4. Connectors, splices, and terminations rated 600 V and less.

1.3 DEFINITIONS

A. PV: Photovoltaic.

B. RoHS: Restriction of Hazardous Substances.

C. VFC: Variable-frequency controller.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: Indicate type, use, location, and termination locations.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer's authorized service representative.

B. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

NOT FOR BIDDING PURPOSES

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. General Cable; Prysmian Group North America.
2. Okonite Company (The).
3. Service Wire Co.
4. Southwire Company, LLC.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

E. Conductor Insulation:

1. Type THHN and Type THWN-2: Comply with UL 83.
2. Type XHHW-2: Comply with UL 44.

2.2 METAL-CLAD CABLE, TYPE MC

A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems; Atkore International.
2. Encore Wire Corporation.
3. General Cable; Prysmian Group North America.
4. Southwire Company, LLC.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Comply with UL 1569.

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3. RoHS compliant.
4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Circuits:

1. Single circuit and multicircuit with color-coded conductors.
2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.

E. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

F. Ground Conductor: Insulated.

G. Conductor Insulation:

1. Type TFN/THHN/THWN-2: Comply with UL 83.
2. Type XHHW-2: Comply with UL 44.

H. Armor: Steel, interlocked. Aluminum interlocked armor is not permitted.

2.3 PHOTOVOLTAIC CABLE, TYPE PV

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated [**2000**] [**600**] V.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Encore Wire Corporation.
2. General Cable, Prysmian Group North America.
3. Service Wire Co.
4. Southwire Company, LLC.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

E. Conductor Insulation: Comply with UL 44 and UL 4703.

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2.4 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. 3M Electrical Products.
2. ILSCO.
3. Ideal Industries, Inc.
4. O-Z/Gedney; brand of Emerson Electric Co., Automation Solutions, Appleton Group.

C. Jacketed Cable Connectors: For steel jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

1. Material: Copper.
2. Type: Two hole with long barrels.
3. Termination: Compression Crimp.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

C. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

D. PV Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW-2, single conductors in raceway.

B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

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E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway. Metal-clad cable, Type MC permitted in areas with accessible ceiling space from local junction box to wiring device or lighting outlet.

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway.

H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

I. PV Circuits: Type USE-2 for PV source circuits rated at 600 V or less.

J. PV Circuits: Type PV for PV source circuits rated at [**600**] [**1000**] [**2000**] V.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 26 0533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 26 0529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

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3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 26 0553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 0544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 07 8413 "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections with the assistance of a factory-authorized service representative.

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
2. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors.
3. Perform each of the following visual and electrical tests:

a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
b. Test bolted connections for high resistance using one of the following:

1) A low-resistance ohmmeter.
2) Calibrated torque wrench.
3) Thermographic survey.

c. Inspect compression-applied connectors for correct cable match and indentation.
d. Inspect for correct identification.
e. Inspect cable jacket and condition.
f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
g. Continuity test on each conductor and cable.

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h. Uniform resistance of parallel conductors.

4. Initial Infrared Scanning: After Substantial Completion, but before Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.

   a. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
   b. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

C. Cables will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 260519

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SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes grounding and bonding systems and equipment, plus the following special applications:

1. Underground distribution grounding.
2. Ground bonding common with lightning protection system.
3. Foundation steel electrodes. (Ufer ground)
4. Intersystem bonding termination devices for the connection of communications systems bonding conductors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans showing dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:

1. Test wells.
2. Ground rods.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 01 7823 "Operation and Maintenance Data," include the following:

a. Plans showing as-built, dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:

1) Test wells.
2) Ground rods.

b. Instructions for periodic testing and inspection of grounding features at test wells and ground rings based on NETA MTS and NFPA 70B.

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1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
2) Include recommended testing intervals.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Certified by NETA.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Burndy; Part of Hubbell Electrical Systems.
2. ERICO International Corporation.
3. Harger Lightning & Grounding.
4. Thomas & Betts Corporation; A Member of the ABB Group.

2.3 CONDUCTORS

A. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.
4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.

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B. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

C. Bus-Bar Connectors: Compression type, copper or copper alloy, with two wire terminals.

D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.

E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

F. Conduit Hubs: Mechanical type, terminal with threaded hub.

G. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

H. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.

I. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.

J. Straps: Solid copper, cast-bronze clamp or copper lugs. Rated for 600 A.

K. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.

L. Water Pipe Clamps:

1. Mechanical type, two pieces with stainless-steel bolts.

    a. Material: Die-cast zinc alloy.
    b. Listed for direct burial.

2. U-bolt type with malleable-iron clamp and copper ground connector rated for direct burial.

2.5 INTERSYSTEM BONDING TERMINATION DEVICE

A. Lay-in connection clamp accepts 6 AWG through 2 AWG grounding electrode conductor.

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B. Accommodates minimum of five 14 AWG through 4 AWG bonding conductors.

C. Housing and integral mounting base:

1. 4-inch wide by 2-inch high by 1 1/2-inch deep.
2. Polymeric, impact resistant, and UV-stabilized.
3. Corrosion resistant, stainless steel mounting hardware.]

2.6 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch diameter by 10 feet.

B. Ground Plates: 1/4 inch (6 mm) thick, hot-dip galvanized.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 <Insert number> AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 Insert number AWG minimum.

1. Bury at least 24 inches (600 mm) below grade.
2. Duct-Bank Grounding Conductor: Bury 12 inches (300 mm) above duct bank when indicated as part of duct-bank installation.

C. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

1. Install bus horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

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3.2 GROUNDING AND BONDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Metal Covers and Other Exposed Conductive Surfaces of Manholes and Handholes: Effectively bond covers and exposed conductive surfaces to an effective ground-fault current path in accordance with NEC 250.4(A)(5) to ensure electrical continuity and the capacity to safely conduct any fault current likely to be imposed on the covers.

1. Manholes and Handholes Containing Service Conductors: Connect a supply-side bonding jumper to metal covers and exposed conductive surfaces of manhole and handhole enclosures. Size supply-side bonding jumper in accordance with NEC Table 250.102(C)(1) based on the size of the service conductors.
2. Manholes and Handholes Containing Branch Circuit or Feeder Conductors: Connect an equipment grounding conductor to metal covers and exposed conductive surfaces of manhole and handhole enclosures. Size equipment grounding conductor in accordance with NEC 250.122 based on the rating of the overcurrent device.

3.4 EQUIPMENT GROUNDING AND BONDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70.

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Metal-clad cable runs.

C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.

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E. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.

1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, or wiring closet.
2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch grounding bus.
3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

F. Poles Supporting Outdoor Lighting Fixtures: Install an insulated equipment grounding conductor with branch-circuit conductors.

G. Metallic Fences: Comply with requirements of IEEE C2.

1. Grounding Conductor: Bare, tinned copper, not less than No. 8 AWG.
2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.
3. Barbed Wire: Strands shall be bonded to the grounding conductor.

3.5 FENCE GROUNDING AND BONDING

A. Fence Grounding and Bonding: Install at maximum intervals of 1500 feet (450 m) except as follows:

1. Fences within 100 Feet (30 m) of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet (225 m).

a. Gates and Other Fence Openings: Ground fence on each side of opening.

1) Bond metal gates to gate posts.
2) Bond across openings, with and without gates, except at openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches (460 mm) below finished grade.

B. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches (150 mm) below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.

C. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.

D. Bonding to Lightning-Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning-protection down conductor or lightning-protection grounding conductor, complying with NFPA 780.

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3.6 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. Use exothermic welds for all below-grade connections.
3. For grounding electrode system, install at least [three] <Insert number> rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 26 0543 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches (300 mm) deep, with cover.

1. Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

E. Intersystem Bonding Termination Devices:

1. Install in close proximity to electrical and communications service entrances and in locations accessible for inspection and maintenance.
2. Connect to equipment enclosure or grounding electrode conductor in accordance with NEC requirements.

F. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

G. Grounding and Bonding for Piping:

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1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

H. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

I. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet (18 m) apart.

J. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet (6 m) of bare copper conductor not smaller than No. 4 AWG.

1. If concrete foundation is less than 20 feet (6 m) long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

K. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.7 LABELING

A. Comply with requirements in Section 26 0553 "Identification for Electrical Systems" for instruction signs. The label or its text shall be green.

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3.8 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections with the assistance of a factory-authorized service representative.

C. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.
4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

D. Grounding system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

F. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.

G. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

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SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

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 SUMMARY

A. Section Includes:

1. Steel slotted support systems.
2. Conduit and cable support devices.
3. Structural steel for fabricated supports and restraints.
4. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
5. Fabricated metal equipment support assemblies.

B. Related Requirements:

1. Section 26 0548.16 "Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

a. Slotted support systems, hardware, and accessories.
b. Clamps.
c. Hangers.
d. Sockets.
e. Eye nuts.
f. Fasteners.
g. Anchors.
h. Saddles.
i. Brackets.

2. Include rated capacities and furnished specialties and accessories.

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B. Shop Drawings: Signed and sealed by a qualified professional engineer. For fabrication and installation details for electrical hangers and support systems.

1. Hangers. Include product data for components.
2. Slotted support systems.
3. Equipment supports.
4. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated-Design Submittal: For hangers and supports for electrical systems.

1. Include design calculations and details of hangers.
2. Include design calculations for seismic restraints.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Ductwork, piping, fittings, and supports.
3. Structural members to which hangers and supports will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Items penetrating finished ceiling, including the following:

a. Luminaires.
b. Air outlets and inlets.
c. Speakers.
d. Sprinklers.
e. Access panels.
f. Projectors.

B. Seismic Qualification Data: Certificates, for hangers and supports for electrical equipment and systems, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Welding certificates.

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1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M.
2. AWS D1.2/D1.2M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design hanger and support systems.

B. Seismic Performance: Hangers and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the supported equipment and systems will remain in place without separation of any parts when subjected to the seismic forces specified and the supported equipment and systems will be fully operational after the seismic event."
2. Component Importance Factor: [**1.5**] [**1.0**].

C. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame Rating: Class 1.
2. Self-extinguishing according to ASTM D 635.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch-(10-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c. in at least one surface.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. CADDY; brand of nVent Electrical plc.
b. Cooper B-line; brand of Eaton, Electrical Sector.
c. Flex-Strut Inc.
d. Unistrut; Atkore International.

2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
3. Material for Channel, Fittings, and Accessories: Galvanized steel.
4. Channel Width: Selected for applicable load criteria with a minimum size of 1-5/8 inches (41.25 mm).

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5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
6. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

D. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

   a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

      1) Hilti, Inc.
      2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
      3) MKT Fastening, LLC.

2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

   a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

      1) Hilti, Inc.
      2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
      3) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

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2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Section 05 5000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:

1. NECA 1.
2. NECA 101
3. NECA 102.
4. NECA 105.
5. NECA 111.

B. Comply with requirements in Section 07 8413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

C. Comply with requirements for raceways and boxes specified in Section 26 0533 "Raceways and Boxes for Electrical Systems."

D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.

E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted [**or other**] support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with two-bolt conduit clamps or single-bolt conduit clamps using spring friction action for retention in support channel.

F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.

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B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, according to NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Expansion anchor fasteners.
5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
7. To Light Steel: Sheet metal screws.
8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.

E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

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3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Section 05 5000 "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 03 3000 "Cast-in-Place Concrete."

C. Anchor equipment to concrete base as follows:

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

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SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

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 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Metal wireways and auxiliary gutters.
4. Surface raceways.
5. Boxes, enclosures, and cabinets.

1.3 DEFINITIONS

A. ARC: Aluminum rigid conduit.

B. GRC: Galvanized rigid steel conduit.

C. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

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B. Qualification Data: For professional engineer.

C. Seismic Qualification Data: Certificates, for enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.

D. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Metal Conduit:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Allied Tube & Conduit; a part of Atkore International.
b. O-Z/Gedney; a brand of Emerson Industrial Automation.
c. Thomas & Betts Corporation; A Member of the ABB Group.
d. Western Tube and Conduit Corporation.
e. Wheatland Tube Company.

2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. GRC: Comply with ANSI C80.1 and UL 6.
4. ARC: Comply with ANSI C80.5 and UL 6A.
5. IMC: Comply with ANSI C80.6 and UL 1242.
6. EMT: Comply with ANSI C80.3 and UL 797.
7. FMC: Comply with UL 1; zinc-coated steel.
8. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

B. Metal Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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a. Allied Tube & Conduit; a part of Atkore International.
b. O-Z/Gedney; a brand of Emerson Industrial Automation.
c. Thomas & Betts Corporation; A Member of the ABB Group.
d. Western Tube and Conduit Corporation.
e. Wheatland Tube Company.

2. Comply with NEMA FB 1 and UL 514B.
3. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. Fittings, General: Listed and labeled for type of conduit, location, and use.
5. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
6. Fittings for EMT:

a. Material: Steel or die cast.
b. Type: Setscrew or compression.

7. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
8. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.

C. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

A. Nonmetallic Conduit:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. CANTEX INC.
b. Condux International, Inc.
c. Thomas & Betts Corporation; A Member of the ABB Group.

2. Listing and Labeling: Nonmetallic conduit shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
4. LFNC: Comply with UL 1660.

B. Nonmetallic Fittings:

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1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. CANTEX INC.
    b. Condux International, Inc.
    c. Thomas & Betts Corporation; A Member of the ABB Group.

2. Fittings, General: Listed and labeled for type of conduit, location, and use.
3. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

    a. Fittings for LFNC: Comply with UL 514B.

4. Solvents and Adhesives: As recommended by conduit manufacturer.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. B-line, an Eaton business.
2. Hoffman; a brand of nVent.
3. MonoSystems, Inc.
4. Square D.

B. Description: Sheet metal complying with UL 870 and NEMA 250, Type 1 or Type 3R for damp or wet locations unless otherwise indicated, and sized according to NFPA 70.

1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wireway Covers: Hinged type or Flanged-and-gasketed type unless otherwise indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Crouse-Hinds, an Eaton business.
2. Hoffman; a brand of nVent.

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3. O-Z/Gedney; a brand of Emerson Industrial Automation.
4. Thomas & Betts Corporation; A Member of the ABB Group.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy or aluminum, Type FD, with gasketed cover.

E. Metal Floor Boxes:

1. Material: Cast metal.
2. Type: Fully adjustable.
3. Shape: Rectangular.
4. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.

G. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb (32 kg).

1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum or galvanized, cast iron with gasketed cover.

J. Box extensions used to accommodate new building finishes shall be of same material as recessed box.

K. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).

L. Gangable boxes are prohibited.

M. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 or Type 3R for use in damp or wet locations with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

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N. Cabinets:

1. NEMA 250, Type 1 or Type 3R for use in damp or wet locations galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge.
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC or IMC.
2. Concealed Conduit, Aboveground: GRC or IMC.
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC or IMC. Raceway locations include the following:
   a. Loading dock.
   b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
   c. Mechanical rooms.
4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations: GRC or IMC.
7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

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1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use setscrew or compression, steel or cast-metal fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface raceways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.2 INSTALLATION

A. Comply with requirements in Section 26 0529 "Hangers and Supports for Electrical Systems" for hangers and supports.

B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.

D. Do not fasten conduits onto the bottom side of a metal deck roof.

E. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

F. Complete raceway installation before starting conductor installation.

G. Arrange stub-ups so curved portions of bends are not visible above finished slab.

H. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.

I. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.

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J. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

K. Support conduit within 12 inches (300 mm) of enclosures to which attached.

L. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m) intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
3. Arrange raceways to keep a minimum of 2 inch (50 mm) Insert dimension of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from RNC, Type EPC-40-PVC, to GRC before rising above floor.

M. Stub-Ups to Above Recessed Ceilings:

1. Use EMT, IMC, or RMC for raceways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

N. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

O. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.

P. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.

Q. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

R. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

S. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

T. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

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U. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

V. Surface Raceways:

1. Install surface raceway with a minimum 2-inch (50-mm) radius control at bend points.
2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

W. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

X. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service raceway enters a building or structure.
3. Conduit extending from interior to exterior of building.
4. Conduit extending into pressurized duct and equipment.
5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure setpoints.
6. Where otherwise required by NFPA 70.

Y. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

Z. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.

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d. Attics: 135 deg F (75 deg C) temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

AA. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 36 inches (915 mm) of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

BB. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

CC. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

DD. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

EE. Locate boxes so that cover or plate will not span different building finishes.

FF. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

GG. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

HH. Set metal floor boxes level and flush with finished floor surface.

II. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

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3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install 0sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 0544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.4 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 8413 "Penetration Firestopping."

3.5 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

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SECTION 26 05 43 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

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 SUMMARY

A. Section Includes:

1. Metal conduits and fittings, including GRC and PVC-coated steel conduit.
2. Rigid nonmetallic duct.
3. Duct accessories.
4. Polymer concrete handholes and boxes with polymer concrete cover.

1.3 DEFINITIONS

A. Direct Buried: Duct or a duct bank that is buried in the ground, without any additional casing materials such as concrete.

B. Duct: A single duct or multiple ducts. Duct may be either installed singly or as component of a duct bank.

C. Duct Bank:

1. Two or more ducts installed in parallel, with or without additional casing materials.
2. Multiple duct banks.

D. GRC: Galvanized rigid (steel) conduit.

E. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include duct-bank materials, including spacers and miscellaneous components.
2. Include duct, conduits, and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
3. Include accessories for manholes, handholes and boxes.

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4. Include underground-line warning tape.
5. Include warning planks.

B. Shop Drawings:

1. Factory-Fabricated Handholes and Boxes Other Than Precast Concrete:

a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.
b. Include duct entry provisions, including locations and duct sizes.
c. Include cover design.
d. Include grounding details.
e. Include dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For duct and duct bank. Show duct profiles and coordination with other utilities and underground structures.

1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
2. Drawings shall be signed and sealed by a qualified professional engineer.

B. Source quality-control reports.

C. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

1.7 FIELD CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions, and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Notify Architect and Owner no fewer than 14-days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.

B. Ground Water: Assume ground-water level is at grade level.

NOT FOR BIDDING PURPOSES

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND FITTINGS

A. GRC: Comply with ANSI C80.1 and UL 6.

1. Comply with NEMA RN 1.
2. Coating Thickness: 0.040 inch (1 mm), minimum.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allied Tube & Conduit; a part of Atkore International.
2. Anamet Electrical, Inc.
3. NEC, Inc.
4. O-Z/Gedney; a brand of Emerson Industrial Automation.
5. Southwire Company.
6. Thomas & Betts Corporation; A Member of the ABB Group.
7. Western Tube and Conduit Corporation.

C. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

2.2 RIGID NONMETALLIC DUCT

A. Underground Plastic Utilities Duct: Type EPC-80-PVC and Type EPC-40-PVC RNC, complying with NEMA TC 2 and UL 651, with matching fittings complying with NEMA TC 3 by same manufacturer as duct.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ARNCO Corp.
2. Condux International, Inc.
3. Electri-Flex Company.
4. Endot Industries Inc.
5. National Pipe & Plastics.
6. Opti-Com Manufacturing Network, Inc (OMNI).
7. Spiraduct/AFC Cable Systems, Inc.

C. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

D. Solvents and Adhesives: As recommended by conduit manufacturer.

NOT FOR BIDDING PURPOSES

2.3 DUCT ACCESSORIES

A. Duct Spacers: Factory-fabricated, rigid, PVC interlocking spacers; sized for type and size of duct with which used, and selected to provide minimum duct spacing indicated while supporting duct during concreting or backfilling.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Allied Tube & Conduit; a part of Atkore International.
b. CANTEX INC.
c. Carlon; a brand of Thomas & Betts Corporation.
d. IPEX USA LLC.
e. PenCell Plastics.
f. Underground Devices, Inc.

B. Underground-Line Warning Tape: Comply with requirements for underground-line warning tape specified in Section 26 0553 "Identification for Electrical Systems."

2.4 POLYMER CONCRETE HANDHOLES AND BOXES WITH POLYMER CONCRETE COVER

A. Description: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Armorcast Products Company; brand of Hubbell Utility Solutions; Hubbell Incorporated.
2. NewBasis.
3. Oldcastle Infrastructure Inc.; CRH Americas.
4. Quazite; brand of Hubbell Utility Solutions; Hubbell Incorporated.

C. Standard: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.

D. Color: Gray or Green.

E. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.

F. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.

G. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

H. Cover Legend: Molded lettering, as indicated for each service.

NOT FOR BIDDING PURPOSES

I. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.

J. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering duct for secure, fixed installation in enclosure wall.

K. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have factory-installed inserts for cable racks and pulling-in irons.

2.5 SOURCE QUALITY CONTROL

A. Test and inspect precast concrete utility structures according to ASTM C 1037.

B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification, complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate layout and installation of duct, duct bank, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Architect if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.

B. Coordinate elevations of duct and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of duct and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct and duct bank will drain to manholes and handholes, and as approved by Architect.

C. Clear and grub vegetation to be removed, and protect vegetation to remain according to Section 31 1000 "Site Clearing." Remove and stockpile topsoil for reapplication according to Section 31 1000 "Site Clearing."

NOT FOR BIDDING PURPOSES

3.2 UNDERGROUND DUCT APPLICATION

A. Duct for Electrical Feeders 600 V and Less: Type EPC-40-PVC RNC, direct-buried unless otherwise indicated.

B. Duct for Electrical Branch Circuits: Type EPC-40-PVC RNC, direct-buried unless otherwise indicated.

C. Underground Ducts Crossing Driveways and Roadways: Type EPC-40 PVC RNC, encased in reinforced concrete.

D. Stub-ups: Concrete-encased GRC.

3.3 UNDERGROUND ENCLOSURE APPLICATION

A. Handholes and Boxes for 600 V and Less:

1. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
2. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer concrete units, SCTE 77, Tier 8 structural load rating.
3. Cover design load shall not exceed the design load of the handhole or box.

3.4 EARTHWORK

A. Excavation and Backfill: Comply with Section 31 2000 "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restoration: Replace area immediately after backfilling is completed or after construction vehicle traffic in immediate area is complete.

C. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

D. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Section 32 9200 "Turf and Grasses" and Section 32 9300 "Plants."

E. Cut and patch existing pavement in the path of underground duct, duct bank, and underground structures according to "Cutting and Patching" Article in Section 01 7300 "Execution."

3.5 DUCT AND DUCT-BANK INSTALLATION

A. Where indicated on Drawings, install duct, spacers, and accessories into the duct-bank configuration shown. Duct installation requirements in this Section also apply to duct bank.

NOT FOR BIDDING PURPOSES

B. Install duct according to NEMA TCB 2.

C. Slope: Pitch duct a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope duct from a high point between two manholes, to drain in both directions.

D. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches (1200 mm), both horizontally and vertically, at other locations unless otherwise indicated.

1. Duct shall have maximum of two 90 degree bends or the total of all bends shall be no more 180 degrees between pull points.

E. Joints: Use solvent-cemented joints in duct and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent duct do not lie in same plane.

F. End Bell Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches (250 mm) o.c. for 5-inch (125-mm) duct, and vary proportionately for other duct sizes.

1. Begin change from regular spacing to end-bell spacing 10 feet (3 m) from the end bell, without reducing duct slope and without forming a trap in the line.
2. Expansion and Deflection Fittings: Install an expansion and deflection fitting in each duct in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight line direct-buried duct with calculated expansion of more than 3/4 inch (19 mm).
3. Grout end bells into structure walls from both sides to provide watertight entrances.

G. Terminator Entrances to Polymer Concrete Handholes: Use manufactured, cast-in-place duct terminators, with entrances into structure spaced approximately 6 inches (150 mm) o.c. for 4-inch (100-mm) duct, and vary proportionately for other duct sizes.

1. Begin change from regular spacing to terminator spacing 10 feet (3 m) from the terminator, without reducing duct line slope and without forming a trap in the line.
2. Expansion and Deflection Fittings: Install an expansion and deflection fitting in each duct in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight line duct with calculated expansion of more than 3/4 inch (19 mm).

H. Building Wall Penetrations: Make a transition from underground duct to GRC at least 10 feet (3 m) outside the building wall, without reducing duct line slope away from the building and without forming a trap in the line. Use fittings manufactured for RNC-to-GRC transition. Install GRC penetrations of building walls as specified in Section 26 0544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

I. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least 15-psig (1.03-MPa) hydrostatic pressure.

NOT FOR BIDDING PURPOSES

J. Pulling Cord: Install 200-lbf- (1000-N-) test nylon cord in empty ducts.

K. Concrete-Encased Ducts and Duct Bank:

1. Excavate trench bottom to provide firm and uniform support for duct. Prepare trench bottoms as specified in Section 31 2000 "Earth Moving" for pipes less than 6 inches (150 mm) in nominal diameter.
2. Width: Excavate trench 12 inches (300 mm) wider than duct on each side.
3. Depth: Install so top of duct envelope is at least 24 inches (600 mm) below finished grade in areas not subject to deliberate traffic, and at least 30 inches (750 mm) below finished grade in deliberate traffic paths for vehicles unless otherwise indicated.
4. Support duct on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
5. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than five spacers per 20 feet (6 m) of duct. Place spacers within 24 inches (600 mm) of duct ends. Stagger spacers approximately 6 inches (150 mm) between tiers. Secure spacers to earth and to duct to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
6. Minimum Space between Duct: 3 inches (75 mm) between edge of duct and exterior envelope wall, 2 inches (50 mm) between ducts for like services, and 4 inches (100 mm) between power and communications ducts.
7. Elbows: Use manufactured GRC elbows for stub-ups, at building entrances, and at changes of direction in duct run.

    a. Couple RNC duct to GRC with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
    b. Stub-ups to Outdoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches (1500 mm) from edge of base. Install insulated grounding bushings on terminations at equipment.

        1) Stub-ups shall be minimum 4 inches (100 mm)above finished floor and minimum 3 inches (75 mm)from conduit side to edge of slab.

    c. Stub-ups to Indoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches (1500 mm) from edge of wall. Install insulated grounding bushings on terminations at equipment.

        1) Stub-ups shall be minimum 4 inches (100 mm)above finished floor and no less than 3 inches (75 mm)from conduit side to edge of slab.

8. Reinforcement: Reinforce concrete-encased duct where crossing disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
9. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
10. Concrete Cover: Install a minimum of 3 inches (75 mm) of concrete cover between edge of duct to exterior envelope wall, 2 inches (50 mm) between duct of like services, and 4 inches (100 mm) between power and communications ducts.

NOT FOR BIDDING PURPOSES

11. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.

    a. Start at one end and finish at the other, allowing for expansion and contraction of duct as its temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written instructions, or use other specific measures to prevent expansion-contraction damage.
    b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch (15-mm) reinforcing-rod dowels extending a minimum of 18 inches (450 mm) into concrete on both sides of joint near corners of envelope.

12. Pouring Concrete: Comply with requirements in "Concrete Placement" Article in Section 03 3000 "Cast-in-Place Concrete." Place concrete carefully during pours to prevent voids under and between duct and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow around duct and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-installation application.

L. Direct-Buried Duct and Duct Bank:

1. Excavate trench bottom to provide firm and uniform support for duct. Comply with requirements in Section 31 2000 "Earth Moving" for preparation of trench bottoms for pipes less than 6 inches (150 mm) in nominal diameter.
2. Width: Excavate trench 12 inches (300 mm) wider than duct on each side.
3. Depth: Install top of duct at least 36 inches (900 mm) below finished grade unless otherwise indicated.
4. Set elevation of bottom of duct bank below frost line.
5. Support ducts on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
6. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than five spacers per 20 feet (6 m) of duct. Place spacers within 24 inches (600 mm) of duct ends. Stagger spacers approximately 6 inches (150 mm) between tiers. Secure spacers to earth and to ducts to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
7. Install duct with a minimum of 3 inches (75 mm) between ducts for like services and 6 inches (150 mm) between power and communications duct.
8. Elbows: Install manufactured duct elbows for stub-ups, at building entrances, and at changes of direction in duct direction unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
9. Install manufactured GRC elbows for stub-ups, at building entrances, and at changes of direction in duct.

    a. Couple RNC duct to GRC with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
    b. Stub-ups to Outdoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches (1500 mm) from edge of base. Install insulated grounding bushings on terminations at equipment.

NOT FOR BIDDING PURPOSES

1) Stub-ups shall be minimum 4 inches (100 mm)above finished floor and minimum 3 inches (75 mm)from conduit side to edge of slab.

c. Stub-ups to Indoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches (1500 mm) from edge of wall. Install insulated grounding bushings on terminations at equipment.

1) Stub-ups shall be minimum 4 inches (100 mm)above finished floor and no less than 3 inches (75 mm)from conduit side to edge of slab.

10. After installing first tier of duct, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inches (100 mm) over duct and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction. Comply with requirements in Section 31 2000 "Earth Moving" for installation of backfill materials.

a. Place minimum 3 inches (75 mm) of sand as a bed for duct. Place sand to a minimum of 6 inches (150 mm) above top level of duct.
b. Place minimum 6 inches (150 mm) of engineered fill above concrete encasement of duct.

M. Underground-Line Warning Tape: Bury conducting underground line specified in Section 26 0553 "Identification for Electrical Systems" no less than 12 inches (300 mm) above all concrete-encased duct and duct banks and approximately 12 inches (300 mm) below grade. Align tape parallel to and within 3 inches (75 mm) of centerline of duct bank. Provide an additional warning tape for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional tapes 12 inches (300 mm) apart, horizontally.

3.6 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of duct, and seal joint between box and extension as recommended by manufacturer.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.

D. Install handholes and boxes with bottom below frost line.

NOT FOR BIDDING PURPOSES

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.

F. Field cut openings for duct according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

G. For enclosures installed in asphalt paving and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.

1. Concrete: 3000 psi (20 kPa), 28-day strength, complying with Section 03 3000 "Cast-in-Place Concrete," with a troweled finish.

3.7 GROUNDING

A. Ground underground ducts and utility structures according to Section 26 0526 "Grounding and Bonding for Electrical Systems."

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Demonstrate capability and compliance with requirements on completion of installation of underground duct, duct bank, and utility structures.
2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 12-inch- (300-mm-) long mandrel equal to duct size minus 1/4 inch (6 mm). If obstructions are indicated, remove obstructions and retest.
3. Test **handhole** grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 26 0526 "Grounding and Bonding for Electrical Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.

C. Prepare test and inspection reports.

3.9 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of duct until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

NOT FOR BIDDING PURPOSES

END OF SECTION 260543

NOT FOR BIDDING PURPOSES

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

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 SUMMARY

A. Section Includes:

1. Color and legend requirements for raceways, conductors, and warning labels and signs.
2. Labels.
3. Bands and tubes.
4. Tapes and stencils.
5. Tags.
6. Signs.
7. Cable ties.
8. Paint for identification.
9. Fasteners for labels and signs.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Delegated-Design Submittal: For arc-flash hazard study.

NOT FOR BIDDING PURPOSES

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Comply with NFPA 70E and Section 26 0573.19 "Arc-Flash Hazard Analysis" requirements for arc-flash warning labels.

F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 degrees F (67 deg C), ambient; 180 degrees F (100 deg C), material surfaces.

2.2 COLOR AND LEGEND REQUIREMENTS

A. Raceways and Cables Carrying Circuits at 600 V or Less:

1. Black letters on an orange field.
2. Legend: Indicate voltage and system or service type.

B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service and feeder conductors.

1. Color shall be factory applied.
2. Colors for 208/120-V Circuits:

a. Phase A: Black.
b. Phase B: Red.
c. Phase C: Blue.

3. Color for Neutral: White.
4. Color for Equipment Grounds: Green.
5. Colors for Isolated Grounds: Green with white stripe.

C. Warning Label Colors:

1. Identify system voltage with black letters on an orange background.

D. Warning labels and signs shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

E. Equipment Identification Labels:

1. Black letters on a white field. Letters shall be ½" high, minium.
2. Emergency Equipment: Red letters on a white field. Letters shall be ½" high, minium.

NOT FOR BIDDING PURPOSES

F. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.
b. Champion America.
c. emedco.
d. Grafoplast Wire Markers.
e. HellermannTyton.
f. LEM Products Inc.
g. Marking Services, Inc.
h. Panduit Corp.
i. Seton Identification Products.

G. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameter and that stay in place by gripping action.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.
b. HellermannTyton.
c. Marking Services, Inc.
d. Panduit Corp.
e. Seton Identification Products.

H. Self-Adhesive Wraparound Labels: Write-on, 3-mil- (0.08-mm-) thick, polyester flexible label with acrylic pressure-sensitive adhesive.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. A'n D Cable Products.
b. Brady Corporation.
c. Brother International Corporation.
d. emedco.
e. Grafoplast Wire Markers.
f. Ideal Industries, Inc.
g. LEM Products Inc.
h. Marking Services, Inc.
i. Panduit Corp.
j. Seton Identification Products.

2. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.

NOT FOR BIDDING PURPOSES

3. Marker for Labels: Permanent, waterproof, black ink marker recommended by tag manufacturer.

I. Self-Adhesive Labels: Polyester or Vinyl, thermal, transfer-printed, 3-mil- (0.08-mm-) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. A'n D Cable Products.
b. Brady Corporation.
c. Brother International Corporation.
d. emedco.
e. Grafoplast Wire Markers.
f. HellermannTyton.
g. Ideal Industries, Inc.
h. LEM Products Inc.
i. Marking Services, Inc.
j. Panduit Corp.
k. Seton Identification Products.

2. Minimum Nominal Size:

a. 1-1/2 by 6 inches for raceway and conductors.
b. 3-1/2 by 5 inches for equipment.
c. As required by authorities having jurisdiction.

2.3 BANDS AND TUBES

A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameters sized to suit diameter and that stay in place by gripping action.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.
b. HellermannTyton.
c. Marking Services, Inc.
d. Panduit Corp.

B. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameters of and shrunk to fit firmly around item being identified. Full shrink recovery occurs at a maximum of 200 deg F (93 deg C). Comply with UL 224.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

NOT FOR BIDDING PURPOSES

a. Brady Corporation.
b. Panduit Corp.

2.4 TAPES AND STENCILS

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Carlton Industries, LP.
b. Champion America.
c. HellermannTyton.
d. Ideal Industries, Inc.
e. Marking Services, Inc.
f. Panduit Corp.

B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Brady Corporation.
b. Carlton Industries, LP.
c. emedco.
d. Marking Services, Inc.

C. Tape and Stencil: 4-inch- wide black stripes on 10-inch centers placed diagonally over orange background and is 12 inches wide. Stop stripes at legends.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. HellermannTyton.
b. LEM Products Inc.
c. Marking Services, Inc.
d. Seton Identification Products.

D. Floor Marking Tape: 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Carlton Industries, LP.
b. Seton Identification Products.

NOT FOR BIDDING PURPOSES

E. Underground-Line Warning Tape:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Brady Corporation.
   b. Ideal Industries, Inc.
   c. LEM Products Inc.
   d. Marking Services, Inc.
   e. Reef Industries, Inc.
   f. Seton Identification Products.

2. Tape:

   a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical utility lines.
   b. Printing on tape shall be permanent and shall not be damaged by burial operations.
   c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.

3. Color and Printing:

   a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
   b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE".

F. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch .

2.5 TAGS

A. Write-on Tags:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Carlton Industries, LP.
   b. LEM Products Inc.
   c. Seton Identification Products.

2. Polyester Tags: 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment.
3. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.6 SIGNS

A. Baked-Enamel Signs:

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1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Carlton Industries, LP.
    b. Champion America.
    c. emedco.
    d. Marking Services, Inc.

2. Preprinted aluminum signs,punched or drilled for fasteners, with colors, legend, and size required for application.
3. 1/4-inch grommets in corners for mounting.
4. Nominal Size: 7 by 10 inches.

B. Metal-Backed Butyrate Signs:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Brady Corporation.
    b. Champion America.
    c. emedco.
    d. Marking Services, Inc.

2. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
3. 1/4-inch grommets in corners for mounting.
4. Nominal Size: 10 by 14 inches .

C. Laminated Acrylic or Melamine Plastic Signs:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Brady Corporation.
    b. Carlton Industries, LP.
    c. emedco.
    d. Marking Services, Inc.

2. Engraved legend.
3. Thickness:

    a. For signs up to 20 sq. in., minimum 1/16 inch thick.
    b. For signs larger than 20 sq. in. , 1/8 inch thick.
    c. Engraved legend with black letters on white face.
    d. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting.
    e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

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2.7 CABLE TIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. HellermannTyton.
2. Ideal Industries, Inc.
3. Marking Services, Inc.
4. Panduit Corp.

B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 Deg F according to ASTM D 638: 22,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black, except where used for color-coding.

C. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 Deg F according to ASTM D 638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

D. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 Deg F according to ASTM D 638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F
5. Color: Black.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop

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Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

G. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

H. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.

I. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.

1. Secure tight to surface of conductor, cable, or raceway.

J. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

K. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer.

L. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

M. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:

1. "EMERGENCY POWER."
2. "POWER."
3. "UPS."

N. Vinyl Wraparound Labels:

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1. Secure tight to surface at a location with high visibility and accessibility.
2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

O. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.

P. Self-Adhesive Wraparound Labels: Secure tight to surface of raceway or cable at a location with high visibility and accessibility.

Q. Self-Adhesive Labels:

1. On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.

R. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.

S. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.

T. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.

U. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.

1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

V. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

W. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.

X. Underground Line Warning Tape:

1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.
2. Install underground-line warning tape for direct-buried cables and cables in raceways.

Y. Write-on Tags:

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1. Place in a location with high visibility and accessibility.
2. Secure using general-purpose cable ties.

Z. Baked-Enamel Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on minimum 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use signs minimum 2 inches (50 mm) high.

AA. Metal-Backed Butyrate Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on minimum 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use signs minimum 2 inches (50 mm) high.

BB. Laminated Acrylic or Melamine Plastic Signs:

1. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on minimum 1-1/2-inch- (38-mm-) high sign; where two lines of text are required, use signs minimum 2 inches (50 mm) high.

CC. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

3.2 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

C. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:

1. "EMERGENCY POWER."
2. "POWER."
3. "UPS."

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D. Wiring Devices: Identify with indelible marker on back of coverplate of receptacles and wiring devices. Indicate circuit number and panel name

E. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use vinyl wraparound labels, self-adhesive wraparound labels, snap-around labels, snap-around color-coding band, or self-adhesive vinyl tape to identify the phase.

1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

F. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use write-on tags or self-adhesive wraparound labelswith the conductor or cable designation, origin, and destination.

G. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.

H. Auxiliary Electrical Systems Conductor Identification: Marker tape or Self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

I. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.

J. Workspace Indication: Apply floor marking tape to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

K. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.

L. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive equipment labels or Baked-enamel warning signs.

1. Apply to exterior of door, cover, or other access.
2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:

a. Power-transfer switches.

M. Arc Flash Warning Labeling: Self-adhesive labels.

N. Operating Instruction Signs: Self-adhesive labels or Baked-enamel warning signs.

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O. Emergency Operating Instruction Signs: Self-adhesive labels or Baked-enamel warning signs with white legend on a red background with minimum 3/8-inch- (10-mm-)high letters for emergency instructions at equipment used for power transfer.

P. Equipment Identification Labels:

1. Indoor Equipment: White phenolic nameplate with black letters and black trim.
2. Outdoor Equipment: White phenolic nameplate with black letters and black trim.

END OF SECTION 260553

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SECTION 26 05 73 - ELECTRICAL POWER STUDIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes a computer-based, fault-current study to determine the minimum interrupting capacity of circuit protective devices.

B. Section includes a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

C. Provide a study to include new and existing building electrical components.

D. An electronic version, by computer software manufacturer, of the study shall be submitted to the owner at the completion of the project.

1.2 DEFINITIONS

A. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

B. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

C. SCCR: Short-circuit current rating.

D. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.3 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: Submit the following after the approval of system protective devices submittals. Submittals may be in digital form.

1. Short-circuit study input data, including completed computer program input data sheets.
2. Short-circuit study and equipment evaluation report; signed, dated, and sealed by a qualified professional engineer.

    a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Contracting Officer for

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preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

b. Revised single-line diagram, reflecting field investigation results and results of short-circuit study.

3. Electronic copy of power study in the file type of software program used for owner's future use.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Short-Circuit Study Specialist and Field Adjusting Agency.

B. Product Certificates: For short-circuit study software, certifying compliance with IEEE 399.

1.5 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. Electrical Power Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

C. Electrical Power Study Specialist Qualifications: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

D. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

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PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. CYME International T&D Inc.; subsidiary of Eaton Corporation plc.
2. EDSA Micro Corporation.
3. ESA Inc.
4. ETAP; brand of Operation Technology, Inc.; subsidiary of Schneider Electric.
5. EasyPower; brand of Bentley Systems, Inc.
6. Power Analytics, Corporation.
7. SKM Systems Analysis, Inc.

B. Comply with IEEE 399 and IEEE 551.

C. Analytical features of fault-current-study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

D. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output.

2.2 SHORT-CIRCUIT STUDY REPORT CONTENTS

A. Executive summary.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of the computer printout.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Cable size and lengths.
3. Motor and kVA ratings.
4. Panelboard designations.

D. Comments and recommendations for system improvements, where needed.

E. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short-circuit ratings.
2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
3. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
4. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
5. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

F. Short-Circuit Study Input Data: As described in "Power System Data" Article in the Evaluations.

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G. Short-Circuit Study Output:

1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

   a. Voltage.
   b. Calculated fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. Equivalent impedance.

2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

   a. Voltage.
   b. Calculated symmetrical fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. Calculated asymmetrical fault currents:

      1) Based on fault-point X/R ratio.
      2) Based on calculated symmetrical value multiplied by 1.6.
      3) Based on calculated symmetrical value multiplied by 2.7.

3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

   a. Voltage.
   b. Calculated symmetrical fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. No AC Decrement (NACD) ratio.
   e. Equivalent impedance.
   f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
   g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

2.3 ARC-FLASH STUDY REPORT CONTENT

A. Executive summary.

B. Study descriptions, purpose, basis and scope.

C. One-line diagram, showing the following:

1. Protective device designations and ampere ratings.
2. Cable size and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and kVA ratings.
5. Switchgear, switchboard, motor-control center and panelboard designations.

D. Study Input Data: As described in "Power System Data" Article.

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E. Short-Circuit Study Output: As specified in "Short Circuit Study Output" Paragraph in "Short-Circuit Study Report Contents" Article in Section 26 0572 "Overcurrent Protective Device Short-Circuit Study."

F. Arc-Flash Study Output:

1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

   a. Voltage.
   b. Calculated symmetrical fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. No AC Decrement (NACD) ratio.
   e. Equivalent impedance.
   f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
   g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

G. Incident Energy and Flash Protection Boundary Calculations:

1. Arcing fault magnitude.
2. Protective device clearing time.
3. Duration of arc.
4. Arc-flash boundary.
5. Working distance.
6. Incident energy.
7. Hazard risk category.
8. Recommendations for arc-flash energy reduction.

H. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of the computer printout.

2.4 ARC-FLASH WARNING LABELS

A. Comply with requirements in Section 26 0553 "Identification for Electrical Systems" for self-adhesive equipment labels. Produce a 3.5-by-5-inch self-adhesive equipment label for each work location included in the analysis.

B. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:

1. Location designation.
2. Nominal voltage.
3. Flash protection boundary.
4. Hazard risk category.
5. Incident energy.
6. Working distance.
7. Engineering report number, revision number, and issue date.

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C. Labels shall be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Obtain all data necessary for the conduct of the study.

1. Verify completeness of data supplied on the one-line diagram. Call any discrepancies to the attention of Contracting Officer.
2. For equipment provided that is Work of this Project, use characteristics submitted under the provisions of action submittals and information submittals for this Project.

B. Gather and tabulate the following input data to support the short-circuit study. Comply with recommendations in IEEE 551 as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.

1. Product Data for Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Obtain electrical power utility impedance at the service.
3. Power sources and ties.
4. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
5. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.
6. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
7. Motor horsepower and NEMA MG 1 code letter designation.
8. Cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).

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3.2 SHORT-CIRCUIT STUDY

A. Perform study following the general study procedures contained in IEEE 399.

B. Calculate short-circuit currents according to IEEE 551.

C. Base study on the device characteristics supplied by device manufacturer.

D. The extent of the electrical power system to be studied is indicated on Drawings.

E. Begin short-circuit current analysis at the service, extending down to the system overcurrent protective devices as follows:

1. To normal system low-voltage load buses where fault current is 10 kA or less.
2. Exclude equipment rated 240-V ac or less when supplied by a single transformer rated less than 125 kVA.

F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. The calculations shall include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and shall apply to low- and medium-voltage, three-phase ac systems. The calculations shall also account for the fault-current dc decrement, to address the asymmetrical requirements of the interrupting equipment.

1. For grounded systems, provide a bolted line-to-ground fault current study for areas as defined for the three-phase bolted fault short-circuit study.

H. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each of the following:

1. Electric utility's supply termination point.
2. Branch circuit panelboards.
3. Disconnect switches.

3.3 ARC-FLASH HAZARD ANALYSIS

A. Comply with NFPA 70E and its Annex D for hazard analysis study.

B. Calculate maximum and minimum contributions of fault-current size.

1. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume no motor load.
2. The maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.

C. Calculate the arc-flash protection boundary and incident energy at locations in the electrical distribution system where personnel could perform work on energized parts.

D. Include medium- and low-voltage equipment locations, except equipment rated 240-V ac or less fed from transformers less than 125 kVA.

E. Safe working distances shall be specified for calculated fault locations based on the calculated arc-flash boundary, considering incident energy of 1.2 cal/sq.cm.

F. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented as follows:

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1. Fault contribution from induction motors should not be considered beyond three to five cycles.
2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g., contributions from permanent magnet generators will typically decay from 10 per unit to three per unit after 10 cycles).

G. Arc-flash computation shall include both line and load side of a circuit breaker as follows:

1. When the circuit breaker is in a separate enclosure.
2. When the line terminals of the circuit breaker are separate from the work location.

H. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.4 ADJUSTING

A. Make minor modifications to equipment as required to accomplish compliance with short-circuit study.

3.5 LABELING

A. Apply one arc-flash label for 600-V ac, 480-V ac, and applicable 208-V ac panelboards and disconnects and for each of the following locations:

1. Low-voltage panelboards.

3.6 APPLICATION OF WARNING LABELS

A. Install the arc-fault warning labels under the direct supervision and control of the Arc-Flash Study Specialist.

3.7 DEMONSTRATION

A. Engage the Arc-Flash Study Specialist to train Government's maintenance personnel in the potential arc-flash hazards associated with working on energized equipment and the significance of the arc-flash warning labels.

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END OF SECTION 260573

SECTION 26 22 17 – DIGITAL PHASE CONVERTERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Digital phase converters with primaries and secondaries rated 600 V and less.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of product.

a. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type and size of transformer.
b. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.

B. Shop Drawings:

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of field connections.
2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
3. Include diagrams for power, signal, and control wiring.

C. Field Quality-Control Submittals:

1. Field quality-control reports.

1.3 INFORMATIONAL SUBMITTALS

A. Source quality-control reports.

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PART 2 - PRODUCTS

2.1 DIGITAL PHASE CONVERTER - GENERAL REQUIREMENTS

A. Description: Factory-assembled and -tested for 60 Hz service.

B. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2.2 DIGITAL PHASE CONVERTER

A. Description: 98.7% efficient at full load with low standby losses, and voltage balance within 2%.

B. Rated Horsepower: 7.5 HP.

C. Output KVA: 10.8 KVA

D. Input Voltage : 240V single phase

E. Output Voltage: 240V three phase.

F. Maximum Steady State Output: 26A

G. Maximum AC Input Current: 45A

H. Operating Temperature: 14 degrees F to 104 degrees F.

I. Efficiency: 98.7%.

J. Short Circuit Rating: 10 kA.

K. Audible Noise: 70 dBA

L. Enclosure Rating: NEMA 3R.

2.3 IDENTIFICATION

A. Nameplates:

1. Engraved, laminated-acrylic or melamine plastic signs for distribution transformers, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

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2.4 SOURCE QUALITY CONTROL

A. Factory Tests and Inspections: Test and inspect digital phase converter, by, or under supervision of, qualified electrical testing laboratory recognized by authorities having jurisdiction, before delivering to site. Affix label with name and date of manufacturer's certification of system compliance on units.

B. Nonconforming Work:

1. System equipment that does not pass tests and inspections will be considered defective.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for transformers.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's published instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance must be 5 Ω at location of transformer.

E. Environment: Enclosures must be rated for environment in which they are located. Covers for UL 50E, Type 4X enclosures may not cause accessibility problems.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

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3.2 INSTALLATION

A. Install wall-mounted phase converters level and plumb with wall brackets fabricated by converter manufacturer.

1. Coordinate installation of wall-mounted and structure-hanging supports with actual transformer provided.

B. Install phase converters level and plumb on concrete base with vibration-dampening supports. Locate transformers away from corners and not parallel to adjacent wall surface.

C. Construct concrete bases and anchor floor-mounted transformers in accordance with manufacturer's published instructions and requirements in Section 260529 "Hangers and Supports for Electrical Systems."

1. Coordinate size and location of concrete bases with actual phase converter provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

D. Secure phase converter to concrete base in accordance with manufacturer's published instructions.

E. Secure covers to enclosure and tighten bolts to manufacturer-recommended torques to reduce noise generation.

F. Remove shipping bolts, blocking, and wedges.

3.3 CONNECTIONS

A. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Tighten electrical connectors and terminals in accordance with manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

D. Provide flexible connections at conduit and conductor terminations and supports to eliminate sound and vibration transmission to building structure.

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Field Tests:

a. Visual and Mechanical Inspection:

1) Inspect physical and mechanical condition.
2) Inspect anchorage, alignment, and grounding.
3) Verify that resilient mounts are free and that shipping brackets have been removed.
4) Verify that unit is clean.
5) Perform specific inspections and mechanical tests recommended by manufacturer.

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b. Electrical Tests:
   1) Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.

B. Test Labeling: On completion of satisfactory testing of units, attach dated and signed "Satisfactory Test" label to tested component.

C. Nonconforming Work:

1. Phase converter will be considered defective if it does not pass tests and inspections.
2. Remove and replace units that do not pass tests or inspections and retest as specified above.

D. Assemble and submit test and inspection reports.

E. Manufacturer Services:

1. Engage factory-authorized service representative to support field tests and inspections.

3.5 ADJUSTING

A. Connect phase converter to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.

B. Output Settings Report: Prepare written report recording output voltages and tap settings.

3.6 CLEANING

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 262217

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SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.2 DEFINITIONS

A. MCCB: Molded-case circuit breaker.

B. SPD: Surge protective device.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.

B. Submit Power System Studies concurrently with Panelboard submittal. Adjust AIC ratings of panelboards where available fault exceeds values shown on the drawings as indicated in Short-Circuit and Arc-Flash Power System Studies.

C. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details.
2. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
6. Include wiring diagrams for power, signal, and control wiring.
7. Key interlock scheme drawing and sequence of operations.
8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

1.4 INFORMATIONAL SUBMITTALS

A. Panelboard schedules for installation in panelboards.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

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1.6 FIELD CONDITIONS

A. Service Conditions: NEMA PB 1, usual service conditions, as follows:

1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS COMMON REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NEMA PB 1.

C. Comply with NFPA 70.

D. Enclosures: Flush and Surface-mounted, dead-front cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations: NEMA 250, Type 1.

2. Height: 84 inches maximum.
3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.

E. Incoming Mains Location: Top or Bottom a required for installation.

F. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.

G. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
3. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

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5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

H. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

I. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

2.2 POWER PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; by Schneider Electric.

B. Panelboards: NEMA PB 1, distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.

1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Mains: Circuit breaker or Lugs as indicated on the drawings.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; by Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs as indicated on the drawings.

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D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton.
2. General Electric Company; GE Energy Management - Electrical Distribution.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; by Schneider Electric.

B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:

a. Inverse time-current element for low-level overloads.
b. Instantaneous magnetic trip element for short circuits.
c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic Trip Circuit Breakers:

a. RMS sensing.
b. Field-replaceable rating plug or electronic trip.
c. Digital display of settings, trip targets, and indicated metering displays.
d. Multi-button keypad to access programmable functions and monitored data.
e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
f. Integral test jack for connection to portable test set or laptop computer.
g. Field-Adjustable Settings:

1) Instantaneous trip.
2) Long- and short-time pickup levels.
3) Long and short time adjustments.
4) Ground-fault pickup level, time delay, and I squared T response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
6. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
8. Subfeed Circuit Breakers: Vertically mounted.

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9. MCCB Features and Accessories:

   a. Standard frame sizes, trip ratings, and number of poles.
   b. Breaker handle indicates tripped status.
   c. UL listed for reverse connection without restrictive line or load ratings.
   d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
   e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
   f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
   g. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
   h. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
   i. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.5 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Directory card inside panelboard door, mounted in transparent card holder.

2.6 ACCESSORY COMPONENTS AND FEATURES

A. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install panelboards and accessories according to NEMA PB 1.1.

C. Mount panelboard cabinet plumb and rigid without distortion of box.

D. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

E. Install overcurrent protective devices and controllers not already factory installed.

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1. Set field-adjustable, circuit-breaker trip ranges.

F. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

G. Install filler plates in unused spaces.

H. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

I. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.2 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 26 0553 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

E. Install warning signs complying with requirements in Section 26 0553 "Identification for Electrical Systems" identifying source of remote circuit.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA ATS. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

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D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 262416

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SECTION 26 27 13 - ELECTRICITY METERING

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 SUMMARY

A. Section includes work to accommodate utility company revenue meters, and Owner's electricity meters used to manage the electrical power system.

1.3 DEFINITIONS

A. KY or KYZ Pulse: Term used by the metering industry to describe a method of measuring consumption of electricity (kWh) that is based on a relay opening and closing in response to the rotation of the disk in the meter. Electronic meters generate pulses electronically.

1.4 ACTION SUBMITTALS

A. Product Data:

1. For each type of meter.
2. For metering infrastructure components.
3. For metering software.

B. Shop Drawings: For electricity-metering equipment.

1. Include elevation views of front panels of control and indicating devices and control stations.
2. Include diagrams for power, signal, and control wiring.
3. Wire Termination Diagrams and Schedules: Include diagrams for power, signal, and control wiring. Identify terminals and wiring designations and color-codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features. Differentiate between manufacturer-installed and field-installed wiring.
4. Include series-combination rating data for modular meter centers with main disconnect device.
5. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators,

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and other devices used. Describe characteristics of network and other data communication lines.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Submit evidence that meters are compatible with connected monitoring and control devices and systems.

1. Show interconnecting signal and control wiring, and interface devices to show compatibility of meters.
2. For reporting and billing interfaces and adapters, list network protocols and provide statements from manufacturers that input and output devices comply with interoperability requirements of the protocol.

B. Qualification Data: For testing agency.

C. Field quality-control reports.

D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: In addition to items specified in Section 01 7823 "Operation and Maintenance Data," include the following:

1. Application and operating software documentation.
2. Software licenses.
3. Software service agreement.
4. Device address list.
5. Hard copies of manufacturer's operating specifications, user's guides for software and hardware, and PDF files on a USB storage device of hard-copy Submittal.
6. Meter data sheet for each meter, listing nameplate data and serial number, accuracy certification, and test results.
7. Meter installation and billing software startup report.

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1.7 FIELD CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:

1. Owner shall be notified and issued written permission no fewer than two days in advance of proposed interruption of electrical service.

1.8 QUALITY ASSURANCE

A. Testing Agency Qualifications: An NRTL.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of metering equipment that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Damage from transient voltage surges.

2. Warranty Period: Cost to repair or replace any parts for two years from date of Substantial Completion.
3. Extended Warranty Period: Cost of replacement parts (materials only, f.o.b. the nearest shipping point to Project site), for eight years, that failed in service due to transient voltage surges.

1.10 COORDINATION

A. Electrical Service Connections:

1. Coordinate with utility companies and utility-furnished components.

a. Comply with requirements of utility providing electrical power services.
b. Coordinate installation and connection of utilities and services, including provision for electricity-metering components.

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PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 916.

2.2 UTILITY METERING INFRASTRUCTURE

A. Install metering accessories furnished by the utility company, complying with its requirements.

B. Utility-Furnished Meters: Connect data transmission facility of metering equipment installed by the Utility.

1. Data Transmission: Transmit pulse data over control-circuit conductors, classified as Class 1 per NFPA 70, Article 725.

C. Current-Transformer Cabinets: Comply with requirements of electrical-power utility company.

D. Meter Sockets:

1. Comply with requirements of electrical-power utility company.
2. Meter Sockets: Steady-state and short-circuit current ratings shall meet indicated circuit ratings.

E. Arc-Flash Warning Labels;

1. Labels: Comply with requirements for "Arc-Flash Warning Labels" in Section 26 0573.19 "Arc-Flash Studies." Apply a 3-1/2-by-5-inch (76-by-127-mm) thermal transfer label of high-adhesion polyester for each work location included in the analysis.
2. Labels: Comply with requirements for "Self-Adhesive Equipment Labels" and "Signs" in Section 26 0553 "Identification for Electrical Systems." Apply a 3-1/2-by-5-inch (76-by-127-mm) thermal transfer label of high-adhesion polyester for each work location included in the analysis. Labels shall be machine printed, with no field-applied markings.

    a. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:

        1) Location designation.
        2) Nominal voltage.
        3) Flash protection boundary.
        4) Hazard risk category.
        5) Incident energy.
        6) Working distance.
        7) Engineering report number, revision number, and issue date.

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2.3 ELECTRICITY METERS

A. System Description: Able to meter designated activity loads, with or without external alarm, control, and communication capabilities, or other optional features.

1. Comply with ANSI C12.1 and ANSI C12.20, 0.5 accuracy class.
2. Ambient Temperature: Minus 22 deg F to plus 158 deg F (Minus 30 deg C to plus 70 deg C).
3. Humidity: Zero to 95 percent, noncondensing.
4. Capacities and Characteristics:

    a. Circuit: 120/240-V ac, 100 A.
    b. Measure: kWh, onboard LED display.
    c. Remote-Reading Options: None.

B. General Requirements for Meters:

1. Billing Meters Accuracy: 1.0 percent of reading, complying with ANSI C12.20.
2. Meters Certification: Certified by California Type Evaluation Program as complying with 4 CCR 4027, Article 2.2.
3. Certify that meters comply with ANSI C12.20 requirements by a laboratory accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) of the National Institute of Standards and Technology (NIST). The laboratory shall use test equipment that is certified annually and is traceable to NIST standards.
4. Enclosure: Supplied by meter manufacturer, NEMA 250, Type 3R minimum, with provisions for locking or sealing.
5. Identification: Comply with requirements in Section 26 0553 "Identification for Electrical Systems."
6. Onboard Nonvolatile Data Storage: kWh, until reset.
7. Sensors: Current-sensing type, supplied by electronic meter manufacturer, with current or voltage output, selected for optimum range and accuracy for meters indicated for this application.

C. kWh Meter: Electronic three-phase meters, measuring electricity use.

1. Voltage and Phase Configuration: Meter shall be designed for use on circuits with voltage rating and phase configuration indicated for its application.
2. Display: LCD with characters not less than 0.25 inch (6 mm) high, indicating accumulative kWh and current kilowatt load. Retain accumulated kWh in a nonvolatile memory, until reset.
3. Display: Digital electromechanical counter, indicating accumulative kWh.

D. kWhd Meter: Electronic three-phase meters, measuring electricity use and demand. Demand shall be integrated over a 15-minute interval.

1. Voltage and Phase Configuration: Meter shall be designed for use on circuits with voltage rating and phase configuration indicated for its application.
2. Display: LCD with characters not less than 0.25 inch (6 mm) high, indicating the following:
    a. Accumulative kWh.
    b. Current time and date.
    c. Current demand.
    d. Historic peak demand.
    e. Time and date of historic peak demand.
3. Retain accumulated kWh and historic peak demand in a nonvolatile memory, until reset.

E. KY and KYZ Pulse Totalizer:

1. Pulse Totalizer: An instrument for demand and billing applications where one or more utility revenue meters stream KY or KYZ energy pulses. The instrument shall totalize kWh accumulated over the user-selected period and shall log the maximum and minimum

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kWhd for that period. Record each period with a date/time stamp. Time period shall be user selected from one to 60 minutes.

a. Pulse Input: One individually programmable, KYZ Form C (three-wire) contact pulse channels. Pulse interval, pulse rate, and minimum pulse width shall be field adjustable, set for the pulse stream provided by the utility revenue meter.
b. Data Totalizing Capacity of Each Channel: Not less than 149 days at 15-minute intervals.
c. Instrument Power: User selectable, 120-V and 277-V ac.
d. Clock: Line frequency.

F. Current-Transformer Cabinet: Size and configuration as recommended by metering equipment manufacturer for use with indicated connected feeder and sensors.

G. Uninterruptible Power Supply: Single phase, 120-V ac, sized and rated to provide continuous power to meter for operations of 48 hours after interruption of normal power.

1. Output: Sine wave, total harmonic distortion less than 5 percent at full load.
2. Battery: Maintenance free, sealed, lead acid, and leakproof.
3. Control Panel: LED status display of "on-battery," "replace battery," and "overload."

H. Data Transmission Cable: Comply with requirements in Section 26 0523 "Control-Voltage Electrical Power Cables."

I. Software: PC based, a product of meter manufacturer, suitable for calculating utility cost allocation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with equipment installation requirements in NECA 1.

B. Install meters furnished by utility company. Install raceways and equipment according to utility company's written instructions. Provide empty conduits for metering leads and extend grounding connections as required by utility company.

C. Install modular meter center according to switchboard installation requirements in NECA 400.

D. Install arc-flash labels as required by NFPA 70.

E. Wiring Method:

1. Comply with requirements in Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."
2. Install unshielded, twisted-pair cable for control and signal transmission conductors, complying with Section 27 1513 "Communications Copper Horizontal Cabling."

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3. Minimum conduit size shall be 1/2 inch (13 mm).

3.2 IDENTIFICATION

A. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

1. Series Combination Warning Label: Self-adhesive labels, with text as required by NFPA 70.
2. Equipment Identification Labels: Self-adhesive labels with clear protective overlay. For residential meters, provide an additional card holder suitable for printed, weather-resistant card with occupant's name.

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

D. Perform tests and inspections.

E. Tests and Inspections:

1. Equipment and Software Setup:

a. Set meter date and time clock.
b. Test, calibrate, and connect pulse metering system.
c. Set and verify billing demand interval for demand meters.
d. Report settings and calibration results.
e. Set up reporting and billing software, insert billing location names and initial constant values and variable needed for billing computations.

2. Connect a load of known kilowatt rating, 1.5 kW minimum, to a circuit supplied by metered feeder.
3. Turn off circuits supplied by metered feeder and secure them in off condition.
4. Run test load continuously for eight hours minimum, or longer, to obtain a measurable meter indication. Use test-load placement and setting that ensures continuous, safe operation.
5. Check and record meter reading at end of test period and compare with actual electricity used, based on test-load rating, duration of test, and sample measurements of supply voltage at test-load connection. Record test results.
6. Generate test report and billing for each tenant or activity from the meter reading tests.

F. Electricity metering will be considered defective if it does not pass tests and inspections.

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G. Prepare test and inspection reports.

3.4 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.5 DEMONSTRATION

A. Train Owner's clerical and maintenance personnel to use, adjust, operate, and maintain the electronic metering and billing software.

END OF SECTION 262713

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SECTION 26 27 26 - WIRING DEVICES

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 SUMMARY

A. Section Includes:

1. Standard-grade receptacles, 125 V, 20 A.
2. USB receptacles.
3. GFCI receptacles, 125 V, 20 A.
4. Twist-locking receptacles.
5. Toggle switches, 120/277 V, 20 A.
6. Decorator-style devices, 20 A.
7. Occupancy sensors.
8. Digital timer light switches.
9. Wall plates.
10. Floor service fittings.

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1.3 DEFINITIONS

A. AFCI: Arc-fault circuit interrupter.

B. BAS: Building automation system.

C. EMI: Electromagnetic interference.

D. GFCI: Ground-fault circuit interrupter.

E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

F. RFI: Radio-frequency interference.

G. SPD: Surge protective device.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

C. Samples: One for each type of device and wall plate specified, in each color specified.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

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PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Comply with NFPA 70.

C. RoHS compliant.

D. Comply with NEMA WD 1.

E. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Essential Electrical System: Red.

F. Wall Plate Color: For plastic covers, match device color.

G. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 STANDARD-GRADE RECEPTACLES, 125 V, 20 A

A. Duplex Receptacles, 125 V, 20 A:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Eaton (Arrow Hart).
b. Hubbell Incorporated; Wiring Device-Kellems.
c. Leviton Manufacturing Co., Inc.
d. Pass & Seymour/Legrand (Pass & Seymour).

2. Description: Two pole, three wire, and self-grounding.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Standards: Comply with UL 498 and FS W-C-596.

B. Tamper-Resistant Duplex Receptacles, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498 and FS W-C-596.
4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

C. Weather-Resistant Duplex Receptacle, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498.
4. Marking: Listed and labeled as complying with NFPA 70, "Receptacles in Damp or Wet Locations" Article.

D. Tamper- and Weather-Resistant Duplex Receptacles, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498.
4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

NOT FOR BIDDING PURPOSES

2.3 GFCI RECEPTACLES, 125 V, 20 A

A. Duplex GFCI Receptacles, 125 V, 20 A:

1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Type: Non-feed through.
4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.

B. Tamper-Resistant Duplex GFCI Receptacles, 125 V, 20 A:

1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Type: Non-feed through.
4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.
5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

C. Tamper- and Weather-Resistant, GFCI Duplex Receptacles, 125 V, 20 A:

1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-15R.
3. Type: Non-feed through.
4. Standards: Comply with UL 498 and UL 943 Class A.
5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2.4 TOGGLE SWITCHES, 120/277 V, 20 A

A. Single-Pole Switches, 120/277 V, 20 A:

1. Standards: Comply with UL 20 and FS W-S-896.

B. Two-Pole Switches, 120/277 V, 20 A:

1. Comply with UL 20 and FS W-S-896.

C. Three-Way Switches, 120/277 V, 20 A:

1. Comply with UL 20 and FS W-S-896.

D. Lighted Single-Pole Switches, 120/277 V, 20 A:

1. Description: Handle illuminated when switch is off.
2. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.

2.5 WALL PLATES

A. Single Source: Obtain wall plates from same manufacturer of wiring devices.

B. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: 0.035-inch-thick, satin-finished, Type 302 stainless steel.

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3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

2.6 RETRACTABLE COORD AND REEL DEVICES

A. Description:

1. Reel: White powder coated
2. NEMA WD 6 configurations 5-20P feed and 5-20R duplex payout end, heavy-duty grade, and FS W-C-596.
3. Cable: White, 25 foot, 3 conductors, 12 AWG, SJOW
4. Pivot base with 345-degree rotation
5. Provide KH Industries RTBB3LW-C520-H12F or approved equal.

2.7 MULTI-OUTLET ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

1. Hubbell Incorporated; Wiring Device-Kellems
2. Wiremold/Legrand 4000 Series (Basis of Design)

B. Description:

1. Divided raceway for multi-service applications of power and telecommunications.
2. Two-piece surface metal raceway with approximate dimensions of 1-3/4" deep by 4-3/4" wide.
3. Components shall be products from single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
4. Raceway Material: Metal, confirm color with Architect.
5. Multioutlet Wiring:
   a. Receptacles: Convenience Duplex Receptacles, 125 V, 20A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
   b. Telecommuncation outlets: Provide adapters for mounting of owner provided telecom outlets. Confirm configuration of adapter with owner.
6. Provide all components for a complete system including end feeds, covers, dividers, divider clips, and ends.
7. Provide touch up paint pen.

2.8 FLOOR SERVICE FITTINGS

A. Flush-Type Floor Service Fittings:

NOT FOR BIDDING PURPOSES

1. Description: Type: Modular, flush-type, dual-service units suitable for wiring method used, with cover flush with finished floor.
2. Compartments: Barrier separates power from voice and data communication cabling.
3. Service Plate and Cover: Rectangular, die-cast aluminum with satin finish.
4. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.
5. Data Communication Outlet: Blank cover with bushed cable opening.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Coordination with Other Trades:

1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes, and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall comply with NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

D. Device Installation:

1. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
2. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.

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3. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
4. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
5. Use a torque screwdriver when a torque is recommended or required by manufacturer.
6. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
7. Tighten unused terminal screws on the device.
8. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

3.2 GFCI RECEPTACLES

A. Install non-feed-through GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Comply with Section 26 0553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

A. Test Instruments: Use instruments that comply with UL 1436.

B. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

C. Tests for Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.

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3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.

D. Wiring device will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 262726

NOT FOR BIDDING PURPOSES

SECTION 26 28 13 - FUSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cartridge fuses rated 600 V ac and less for use in the following:

a. Enclosed controllers.
b. Enclosed switches.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Bussmann; an Eaton business.
2. Edison; a brand of Bussmann by Eaton.
3. Littelfuse, Inc.
4. Mersen USA.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

1. Type RK-5: 250-V, zero- to 600-A rating, 200 kAIC, time delay.
2. Type J: 600-V, zero- to 600-A rating, 200 kAIC.
3. Type L: 600-V, 601- to 6000-A rating, 200 kAIC.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA FU 1 for cartridge fuses.

D. Comply with NFPA 70.

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E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

B. Install spare-fuse cabinets in location shown on the Drawings.

3.2 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813

NOT FOR BIDDING PURPOSES

SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Enclosures.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

B. Shop Drawings: For enclosed switches and circuit breakers.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include wiring diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. and circuit breakers, accessories, and components, from manufacturer.

C. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

NOT FOR BIDDING PURPOSES

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2.2 GENERAL REQUIREMENTS

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

D. Comply with NFPA 70.

2.3 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton.
2. General Electric Company.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; by Schneider Electric.

B. Type HD, Heavy Duty:

1. Single throw.
2. Three pole.
3. 600-V ac.
4. 1200 A and smaller.
5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses.
6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

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1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.

2.4 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton.
2. General Electric Company.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; by Schneider Electric.

B. Type HD, Heavy Duty, Three Pole, Single Throw, 600 V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Service-Rated Switches: Labeled for use as service equipment.

2.5 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

B. Enclosure Finish: The enclosure shall be gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1) or gray baked enamel paint, electrodeposited on cleaned, phosphatized galvannealed steel (NEMA 250 Types 3R, 12).

C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both endwalls.

D. Operating Mechanism: The circuit-breaker operating handle shall be externally operable with the operating mechanism being an integral part of the box, not the cover. The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

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E. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, 12, or 12K shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.

PART 3 - EXECUTION

3.1 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

3.2 INSTALLATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

C. Install fuses in fusible devices.

D. Comply with NFPA 70 and NECA 1.

E. Set field-adjustable circuit-breaker trip ranges as specified in Section 26 0573.16 "Coordination Studies."

3.3 IDENTIFICATION

A. Comply with requirements in Section 26 0553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections with the assistance of a factory-authorized service representative.

B. Tests and Inspections for Switches:

1. Visual and Mechanical Inspection:

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a. Inspect physical and mechanical condition.
b. Inspect anchorage, alignment, grounding, and clearances.
c. Verify that the unit is clean.
d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
e. Verify that fuse sizes and types match the Specifications and Drawings.
f. Verify that each fuse has adequate mechanical support and contact integrity.
g. Inspect bolted electrical connections for high resistance using one of the two following methods:

1) Use a low-resistance ohmmeter.

a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.

2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
i. Verify correct phase barrier installation.
j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.

2. Electrical Tests:

a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
e. Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."

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C. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

1. Test procedures used.
2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
3. List deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 262816

NOT FOR BIDDING PURPOSES

SECTION 26 43 13 - SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes field-mounted external SPDs for low-voltage (120 to 600 V) power distribution and control equipment.

B. Related Requirements:

1. Section 26 2300 "Low-Voltage Switchgear" for factory-installed integral SPDs.
2. Section 26 2413 "Switchboards" for factory-installed integral SPDs.

C. References:

1. ANSI/IEEE Std C62.41.1™-2002, IEEE Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits.
2. ANSI/IEEE Std C62.41.2™-2002 IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits.
3. ANSI/IEEE Std C62.45™-2002, IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits.
4. ANSI C84.1, American National Standard for Electric Power Systems and Equipment – Voltage Ratings (60 Hertz)
5. IEEE Standard 1100-2005, IEEE Recommended Practice for Power and Grounding Electronic Equipment - Clause 8.6.1.
6. National Fire Protection Association (NFPA) 70 (N.E.C.) –2014 – Article 285.
7. ANSI/UL 1449 fourth edition - Surge Protective Devices.
8. IEEE Std C62.72™-2007 – IEEE Guide for the Application of Surge-Protective Devices for Low-Voltage (1000 V or less) AC Power Circuits.

NOT FOR BIDDING PURPOSES

1.2 DEFINITIONS

A. Type 1 SPD – Permanently connected SPDs intended for installation between the secondary of the service transformer and the line side of the service equipment overcurrent device, as well as the load side, including watt-hour meter socket enclosures and intended to be installed without an external overcurrent protective device.

B. Type 2 SPD – Permanently connected SPDs intended for installation on the load side of the service equipment overcurrent device; including SPDs located at the branch panel.

C. Type 3 SPD – Point of utilization SPDs, installed at a minimum conductor length of 30 feet from the electrical service panel to the point of utilization, for example cord connected, direct plug-in, receptacle type and SPDs installed at the utilization equipment being protected.

D. Type 4 SPD – Recognized Component SPDs, including discrete components as well as component assemblies, which bear specific conditions of acceptability.

E. Inominal: Nominal discharge current. Peak value of the current, selected by the manufacturer from a list of values specified in ANSI/UL fourth edition, through the SPD having a current waveshape of 8/20 where the SPD remains functional after 15 surges using the test procedure described in ANSI/UL 1449-fourth edition.

F. LTV: Let-Through Voltage. The part of the surge that passes by a surge-protective device (SPD) with little or no alteration. Also known as the measured limiting voltage.

G. MCOV: Maximum continuous operating voltage. The maximum designated root mean-square (rms) value of the power frequency voltage that may be continuously applied to the mode of protection of an SPD.

H. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies. Electrical paths where the SPD offers defense against transient overvoltages. e.g. Each Line to Neutral (L-N), Line to Ground (L-G), Line to Line (L-L) and Neutral to Ground (N-G).

I. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.

J. OCPD: Overcurrent protective device.

K. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

L. SCCR: Short-circuit current rating.

M. SPD: Surge protective device.

N. VPR: Voltage protection rating. A rating selected from a list of preferred values as detailed in ANSI/UL 1449-fourth edition and assigned to each mode of protection. The value of VPR is determined as the nearest highest value taken from a list of preferred values as detailed in ANSI/UL 1449-fourth edition to the measured limiting voltage (let thru voltage) determined during the transient-voltage surge suppression test using the combination wave generator at a setting of 6 kV, 3 kA.

NOT FOR BIDDING PURPOSES

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Submittal shall be clearly marked by highlighting, circling, boxing, or similar the model numbers and product data applicable to the submittal. Extraneous data and information shall be crossed out (X) and clearly marked.

B. Provide a table indicating which panel/switchboard/equipment each SPD will serve. Table shall be formatted per the following format:

Panelboard Name	Volts, Phase, Wires, Amps	SPD Model Number

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1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For SPDs to include in maintenance manuals.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to replace SPDs that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Ten (10) years from date of Substantial Completion. Free replacement shall include damage due to lightning strikes and or damage due to electrical surges.
2. The manufacturer shall provide unlimited free replacement of the entire SPD (not just modules, components or sub-assemblies) for all inoperable SPDs during the warranty period.

PART 2 - PRODUCTS

2.1 GENERAL SPD REQUIREMENTS

A. SPD with Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

C. Comply with UL 1449.

D. MCOV of the SPD shall be the nominal system voltage.

E. All SPDs shall be tested and listed to ANSI/UL 1449 4rd Edition.

2.2 PANELBOARD SUPPRESSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Advanced Protection Technologies Inc. (APT).
2. Current Technology Inc.
3. Liebert; a brand of Emerson Electric Co.
4. ASCO.
5. Eaton.
6. Siemens Industry, Inc.
7. Square D; by Schneider Electric.
8. General Electric Company
9. Mersen.
10. Surge Suppression Inc.

B. SPDs: Type 1 where located at service entrance rated equipment and Type 2 where located at non-service entrance rated equipment.

1. Include LED indicator lights for power and protection status.
2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.

C. Comply with UL 1283.

D. Units must be non-modular in design and not utilize replaceable parts. SPDs are considered non-repairable items and shall be fully replaced upon failure.

E. SPDs shall be external from Panelboard. SPDs integral/internal to Panelboards is prohibited.

F. SCCR: Equal or exceed 200 kA.

G. In Nominal Rating: Equal to 20 kA.

H. Discrete Modes of Protection, equal to:

1. 480Y/277V, 3-Phase, 4-Wire Panels: 7 or 10 Modes.
2. 480V, 3-Phase, 3-Wire Panels: 6 Modes.
3. 208Y/120V, 3-Phase, 4-Wire Panels: 7 or 10 Modes.

I. Peak Surge Current Rating:

1. Panelboards up to 225Amps: Equal or exceed 60kA Per Mode (120kA Per Phase).
2. Panelboards 226-800Amps: Equal or exceed 100kA Per Mode (200kA Per Phase).
3. Panelboards 801-1200Amps: Equal or exceed 150kA Per Mode (300kA Per Phase).

NOT FOR BIDDING PURPOSES

J. Protection modes and UL 1449 VPR shall not exceed the following:

	480Y/277V, 3Ph, 4W Panelboards	480V, 3Ph, 3W Panelboards	208Y/120V, 3Ph, 4W Panelboards
Protection Modes	UL 1449 Voltage Protection Rating (VPR)		
L-N	1200	-	700
L-L	1800	1800	1200
L-G	1200	1800	700
N-G	1200	-	700

2.3 ENCLOSURES

A. Indoor Enclosures: NEMA 250, Type 1.

B. Outdoor Enclosures: NEMA 250, Type 4X Composite.

C. Maximum Dimensions: 12” wide, 12” tall, 5” deep.

2.4 FIRE ALARM SYSTEM SURGE PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following.

1. Ditek
2. Siemens
3. Advanced Protection Technologies, Inc.
4. Surge Suppression Incorporated.

B. SPD shall be listed for use with fire alarm systems.

C. Power Surge Protection:

1. SPD Model – Siemens model TPS3A03050; Advanced Protection Technologies model S50A120V2P, Or Approved Equal.
2. SPD shall be listed or recognized in accordance with UL 1449 Third Edition verifiable by visiting UL.com.
3. SPD shall provide surge current L-N or L-G mode of protection.
4. SPD shall meet or exceed the following criteria:

a. Minimum surge current capability (single pulse rated) per phase shall be:

1) 120/240 Panel Application 50kA per phase

b. UL 1449 3rd Edition listed Voltage Protection Ratings for shall not exceed the following:

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VOLTAGE	L-N/L-G	MCOV
120V or 240/120V	600V	150V

5. SPD shall have a warranty for a period of ten years, incorporating unlimited replacements of suppressor parts if they are destroyed by transients during the warranty period.

D. Telephone Line Protection

1. For telephone systems consisting of two or one pair lines, protect using SPD Model – Siemens SPD4tel
2. For telephone systems having multiple pairs, protect using SPD Model – TII Network Technologies, 631-559-8518
3. SPD shall be UL 497A suitable for compliance to UL 96A Lightning Protection Master Label.
4. SPD shall be solid state, silicon avalanche diode circuitry for protection from overvoltages on 2 or 4 wire signal lines such as balanced pair telephone, metallic pair telephone, buried and overhead field cable, remote radio equipment, and control systems. Unit shall have an external ground lug or wire. Connect ground lug or wire to protected equipment grounding system with a No. 12 green insulated stranded ground wire as short as possible.
    a. Pins Protected: Pins 4, 5 on the RJ- 45 Interface; Pins 3, 4 on the RJ- 11 Interface
    b. Clamping Voltage: 310 Volts in 500 nsec
    c. Surge Capacity: 1500 Watts for 1 msec;
    d. Protection Mode: Common Mode Pins 4, 5 to shielding braid
       Differential Mode Pins 4,5
    e. Shall be listed to UL497A Telco Specification

E. 24V Low Voltage Alarm Circuits: 24V SPDs are required to protect fire alarm signals entering and exiting structures. These SPDs shall meet the following performance benchmarks:

1. SPD shall consist of a multistage hybrid circuit with staging inductors or resistors to properly coordinate the components.
2. SPD DIN rail mounted housing width shall not exceed 12mm.
3. SPD for analog and digital I/O shall be designed to withstand a Imax 15kA test current of an 8/20µs waveform according to IEC 1024 Application Guide A and IEEE C62.41.1-2002. In shall be 10kA of 8/20µs waveform.
4. Operating temperature range shall be at least -40˚C to +85˚C.
5. Maximum load current through the surge protection module shall not exceed 250 milliamps for analog and digital signal protection.
6. Cutoff frequency for analog modules shall be 3 MHz for a 50 ohm system and 1 MHz for a 150 ohm system. Cutoff frequency for digital modules shall be 2 MHz for a 50 ohm system and 600 KHz for a 150 ohm system.
7. Wire size cross section shall be 12 AWG.
8. Acceptable Part Numbers for non-pluggable / high density communication and data SPDs include: APT Model D601 Series.
9. For analog signals, DIN rail mounted, 24 VDC, use APT Model: D60401-024S or equal

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PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install a 3P-30A Molded Case Circuit Breaker to serve as a disconnecting means to the SPD. Provide larger size where required by a specific manufacturer to coordinate with lug/terminal sizes of wires to SPD. Coordinate with Panelboard submittal in Section 26 2416 "Panelboards".

C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

D. Surge protective devices shall be installed neatly. Bind the phase, neutral, and ground conductors tightly, over the entire run, from the suppressor to the service panel, and always use the shortest length of connecting cable possible.

E. Use crimped connectors and splices only. Wire nuts are unacceptable.

F. Coordinate location of field installed SPDs to allow adequate clearances for maintenance, yet minimize conductor leads into panelboard.

G. Wiring:

1. Power Wiring: Comply with wiring methods in Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

H. Do not perform insulation resistance tests of the distribution wiring equipment with the SPDs installed. Disconnect all SPDs (all Phase, Neutral and Ground connections) before conducting insulation resistance tests, and reconnect immediately after the testing is over

3.2 FIELD QUALITY CONTROL

A. Perform the following inspections:

1. Compare equipment nameplate data for compliance with Drawings and Specifications.
2. Inspect anchorage, alignment, grounding, and clearances.
3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
4. Verify that conductors between suppressor and points of attachment are as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Verify installation complies with installation detail on contract drawings.

B. An SPD will be considered defective if it does not pass inspections.

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END OF SECTION 264317

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SECTION 26 51 19 - LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes LED luminaires:

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
2. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

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1.6 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.

1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

B. Ambient Temperature: 41 to 104 degrees F.

1. Relative Humidity: Zero to 95 percent.

C. Altitude: Sea level to 1000 feet.

2.2 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

1. Label shall include the following lamp characteristics:

a. "USE ONLY" and include specific lamp type.
b. Lamp diameter, shape, size, wattage, and coating.
c. CCT and CRI.

C. Recessed luminaires shall comply with NEMA LE 4.

D. Nominal Operating Voltage: As scheduled.

E. CRI: As scheduled

F. Color Temperature: As Schedule

G. Rated lamp life: As Scheduled

H. Internal driver

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I. Housings:

1. Extruded aluminum or steel housing and heat sink.
2. Powder-coat finish.
3. Integral junction box with conduit fittings.

J. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

K. Diffusers and Globes:

1. Prismatic acrylic.
2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

L. Standards:

1. ENERGY STAR certified.
2. RoHS compliant.
3. UL Listing: Listed for damp location.

2.3 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Steel:

1. ASTM A 36/A 36M for carbon structural steel.
2. ASTM A 568/A 568M for sheet steel.

C. Stainless Steel:

1. Manufacturer's standard grade.
2. Manufacturer's standard type, ASTM A 240/240 M.

D. Galvanized Steel: ASTM A 653/A 653M.

E. Aluminum: ASTM B 209.

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2.4 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.5 LUMINAIRE SUPPORT

A. Comply with requirements in Section 26 0529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

E. Comply with requirements in Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.2 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

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1. Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.4 STARTUP SERVICE

A. Comply with requirements for startup specified in Section 26 0923 "Lighting Control Devices."

END OF SECTION 265119

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SECTION 26 52 13 - EMERGENCY AND EXIT LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Emergency lighting units.
2. Exit signs.
3. Luminaire supports.

1.2 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Emergency Lighting Unit: A lighting unit with integral or remote emergency battery powered supply and the means for controlling and charging the battery and unit operation.

D. Fixture: See "Luminaire" Paragraph.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support, arranged by designation.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of luminaire.

B. Sample Warranty.

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1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two year(s) from date of Substantial Completion.

B. form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.

C. Comply with NFPA 70 and NFPA 101.

D. Comply with NEMA LE 4 for recessed luminaires.

E. Comply with UL 1598 for recessed luminaires.

F. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body.

1. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
2. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:

a. Ambient Temperature: Less than 0 degrees F or exceeding 104 degrees F, with an average value exceeding 95 degrees F over a 24-hour period.
b. Ambient Storage Temperature: Not less than minus 4 degrees F and not exceeding 140 degrees F.
c. Humidity: More than 95 percent (condensing).
d. Altitude: Exceeding 3300 feet.

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3. Test Push-Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.

    a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.

4. Battery: Sealed, maintenance-free, nickel-cadmium type.
5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.

2.2 EMERGENCY LIGHTING

A. General Requirements for Emergency Lighting Units: Self-contained units.

B. Emergency Luminaires: As scheduled

2.3 EXIT SIGNS

A. Internally Lighted Signs: As Scheduled

1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.

2.4 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Doors, Frames, and Other Internal Access:

1. Smooth operating, free of light leakage under operating conditions.
2. Designed to permit relamping without use of tools.
3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Housings: As scheduled

D. Conduit: Electrical metallic tubing, minimum 3/4 inch (21 mm) in diameter.

2.5 METAL FINISHES

A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

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2.6 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 26 0529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Install lamps in each luminaire.

D. Supports:

1. Sized and rated for luminaire and emergency power unit weight.
2. Able to maintain luminaire position when testing emergency power unit.
3. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire and emergency power unit weight and vertical force of 400 percent of fixture weight.

E. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.
2. Do not attach fixtures directly to gypsum board.

F. Suspended Luminaire Support:

1. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of fixture oscillations. Support outlet box vertically to building structure using approved devices.
2. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

G. Ceiling Grid Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure emergency power unit using approved fasteners in a minimum of four locations, spaced near corners of emergency power unit.

H. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

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3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 265213

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SECTION 26 56 13 - LIGHTING POLES AND STANDARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Poles and accessories for support of luminaires.

1.2 DEFINITIONS

A. EPA: Equivalent projected area.

B. Luminaire: Complete luminaire.

C. Pole: Luminaire-supporting structure, including tower used for large-area illumination.

D. Standard: See "Pole."

1.3 ACTION SUBMITTALS

A. Product Data: For each pole, accessory, and luminaire-supporting and -lowering device.

B. Shop Drawings:

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail fabrication and assembly of poles and pole accessories.
4. Foundation construction details, including material descriptions, dimensions, anchor bolts, support devices, and calculations, signed and sealed by a professional engineer licensed in the state of installation.
5. Anchor bolt templates keyed to specific poles and certified by manufacturer.
6. Method and procedure of pole installation. Include manufacturer's written installations.

1.4 INFORMATIONAL SUBMITTALS

A. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements according to AASHTO LTS-6-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations signed and sealed by a professional engineer.

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B. Field quality-control reports.

C. Sample warranty.

D. Soil test reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data for pole-lowering devices and pole-mounted accessories.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of pole(s) that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within a specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs from special warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Characteristics: Comply with AASHTO LTS-6-M.

B. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied according to AASHTO LTS-6-M.

C. Live Load: Single load of 500 lbf distributed according to AASHTO LTS-6-M.

D. Wind Load: Pressure of wind on pole and luminaire, calculated and applied according to AASHTO LTS-6-M.

1. Basic wind speed for calculating wind load for poles 50 feet high or less is 100 mph.

a. Wind Importance Factor: 1.0.
b. Minimum Design Life: 25 years.
c. Velocity Conversion Factor: 1.0.

E. Strength Analysis: For each pole, multiply the actual EPA of luminaires and brackets by a factor of 1.1 to obtain the EPA to be used in pole selection strength analysis.

F. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

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2.2 ALUMINUM POLES

A. Poles: Seamless, extruded structural tube complying with ASTM B221, Alloy 6063-T6, with access handhole in pole wall.

B. Brackets for Luminaires: Detachable, cantilever, without underbrace.

1. Adaptor fitting welded to pole, allowing the bracket to be bolted to the pole-mounted adapter, then bolted together with galvanized-steel bolts.
2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire. Match pole material and finish.

C. Fasteners: Galvanized steel, size and type as determined by manufacturer. Corrosion-resistant items compatible with support components.

1. Materials: Compatible with poles and standards as well as the substrates to which poles and standards are fastened and shall not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.

D. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Section 26 0526 "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size indicated, and accessible through handhole.

E. Handhole: Oval shaped, with minimum clear opening of 2-1/2 by 5 inches, with cover secured by stainless-steel captive screw.

F. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported load multiplied by a 5.0 safety factor.

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2.3 POLE ACCESSORIES

A. Base Covers: Manufacturers' standard metal units, finished same as pole, and arranged to cover pole's mounting bolts and nuts.

2.4 MOUNTING HARDWARE

A. Anchor Bolts: Manufactured to ASTM F 1554, Grade 55, with a minimum yield strength of 55,000 psi.

1. Galvanizing: Hot dip galvanized according to ASTM A 153, Class C.
2. Headed rods.
3. Threading: Uniform National Coarse, Class 2A.

B. Nuts: ASTM A 563, Grade A, Heavy-Hex

1. A 153, Class C.
2. Two nuts provided per anchor bolt.

C. Washers: ASTM F 436, Type 1.

1. Galvanizing: Hot dip galvanized according to ASTM A 153, Class C.
2. Two washers provided per anchor bolt.

2.5 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

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PART 3 - EXECUTION

3.1 POLE FOUNDATION

A. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123 M; and with top-plate and mounting bolts to match pole-base flange and strength required to support pole, luminaire, and accessories. Concrete, reinforcement, and formwork are specified in Section 03 3000 "Cast-in-Place Concrete."

B. Anchor Bolts: Install plumb using manufacturer-supplied template, uniformly spaced.

3.2 POLE INSTALLATION

A. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Section 03 3000 "Cast-in-Place Concrete."

B. Poles and Pole Foundations Set in Concrete-Paved Areas: Install poles with a minimum 6-inch-wide, unpaved gap between the pole or pole foundation and the edge of the adjacent concrete slab. Fill unpaved ring with pea gravel. Insert material to a level 1 inch below top of concrete slab.

C. Raise and set pole using web fabric slings (not chain or cable) at locations indicated by manufacturer.

3.3 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum using insulating fittings or treatment.

B. Steel Conduits: Comply with requirements in Section 26 0533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- thick, pipe-wrapping plastic tape applied with a 50-percent overlap.

3.4 GROUNDING

A. Ground Metal Poles and Support Structures: Comply with requirements in Section 26 0526 "Grounding and Bonding for Electrical Systems."

1. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

END OF SECTION 265613

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SECTION 26 56 19 – LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
2. Luminaire supports.

1.2 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color rendering index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of luminaire.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

1.5 FIELD CONDITIONS

A. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

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1.6 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.

2.2 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. UL Compliance: Comply with UL 1598.

D. Lamp base complying with ANSI C81.61.

E. Source Limitations:

1. Obtain luminaires from single source from a single manufacturer.

2.3 LUMINAIRE TYPES

A. Type as scheduled on the drawings.

B. Nominal Operating Voltage: Suitable and coordinated with the indicated circuit voltage.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.

D. Diffusers and Globes:

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1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
2. Glass: Annealed crystal glass unless otherwise indicated.

E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

F. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:

1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

G. Housings:

1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
2. Provide filter/breather for enclosed luminaires.

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2.4 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

2.5 FINISHES

A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

2.6 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 26 0529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. Install lamps in each luminaire.

C. Fasten luminaire to structural support.

D. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Support luminaires without causing deflection of finished surface.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

E. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls or a minimum 1/8 inch (3 mm) backing plate attached to wall structural members.

F. Wiring Method: Install cables in raceways. Conceal raceways and cables.

G. Install luminaires level, plumb, and square with finished grade unless otherwise indicated.

H. Coordinate layout and installation of luminaires with other construction.

I. Adjust luminaires that require field adjustment or aiming.

J. Comply with requirements in Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables" and Section 26 0533.13 "Conduits for Electrical Systems" for wiring connections and wiring methods.

3.2 INSTALLATION OF INDIVIDUAL GROUND-MOUNTED LUMINAIRES

A. Aim as directed by Architect.

B. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 03 3000 "Cast-in-Place Concrete."

3.3 CORROSION PREVENTION

A. Steel Conduits: Comply with Section 26 0533.13 "Conduits for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

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3.5 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Control Operation: Verify operation of controls.
3. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

C. Luminaire will be considered defective if it does not pass tests and inspections.

D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.6 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaires and controls.

END OF SECTION 265619

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SECTION 31 10 00 – SITE CLEARING

PART 1 – GENERAL

1.1 DESCRIPTION

A. Site Clearing shall consist of clearing of the site within the limits of disturbance to include the following:

1. Removal and disposal of trees and brush, weeds, roots, and similar materials.
2. Removal and disposal of civil structures, paving, base course, utilities, concrete sidewalks and aprons, and all other obstructions which are designated on the Plans for removal during construction.
3. Topsoil stripping and stockpiling.
4. Saw-cutting existing concrete and paved surfaces.
5. Protection of existing utilities and adjacent property, structures, benchmarks, and monuments.

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1.2 STANDARDS

A. The quality and performance of work specified in this section shall be in accordance with the Delaware Department of Transportation Standard Specifications for Road and Bridge Construction, dated August 2016, latest revision (hereinafter referred to as the "Standard Specifications").

1. Section 201: Clearing and Grubbing
2. Section 211: Removal of Structures and Obstructions and Existing Portland Cement Concrete Pavement, Curb, and Sidewalk
3. Section 762: Saw Cutting and Butt Joints

1.3 PHASING

A. Site clearing shall be performed prior to the grading and stripping operations, within the limits of grading, as indicated on the drawings and as specified herein. Following clearing, topsoil shall be stripped and stored for later use on the site or disposition by the Owner.

1.4 PROTECTION

A. The Contractor shall protect all trees, shrubs, ground plants, roads, walks, pavements, structures, civil improvements, and appurtenances not indicated to be cleared from the site. Methods of protection shall be by use of substantial wood or chain link fences, barriers, or other methods, as approved by the Engineer. Any trees, shrubs, ground plants, roads, walks, pavements, structures, or appurtenances indicated to remain that become damaged during construction of the project shall be repaired or replaced by the Contractor, as directed by the Engineer, at no additional cost to the Owner.

B. The Contractor shall contact all utility companies to mark the location of their facilities. The Contractor shall protect all existing utilities in place and maintain continuous service to the Owner. Any damage to the utilities shall be corrected by the Contractor at his expense. The Contractor shall also be responsible for coordinating and/or relocating any utilities which must be relocated to accommodate the proposed construction.

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PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials shall be at the Contractor's option, subject to the approval of the Engineer.

PART 3 - EXECUTION

3.1 CLEARING AND GRUBBING

A. Clearing shall consist of the removal of all trees and shrubs, brush, down timber, rotten wood, heavy growth of grass and weeds, vines, rubbish, walks, roads, curbs, walls and foundations, existing utilities already abandoned, and all objectionable debris. All walls, foundations, slabs, pavements, curbs, and footings shall be removed to their full depth.

B. Grubbing shall consist of the removal of stumps, roots, root mats, stubs, buried logs, and other debris within the project limits. The Contractor shall remove all stumps and root mats in their entirety and all buried logs and other debris from within building areas and from the limits of proposed drives and walks. Within proposed lawn areas, stumps, roots and debris shall be removed to a minimum depth of one foot below design rough grade.

C. Construction methods shall be in accordance with Sections 201 and 211 of the Standard Specifications.

3.2 DISPOSAL OF REMOVED MATERIALS

A. All timber and cleared materials shall become the property of the Contractor, and shall be disposed of by the Contractor. Burning and/or burial of materials on site is prohibited.

B. Pavement, base course, concrete, utilities, and other obstructions shall be removed from the site and shall be disposed lawfully. The Contractor shall provide evidence of the lawful disposal when requested by the Owner or the Owner's Representative.

3.3 SALVAGED MATERIALS

A. Materials listed to be salvaged for reuse shall be stored by the Contractor in such a manner to prevent damage to the material. Salvaged materials which are not reused shall be disposed of lawfully by the Contractor unless the Owner specifically requests to take possession of the material.

3.4 STRIPPING AND STORING TOPSOIL

A. Topsoil shall be considered to mean original surface soil, typical of the area, which is capable of supporting native plant growth.

B. All topsoil suitable for reuse, in the opinion of the Engineer, shall be stripped to its full depth, and stockpiled.

C. Topsoil stripping shall be accomplished from all topsoiled areas to be disturbed.

D. Heavy strands of weeds and grasses shall be removed or turned over, as directed by the Engineer, prior to the stripping operations.

E. The topsoil shall be kept separate from the excavated material and stored in stockpiles, the location of which shall be as directed by the Engineer. Topsoil shall be stockpiled so that it shall not be subject to abnormal erosion and loss, and it does not impede the flow of drainage runoff. Topsoil shall be stockpiled in the location sown on the Plans or as approved by the Engineer.

3.5 SITE DEMOLITION

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A. Remove walks, roads, curbs, walls and foundations, existing utilities already abandoned, and all objectionable debris. All walls, foundations, slabs, pavements, curbs, and footings shall be removed to their full depth.

B. Procure all permits required for demolition and disposal. Coordinate utility work with utility companies and subcontractors. All debris shall be removed and disposed lawfully.

C. Where applicable, brace and shore all portions of the existing structure for safety and to maintain the integrity of the existing building. Provide protection for the general public. Disconnect all utilities prior to demolition in areas where live utilities may be located.

3.6 SAW-CUTTING

A. Mechanically saw cut patch edges or tie-in joints into existing paving or sidewalk using a concrete cutting machine with a suitable motor-driven diamond blade and a circular cutter unless otherwise approved by the Engineer.

B. Saw-cut grooves shall be straight lines to a sufficient depth so that an even, neat joint can be cut to allow removal of material without damage to the adjacent pavement, sidewalk, or curb. A continuous water supply shall be supplied to the cutting blade.

END OF SECTION 31 10 00

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SECTION 31 20 00 - EARTHMOVING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide labor, materials, and equipment necessary to complete the work of this Section, including but not limited to the following:

1. Filling and backfilling to attain indicated grades.
2. Excavation, rough and finish grading.
3. Furnishing and installing graded aggregate base course material for pavements, hot-mix patches and other structures.
4. Undercut excavation and furnishing graded aggregate base course for undercut excavation.
5. Furnishing excavation support systems, as required, including shoring and bracing.
6. Excavation for trenches.
7. Preparing topsoil stripped from the site and placing topsoil in locations requiring seeding or sodding.

B. Definitions

1. Excavation: removal and disposal of all material encountered when establishing required grade elevations, including pavements and other obstructions visible on the ground surface, and underground structures and utilities indicated to be demolished and removed, and unsuitable subgrade material.
2. Unauthorized excavation: Removal of materials beyond specified subgrade elevations without approval of a Geotechnical Engineer.

1.2 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies

1. All excavations shall be in compliance with Federal Occupational Safety and Health Act.
2. Excavation work shall be in compliance with application requirements of other governing authorities having jurisdiction.

B. Standards

1. Refer to the following sections in the Delaware Department of Transportation Standard Specifications for Road and Bridge Construction, dated August 2016, latest revision. (Hereinafter referred to as the "Standard Specifications")

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Section 202: Excavation and Embankment
Section 207: Structural Excavation and Backfill
Section 209: Borrow
Section 301: Graded Aggregate Base Course
Section 302: Stone
Section 908: Soil Stabilization Practices
Section 1001: Borrow
Section 1004: Coarse Aggregate
Section 1005: Graded Aggregate

2. American Society for Testing and Materials (ASTM);

D-1556: Density and Unit Weight of Soil in Place by the Sand-Cone Method.
D-698: Moisture Density Relations of Soils and Soil Aggregate Mixtures
D-2049: Relative Density of Cohesionless Soils
D-2166: Unconfined Compressive Strength of Cohesive Soil
D-2922: Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth)

1.3 SUBMITTALS

A. Material Certification and delivery slips for:

1. Select Borrow
2. Graded Aggregate Base Course
3. Delaware #57 Stone
4. Topsoil and Special Planting Soil

1.4 JOB CONDITIONS

A. Existing Utilities

1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult the Utility Owner immediately for directions. Cooperate with the Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility Owner.
2. Do not interrupt existing utilities serving facilities occupied and used by the Owner.
3. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut-off of services if lines are active.

B. Use of Explosives: The use of explosives is not permitted unless approved by the Engineer.

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C. Protection of Persons and Property

1. Barricade open excavations occurring as part of this work and post with warning signs as required to protect persons on the site.
2. Protect trees, shrubs, lawns and other features remaining as part of final landscaping.
3. Protect structures, utilities, sidewalks, pavements and other facilities from damage caused by settlement lateral movement undermining, washout and other hazards created by earthwork operations.
4. In the event of damage, immediately make all repairs and replacements to the approval of the Owner, at no cost to the Owner.

D. Dust Control

1. Use all means necessary to control dust on and near the work if such dust is caused by the Contractor's operations during performance of the work or if resulting from the conditions in which the Contractor leaves the site.
2. Thoroughly moisten all surfaces as required to prevent dust being a nuisance to the public, neighbors and concurrent performance of other work on the site.

E. Weather Conditions: Do not place, spread, or roll fill material during freezing, raining, or otherwise unfavorable weather conditions.

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PART 2 - PRODUCTS

2.1 GENERAL

A. For approval of borrow materials, at least five (5) working days in advance of intention to import material, designate the proposed borrow area, and provide samples to prove the quality and suitability of the material.

2.2 ON-SITE FILL

A. All on-site materials used for fill shall be acceptable to a Geotechnical Engineer and shall be minimally subject to the following requirements:

1. Free from deleterious substances, stumps, brush, weeds, roots, sod, rubbish, garbage and matter that may decay.
2. Free of large rocks or lumps that may create voids or prevent proper compaction.

2.3 BORROW FILL MATERIAL

A. Free from deleterious substances, stumps, brush, weeds, roots, sod, rubbish, garbage and matter that may decay, and shall be Borrow Type "C" conforming to Section 1001 of the Standard Specifications. All suitable excavated material, which meets the requirements of Section 1001 of the Standard Specifications shall be used for borrow fill material, except as otherwise stated in the plan of remedial action.

2.4 TRENCH AND CIVIL STRUCTURE BACKFILL MATERIAL

A. Backfill for civil structures shall conform to the requirements of Section 209 of the Standard Specifications.

B. Backfill for trenches shall conform to the requirements of Section 209 of the Standard Specifications.

C. All trench and civil structure backfill material shall meet the requirements of Section 1001 of the Standard Specifications for Borrow Type C backfill. All suitable excavated material, which meets the requirements of Section 1001 of the Standard Specifications shall be used for structure or trench backfill as far as practicable.

2.5 GRADED AGGREGATE BASE COURSE

A. Graded Aggregate base course for bituminous and concrete pavements and other structures shall be Type "B" conforming to the requirements for Graded Aggregate in Sections 301 and 1005 of the Standard Specifications.

2.6 TOPSOIL

A. Topsoil furnished from within or outside the project limits shall conform to Section 908 of the Standard Specifications except as modified by the following requirements.

1. Topsoil shall not contain stones, lumps, roots or other objects larger than one inch in any dimension.
2. Acid-Alkaline Range: pH 6.0 to 7.5.
3. Free of pests, pest larvae, and matter toxic to plants.
4. Maximum soluble salts: 500 ppm
5. Free of viable Bermudagrass, quackgrass, Johnsongrass, nutsedge, poison ivy, Canada thistle, and other objectionable grassy or broadleaf weeds.

B. Topsoil Furnished from Outside Project Limits

1. Gradation range:
   Sand (2.00 mm to 0.05 mm) 40-80 percent

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Silt (0.050 mm to 0.005 mm) 10-30 percent
Clay (0.005 mm and smaller) 10-30 percent

a. When one-half of the sand content is larger than 0.500 mm, the maximum sand content shall be seventy-five percent; and maximum clay content shall be fifteen percent.
b. Lower limits of silt and clay shall be flexible to extent that soils with minimum combined silt and clay content of twenty percent shall be satisfactory. However, if more than one-half of the sand is larger than 0.50 mm., then minimum clay content shall be fifteen percent, or the minimum combined silt and clay content shall be twenty-five percent.

2. Organic content:

a. Minimum of 1.5 percent by weight.
b. If necessary, add peat at the rate necessary to attain minimum organic content.

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PART 3 - EXECUTION

3.1 INSPECTION BY CONTRACTOR

A. Examine the areas and conditions under which excavating, filling and grading are to be performed. No extra cost or time allowances will be granted for conditions existing and visible at the time of the bid opening.

3.2 PREPARATION

A. Prior to commencement of work, establish location and extent of all utilities in the work areas. Maintain and protect, as required, existing utilities which pass through the work area.

B. Prior to excavation in pavement areas, saw cut existing pavement in accordance with Section 762 of the Standard Specifications.

3.3 EXCAVATION

A. Unauthorized Excavation

Unauthorized excavation shall not be at the Owner's expense. Under roadways and pipes, fill unauthorized excavation by removing all loosened material and providing select material as required to attain a firm and unyielding subgrade and/or foundation and to attain required grade elevations.

B. Rock Excavation

Rock Excavation shall apply to the removal of bedrock and ledgerock which cannot be accomplished without blasting or the use of rippers, and the use or disposal of such material. Excavation of material classified as "rock" shall conform to the requirements of Section 202 of the Standard Specifications.

D. Undercut Excavation

1. If unsuitable bearing materials are encountered at the required subgrade elevations notify a Geotechnical Engineer immediately, and have the work reviewed by a Geotechnical Engineer.
2. Unstable bearing materials shall be removed to a depth of one foot below subgrade and replaced with one foot of graded aggregate base course.
3. Base course shall be placed and compacted in six-inch lifts.

E. Stability of Excavations

1. Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space.
2. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.

F. Shoring and Bracing

1. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition.
2. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction
3. Maintain shoring and bracing in excavations regardless of time period excavations will be open.
4. Brace, sheet, and support trench walls in such a manner that they will be safe and that the ground alongside the excavation will not slide or settle, and that all existing improvements of every kind, whether on public or private property, will be fully protected from damage.
5. In the event of damage to such improvements, immediately make all repairs and replacements necessary at no additional cost to the Owner.

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6. Arrange bracing, sheeting and shoring so as to not place stress on any portion of the completed work until the general construction thereof has proceeded far enough to provide sufficient strength.
7. Exercise care in the drawing and removal of sheeting, shoring, bracing and timbering to prevent collapse and caving of excavation faces being supported.

G. Dewatering

1. Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding the project site and surrounding area.
2. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to the stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water from excavations.
3. Convey water removed from excavations and rainwater to collecting or runoff areas, which are not subject to erosion. Establish and maintain temporary drainage ditches and other diversions outside excavation limits for each structure. Do not use trench excavations as temporary drainage ditches.

H. Material Storage

1. Stockpile satisfactory excavated materials where directed until required for use as backfill or fill. Place, grade and shape stockpiles for proper drainage.
2. Locate and retain soil materials away from edge of excavations.
3. Dispose of excess soil material and waste materials as herein specified. Excavated material unsuitable for backfilling shall be kept separate from other materials excavated, and disposed of. Materials suitable for backfilling shall not be disposed of until completion of filling or backfilling operations.

I. Excavation for Pavements and Pavement Patches

1. Cut surface under pavements to comply with cross- sections, elevations and grades as shown.

J. Excavation for Trenches

1. Dig trenches to the uniform width required for the particular item to be installed sufficiently wide to provide ample working room. Trench width to a point no less than two feet (2') above the outside top of pipe shall be the pipe outer diameter plus twenty-four inches (24").
2. Excavate trenches to the depth indicated or required. Carry the depth of trenches for piping to establish the indicated flow lines and invert elevations. Beyond the building

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perimeter, keep bottoms of trenches for which elevations are not given sufficiently below finish grade to avoid freeze-ups.

3. Trenches for pipes shall not be opened more than the number of linear feet of pipe that can be placed and backfilled in one (1) day.
4. Grub roots and stumps within six inches (6") of outside surface of pipe bottom and sides to minimum depth of six inches (6") below grade. Backfill trenches with concrete where trench excavations pass within eighteen inches (18") of column or wall footings and which are carried below the bottom of such footings, or which pass under wall footings. Place concrete to the level of the bottom of adjacent footing.
5. Pipe bedding shall be as shown on the Plans.

K. Cold Weather Protection

1. Protect excavation bottoms against freezing when atmospheric temperature is less than thirty-five degrees (35°).

3.4 BACKFILL FILL AND COMPACTION

A. General

1. The project Inspector or a Geotechnical Engineer shall be notified 24 hours in advance of any fill, backfill or compaction operations.
2. Place acceptable material in 8" lifts to required subgrade elevations.
3. Fills: Use suitable material (per Section 2.2 of this section) obtained from on-site excavation, except use borrow material when suitable on-site material is not available.
4. Backfilling: Use suitable material (per Section 2.2 of this section) obtained from on-site excavation, except use select backfill where indicated on Plans. Backfill to a height of two feet (2') above the top of pipe with earth free from stones, rock fragments, dirt clogs or frozen material greater than two inches (2") in largest dimension.
5. Do not provide additional off-site borrow material until all acceptable excavated materials on the site have been utilized in the work unless approved by the Owner.
6. Place the various types of materials in the areas as designated on the Plans.

B. Backfill excavation as promptly as work permits, but not until completion of the following:

1. Inspection, testing, approval and recording locations of underground utilities.
2. Removal of concrete formwork.
3. Removal of shoring and bracing, and backfilling of voids satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.

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4. Removal of trash and debris.
5. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

C. Backfilling Prior to Approvals

1. Should any of the work be so enclosed or covered up before it has been approved, uncover all such work at no additional cost to the Owner.
2. After the work has been completely tested, inspected and approved, make all repairs and replacements necessary to restore the work to the condition in which it was found at the time of uncovering, all at no additional cost to the Owner.

D. Ground Surface Preparation Prior to Filling

1. Remove all vegetation, debris, topsoil, unsatisfactory soil materials, obstructions and deleterious materials from existing ground surface to a depth of not less than four inches (4") and not more than six inches (6") prior to placement of fills. Plow, strip or break-up sloped surfaces steeper than one (1) vertical to four (4) horizontal to a depth of not less than six inches (6") so that fill material will bond with existing surface.
2. When existing ground surface has a density less than that specified under "Compaction," for the particular area classification, break up the ground surface, pulverize, moisture condition to the optimum moisture content, and compact to required depth and percentage of maximum density.

E. Placement and Compaction

1. Place backfill materials in layers not more than eight inches (8") in loose depth.
2. Control soil compaction during construction providing minimum percentage of density specified for each area classification listed below.
3. Pavement areas are defined, for the purpose of this Section, as extending a minimum of five feet (5') beyond the building and/or pavement.
4. Compact soil to not less than the following percentages of maximum dry density for soils which exhibit a well-defined moisture density relationship determined in accordance with ASTM D-1557; and not less than the following percentages of relative density determined in accordance with ASTM D-4253, for soils which will not exhibit a well-defined moisture-density relationship.

    a. Lawn or Unpaved Areas: Compact top six inches (6") of subgrade and each layer of backfill or fill material at 90 percent (90%) maximum dry density.
    b. Walkways: Compact top six inches (6") of subgrade and each layer of backfill or full material at 95 percent (95%) maximum dry density or 90 percent (90%) relative dry density.

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c. Pavement Areas: Compact top twelve inches (12") of subgrade and each layer of backfill or fill material at 95 percent (95%) maximum dry density or 90 percent (90%) relative dry density.
d. Base Course Materials: Compact each layer of base course material to 95% percent (95%) of maximum dry density.
e. Trench Stabilization Materials: Compact each layer of material to 95 percent (95%) of maximum dry density.

5. Moisture control:

a. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.
b. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
c. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.
d. Moisture condition fills materials to within 3 percent (3%) of the optimum moisture. Fill that is so wet that it is unstable under compaction equipment shall be dried and re-compacted to achieve a stable fill.

6. Puddling or jetting will not be permitted.
7. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice, or other unsuitable materials.
8. Place backfill and fill material evenly adjacent to structures, to be required elevations. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around structure to approximately same elevation in each lift.
9. Compact backfill to height of two feet (2') above top of pipe using approved flat faced mechanical tampers.

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3.5 GRADING

A. General

Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

B. Grading Outside Building Lines

Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes, and as follows:

1. Lawn or unpaved areas: Finish area to receive topsoil to within not more than 0.10 feet above or below the required subgrade elevations.
2. Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 1/2 inch above or below the required subgrade elevation.
3. Pavement: Shape surface of areas under pavement line, grade and cross-section, with finish surface not more than 1/2 inch above or below the required subgrade elevation. All topsoil and other unsuitable material shall be removed and replaced with suitable backfill.

C. Compaction

1. After grading, compact subgrade surfaces to the depth and percentage of maximum density for each area classification.

D. Treating after Grading

1. After grading is completed, permit no further excavating, filling or grading.
2. Use all means necessary to prevent erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

E. Subgrade Preparation

1. All subgrade preparation shall be performed in accordance with the applicable Sections of the Delaware Department of Transportation Standard Specifications except as may be modified by this Specification Section.
2. Subgrades for paving shall be firm and unyielding when proof-rolled in accordance with Section 202 of the Standard Specifications.

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3.6 GRADED AGGREGATE BASE COURSE

A. General

1. Base Course consists of placing graded aggregate base course material in layers of specified thickness over subgrade surface to support pavements, pavement patches and structures, as shown on Plans.
2. Provide Base Course in accordance with Section 301 of the Standard Specifications, except as otherwise modified by this Specification Section.

B. Grade Control

1. During construction, maintain lines and grades including crown and cross-slope of base course.

C. Placing

1. Place base course material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting base course material during placement operations.
2. When a compacted base course is shown to be eight inches (8") or less, place material in a single layer. When shown to be more than eight inches (8") thick, place material in equal layers, except no single layer shall be more than eight inches (8") in thickness when compacted.
3. Spread, shape and compact all base course material deposited on the subgrade during the same day.

3.7 FIELD QUALITY CONTROL

A. Quality control testing during construction. Allow testing service to inspect and approve subgrades and fill layers before further construction work is performed.

B. If subgrade or fills which have been placed are below specified density, provide additional compaction and testing at no expense to the Owner. This shall include compaction and testing at areas initially tested and at other locations as directed.

3.8 MAINTENANCE

A. Protection of Graded Areas

1. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
2. Repair and establish grades in settled, eroded and rutted areas to specified tolerances.

B. Reconditioning Compacted Areas

1. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape and compact to required density prior to further construction.

3.9 DISPOSAL OF EXCESS AND WASTE MATERIALS

NOT FOR BIDDING PURPOSES

A. Remove waste materials, including excess and unacceptable excavated material, trash and debris, and dispose of it off the Owner's property.

3.10 TOPSOILING

A. Preparation

1. Verify that clearing, earthwork, grading and other preceding work affecting ground surface have been completed and that the area to be topsoiled is cleared, shaped, and dressed.
2. Preparation of Topsoil Subsoil
   a. Shape and dress area to be topsoiled. This work includes grading to required lines and elevations; removal of all stones, clods, lumps two inches or larger in any dimension; removal of all wires, cables, pieces of concrete, tree roots, and debris or other unsuitable material.
   b. Do not proceed with installation of topsoil until this work has been approved.

B. Installation

1. Place in even layers that will produce the minimum compacted thickness as indicated on the Plans.
2. If the quantity of topsoil obtained from stripping is insufficient for the project requirements, provide required topsoil from approved sources located outside project limits.
3. Within the Multipurpose field area shown on the Plans, remove stones, lumps, roots and other objects larger than one-half inch in any dimension from graded topsoil surface using a mechanical landscape rake.

C. Maintenance

1. Immediately before establishment of ground cover, re-topsoil and regrade areas, which become eroded or otherwise disturbed.
2. Perform all maintenance work in accordance with the Specifications without additional compensation.
3. Maintenance period to extend until installation of ground cover.

D. Cleaning

1. Immediately clean spills, soil, and conditioners on paved and finished areas.
2. Haul and dispose of topsoil in excess of the quantity required for the project off site.
3. Dispose of protective barricades and warning signs at termination of maintenance period.

NOT FOR BIDDING PURPOSES

END OF SECTION 31 20 00

NOT FOR BIDDING PURPOSES

SECTION 31 25 00 – EROSION AND SEDIMENT CONTROLS

PART 1 – GENERAL

1.1 DESCRIPTION

A. General: Provide temporary soil and sediment control measures in accordance with the Plans and Contract Documents.

1.2 QUALITY ASSURANCE

A. Standards

Except as modified by governing codes and by the Contract Documents, comply with the applicable provisions and recommendations of the following:

1. Delaware Erosion and Sediment Control Handbook, current edition.
2. Delaware Department of Transportation Standard Specifications for Highways and Bridges, dated August 2016 (hereinafter referred to as the "Standard Specifications").

B. Design Criteria

1. The primary objective of this specification is to control soil erosion to the maximum extent practicable.
2. The temporary control provisions contained herein shall be coordinated with permanent erosion control features to the extent practical to assure effective and continuous erosion control throughout the construction and post- construction period.
3. The erosion control measures described herein shall be continued until the construction is complete and all disturbed areas are fully stabilized.
4. Wherever construction exposes work which is subject to erosion, erosion control features or other work to be completed within such areas shall follow as soon after exposure as practicable.

NOT FOR BIDDING PURPOSES

PART 2 - PRODUCTS

2.1 MATERIALS

A. Temporary mulches shall conform to Section 908 of the Delaware Department of Transportation Standard Specifications for Bridges and Highways.

B. Temporary grass mixtures shall be as shown on the Plans, or in the absence of plan information, shall conform to the Section 908 of the Standard Specifications.

C. Temporary structural Erosion Control measures shall conform to the requirements of the Delaware Erosion and Sediment Control Handbook and the Delaware Department of Transportation Standard Specifications.

D. Erosion control matting and blankets shall conform with the Delaware Erosion and Sediment Control Handbook requirements for soil stabilization matting (SSM) I and II. Matting shall be composed of 100% agricultural straw (minimum 0.5 pounds per square yard) or 100% wood excelsior fiber (0.8 pounds per square yard) with a single or double netting of bio-degradable material. SSM-I shall be North American Green S75BN, Carthage Mills ECS-1B, American Excelsior Curlex I or approved equal. SSM-II shall be North American Green S150BN, Carthage Mills ECS-2B, American Excelsior Curlex II, or approved equal.

PART 3 - EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. Vegetative stabilization shall be used on graded or cleared areas, which are subject to erosion for a period of 14 days or more.

B. All temporary erosion control measures shall be installed in accordance with the Delaware Erosion and Sediment Control Handbook.

C. Erosion control matting shall be installed in accordance with the manufacturer's written instructions, the requirements of the Delaware Erosion and Sediment Control Handbook, and the details on the Plans.

D. In the event of conflict between these requirements and pollution control laws, rules, or regulations of other federal or state agencies, the more restrictive laws, rules, or regulations shall apply.

E. The Contractor shall be responsible for maintaining all soil erosion and sediment control measures in an acceptable and functional manner. The Contractor shall remove all temporary measures after all other construction is complete, final restorations installed, and all disturbed areas have been adequately stabilized.

END OF SECTION 31 25 00

NOT FOR BIDDING PURPOSES

SECTION 32 12 16 – ASPHALT PAVING

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work included: Provide labor, materials, and equipment necessary to complete the work of this Section, including but not limited asphalt paving parking areas, entrances per the following:

1. Saw cutting and milling existing pavements.
2. Patching pavement, including removal of existing pavement and installation of bituminous concrete base course patch.
3. Surface preparation, and installation of Type B, binder course pavement.
4. Installation of Type C, wearing surface course for pavement patching, and for overlay of existing bituminous pavement including patched and repaired areas.
5. Pavement markings.
6. Traffic control and signage.

1.2 STANDARDS

A. The quality of materials and performance of work specified in this section shall be in accordance with the Delaware Department of Transportation Standard Specifications for Road and Bridge Construction, dated August 2016, latest revision (hereinafter referred to as the "Standard Specifications").

1. Section 401: Bituminous Pavement
2. Section 402: Bituminous Paving Materials, Patching
3. Section 760: Pavement Milling
4. Section 762: Saw Cutting and Butt Joints
5. Section 817: Pavement Marking
6. Section 1011: Tack Coat
7. Section 1014: Asphalt Materials Production

NOT FOR BIDDING PURPOSES

B. All pavement markings shall be in accordance with the Delaware Manual on Uniform Traffic Control Devices, dated 2011, latest revision, and the Delaware Department of Transportation Striping Item Usage Guidelines (Permanent Pavement Markings – Conventional Roads), dated 1/4/2017, latest revision.

1.3 DEFINITIONS

A. Subgrade: Surface upon which pavements will be constructed.

B. Base Course: That portion of the pavement cross section consisting of graded aggregate base course or bituminous concrete deep lift.

1.4 QUALITY ASSURANCE

A. Bituminous concrete producer shall be regularly engaged in the production of hot-mix, hot-laid bituminous concrete, and shall be approved by the Delaware Department of Transportation or the Pennsylvania Department of Transportation.

1.5 SUBMITTALS

A. Job mix formula.

B. Provide copies of delivery slips at the end of each working day.

PART 2 - PRODUCTS

2.1 GENERAL

NOT FOR BIDDING PURPOSES

A. Materials and mixtures shall comply with the following sections of Delaware Department of Transportation Standard Specifications. All bituminous concrete paving shall be obtained from a DelDOT approved plant.

2.2 PAVING MATERIALS AND MIXTURES

A. Graded Aggregate Base Course

1. Materials: Sections 301 and 1005.

B. Hot Mix, Hot Laid Bituminous Concrete Pavement

1. Materials: Section 401.
2. Mixture: Section 401

C. Emulsified Asphalt: Section 1016

D. Course and Fine Aggregate: Sections 1003 and 1004

E. Tack Coat: Meeting the requirements of Section 1011 of the Standard Specifications

NOT FOR BIDDING PURPOSES

2.3 JOB MIX FORMULA REQUIREMENTS

A. Provide job mix formulas for each required bituminous concrete mixture as specified in Section 401 of the Standard Specifications.

B. Submit for approval prior to beginning paving operations.

2.4 MIX DESIGN AND CONTROL REQUIREMENTS

A. The design and control requirements for all paving mixtures shall conform to Section 401 of the Standard Specifications.

2.5 SAMPLES AND TESTING

A. Methods and rates of sampling bituminous mixtures shall conform to Section 1014 of the Standard Specifications with the following exceptions:

1. Sampling shall be performed by the producer's quality control technician.
2. For small scale projects where it is possible to attain the minimum lot size specified, a total of five (5) samples shall be taken at random for each type of mix specified, per each day's production.

B. Testing of bituminous concrete mixtures to determine the quantity of bitumen, gradation of aggregate, and conformance to mix design requirements shall be as specified in Section 1014 of the Standard Specification.

C. Submit results of tests on forms signed by producer's quality control technician.

2.6 PREPARATION OF MIXTURES

A. The preparation of all bituminous mixtures shall conform to Section 1014 of the Standard Specifications.

NOT FOR BIDDING PURPOSES

2.7 PAVEMENT MARKINGS

A. All paint shall be of materials approved by the Delaware Department of Transportation per Sections 817 and 1071 of the Standard Specifications for Latex or Epoxy Paint. Glass beads will not be required for paint striping in parking lots or private driveways.

B. Thermoplastic material, where shown on the plan or required by DelDOT, shall meet the requirements of Section 817 and 1071 of the Standard Specifications.

2.8 TRAFFIC CONTROL SIGNS

A. All traffic control signs and posts shall conform with the Delaware Manual of Uniform Traffic Control Devices, the Standard Specifications, and the Americans with Disabilities Act.

B. Street signs shall conform with the requirements of the Town of Whitehall and DelDOT requirements, and shall be of a consistent style with street signs in the surrounding neighborhood.

PART 3 - EXECUTION

3.1 GENERAL

A. The method of construction, including bituminous concrete plant and equipment, bituminous concrete pavers, vehicles for transporting bituminous mixtures, rollers, and all construction methods shall conform to Section 401 of the Standard Specifications except as modified by the Supplemental Requirements below.

3.2 SAW CUTTING AND PAVEMENT MILLING

A. Construction methods for saw cutting and pavement milling shall conform to Sections 760 and 762 of the Standard Specifications.

3.3 PAVEMENT PATCHING

A. Construction methods for patching pavement shall conform to Sections 401 and 402 of the Standard Specifications. A milling machine may be use for pavement and base course removal.

NOT FOR BIDDING PURPOSES

3.4 PROOF ROLL

A. Proof roll subgrade surfaces using heavy, rubber-tired rollers, or loaded dump truck in accordance with Section 202 of the Standard Specifications. Proof roll in the presence of the Owner's Representative.

1. Subgrades shall be firm and unyielding.
2. Compact areas showing deflection and instability.

B. Notify the Engineer or the Inspector of unsatisfactory conditions.

C. Do not begin paving work until any such unsatisfactory conditions have been corrected.

3.5 SURFACE PREPARATION

A. Earth and Base Course Surface

1. Remove loose and foreign material from compacted subgrade surface immediately before application as required.
2. Use power broom or blowers and hand brooming as required.
3. Do not displace subgrade material.

B. Existing Pavement Surfaces

1. Remove loose and foreign material from existing pavement surfaces immediately before application of paving

2. Use self-propelled mechanical sweepers. Supplement with hand brooming as required.
3. Pay particular attention to cleaning of gutter lines and outer edges of pavement areas.
4. Remove all weeds, grass or other vegetative matter growing in pavement areas, particularly along joints and curbs.

C. Minor Patching

NOT FOR BIDDING PURPOSES

1. Existing pavement surfaces: Fill in depressions, and patch pavement in overlay areas that are not marked out for base repairs.

3.6 TACK COAT

A. Apply to cleaned surfaces of all pavements to be overlaid or slurry seal coated.

B. Apply to cleaned surfaces of newly constructed base pavement if coated with dust, dirt, foreign materials in sufficient amount to prevent bond with surface course.

C. Apply to edges of paving where base repairs are to be made.

D. Apply tack coat material at temperatures specified in Section 401 of the Standard Specifications.

E. Apply at a uniform rate of 0.05 to 0.15 gallons per square yard immediately prior to placing pavement.

F. Apply tack coat by brush to contact surfaces of pavement cold joints, curbs, gutters, manholes, and other structures projecting into or abutting asphalt concrete pavement.

G. Allow surfaces to dry until material is in a condition of tackiness to receive pavement.

H. Take precautions to ensure tack coat is not applied to exposed surfaces of curbs or other exposed surfaces. Tack coat so applied shall be removed by Contractor at no additional cost to Owner.

3.7 GENERAL SURFACE REQUIREMENTS

NOT FOR BIDDING PURPOSES

A. Test finished surface of each bituminous concrete course for smoothness using a ten (10) foot straightedge.

B. The straightedge shall have projections on the bottom at each end, either built-in or firmly attached, so that it is supported six (6") inches above the pavement surface at the ends. It shall be free from warp and deflection, and furnished by the Contractor without additional compensation.

C. Check surfaced areas at intervals and in directions specified.

D. Check surfaces for pavement smoothness immediately after initial compaction, and correct variations by removing or adding material as may be necessary. Then rolling shall be continued as specified.

E. Immediately after final rolling and while the pavement is still hot, the smoothness of the course shall be checked again and all projections or depressions exceeding the specified tolerances shall be corrected by removing defective work and replacing it with new surface course as specified. Portions of the surface otherwise unsatisfactory shall be replaced.

F. Finished surfaces shall be free of all roller marks, ridges and voids.

NOT FOR BIDDING PURPOSES

3.8 FIELD QUALITY CONTROL

A. Taking of pavement cores and testing for the determination of conformance to control air voids and pavement thickness, when required, shall be performed in accordance with Section 401 of the Standard Specifications.

B. When required per the General or Special Provisions, the Contractor shall employ and pay for the services of an Independent Testing Laboratory acceptable to the Engineer to perform additional field quality control sampling and testing when initial tests indicate work does not comply with the Contract Documents. All sampling and testing shall be performed as specified in section 401 of the Standard Specifications.

C. Areas of pavement removed for field quality control testing shall be replaced by the Contractor as follows:

1. Clean debris from core area. Cut all exposed pavement edges vertical.
2. Apply tack coat to exposed surfaces before installing replacement pavement.
3. Fill core area with surface course mixture for the full depth of the core.
4. Compact and grade mixture; seal repaired area with tack coat; and apply thin layer of sand over tack coat.

3.9 PAVEMENT MARKINGS

A. Paint equipment and installation shall conform to Section 817 of the Standard Specifications.

B. Application of Thermoplastic materials, where required, shall conform to Sections 817.03.5 of the Standard Specifications.

C. All markings shall comply with the Manual on Uniform Traffic Control Devices, the Delaware Manual on Traffic Controls for Street and Highway Construction and Maintenance, the Delaware State Fire Prevention Regulations, and the Delaware State Accessibility Board.

3.10 TRAFFIC CONTROL SIGNS

A. Traffic control signs shall be installed in accordance with the Delaware Manual of Uniform Traffic Control Devices, and the Standard Specifications.

END OF SECTION 32 12 16

NOT FOR BIDDING PURPOSES

SECTION 32 13 13 - CONCRETE PAVING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Sawcut and remove existing concrete paving, sidewalk, ramps, and pads as shown on the plan, marked in the field, or as directed by the Engineer.

B. Provide new concrete paving and pads in areas designated on Plans, marked in the field, or as directed by the Engineer.

C. Place Graded Aggregate Base Course below proposed concrete paving and sidewalks.

1.2 STANDARDS

A. The quality of materials and performance of work specified in this section shall be in accordance with the Delaware Department of Transportation Standard Specifications for Road and Bridge Construction, dated August 2016 (hereinafter referred to as the "Standard Specifications").

Section 301: Graded Aggregate Base Course
Section 501: Portland Cement Concrete Pavement
Section 611: Concrete Reinforcement
Section 705: P.C.C. Sidewalk, Curb Ramps, and Sidewalk Detectable Warning System
Section 762: Saw Cutting and Butt Joints
Section 1022: Portland Cement Concrete Production

1.3 SUBMITTALS

A. Certificates: All deliveries of concrete shall be accompanied by delivery slips.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Allowable Concrete Temperatures

1. Cold weather: 60 degrees Fahrenheit. (18° C) when discharged from the mixer.
2. Hot weather: Maximum concrete temperature is 80 degrees Fahrenheit. (30° C
3. Maintain temperatures of not less than 50 degrees Fahrenheit surrounding the concrete pavement for a curing period of five (5) calendar days following placement of the concrete.

B. Do not place concrete during rain, when atmospheric temperature is at or below 36 degrees Fahrenheit (2° C), or when conditions are otherwise unfavorable.

NOT FOR BIDDING PURPOSES

1.5 PROTECTION

A. Protect concrete from pedestrian and vehicular traffic until concrete has been sufficiently cured.

B. Protect the concrete from freezing or other thermal damage.

NOT FOR BIDDING PURPOSES

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete
   1. Use concrete developing a compressive strength at twenty-eight (28) days of 4,500 p.s.i. for concrete paving.
   2. Use air-entrained concrete.

B. Cement, aggregates, water, and air-entrainment methods and materials shall conform with Section 1022 of the Standard Specifications for Class A concrete.

C. Joint filler: Pre-formed expansion joint material, conforming to Section 1042 of the Standard Specifications.

D. Curing compound: White pigmented liquid, conforming to AASHTO M 148 for Type 2, Class A or B.

E. Vapor barrier: Where called for on Plans shall be 6 mil. polyethylene.

F. Welded Wire Fabric as specified on the Plans shall conform to AASHTO M 55.

G. Fiber reinforcement shall be monofilament or fibrillated polypropylene micro-fibers engineered and designed for use in concrete, complying with ASTM 1116, three-fourths inch (3/4") to two inches (2") long. Fibers shall be SikaFiber PPF as manufactured by the Sika Corporation, or approved equal. Uniformly disperse fibers in concrete mix per the manufacturer's recommendations, but at not less than a rate of 1.5 pound per cubic yard.

H. Spalled areas shall be removed, or when acceptable to the Engineer, repaired with a pre-blended, pre-packaged, cement based mortar requiring only the addition of potable water. The material shall not contain any chlorides or lime other than the amounts contained within the hydraulic composition. The concrete repair material shall have a minimum

strength of 5000 psi after 28 days. Concrete repair material shall be as manufactured by Five Star Products, Inc., or approved equal.

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2.2 GRADED AGGREGATE BASE COURSE

A. Graded aggregate base course shall meet the requirements of Section 1005 of the Standard Specifications for Type B graded aggregate base course.

PART 3 - EXECUTION

3.1 REMOVING EXISTING PAVING

A. All portions of existing concrete paving to be removed shall be isolated from pavements, curb, or buildings to remain by saw cutting or by the presence of an existing expansion joint. Care shall be exercised by the Contractor to ensure that no damage occurs to any elements to remain and any damage to items to remain shall be replaced or repaired by the Contractor at no additional cost to the Owner.

B. Concrete shall be broken up by an approved power breaking machine. All concrete removed shall be taken off the project site and disposed of lawfully.

3.2 PREPARATION FOR NEW PAVING AND SIDEWALK

A. Excavate subgrade and set forms so that finished paving and sidewalk conforms to lines and grades shown on Plans.

B. Prepare paving and subgrade as specified in Section 501 of the Standard Specifications.

C. Verify that earthwork is completed to correct line and grade.

D. Verify that forms conform to line, grade and dimensions shown on Plans.

E. Check that subgrade is smooth, compacted and free of excessive moisture.

F. Do not commence work until conditions are satisfactory.

3.3 CONSTRUCTION METHODS

A. Concrete paving shall be constructed in accordance with the requirements of Section 501 of the Delaware Department of Transportation Standard Specifications for Road and Bridge Construction.

NOT FOR BIDDING PURPOSES

B. Use vibration or tamping to consolidate the rapid set concrete patching material. Work material into saw cuts, extending beyond the corners of the repair area. Strike-off and shape the material to match the surrounding concrete.

3.4 TESTING

A. Subgrade shall be compaction tested to ensure compliance with the standards of Section 312000 of these Specifications.

B. Test the compressive strength of the concrete in accordance with Section 501 of the Standard Specifications.

C. The contractor shall be responsible to provide all required testing including the use of third-party testers.

END OF SECTION 32 13 13

NOT FOR BIDDING PURPOSES

SECTION 32 31 19 – ALUMINUM AND METAL FENCE AND GATES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install ornamental aluminum fence and gates, including foundations and appurtenances as shown on the Plans and described herein.

B. Furnish and install steel fence and gates, including foundations and appurtenances as shown on the Plans and described herein.

C. Furnish and install fence and gates at dumpster location, including foundations, and appurtenances as shown on the Plans and described herein.

1.2 STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM A653 – Steel Sheet Zinc Coated (Galvanized) by the Hot Dip Process
2. ASTM D822 – Practice for Conducting Tests on Paint and Related Coating and Materials Using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus
3. ASTM D1654 – Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
4. ASTM D2794 – Test Method for Resistance to Organic Coatings to the Effects of Rapid Deformations (Impact)
5. ASTM D3359 – Test Method for Measuring Adhesion by Tape Test

NOT FOR BIDDING PURPOSES

1.3 SUBMITTALS

A. Submit shop drawings and product literature in accordance with the conditions of the Contract.

B. Submit operation and maintenance manuals for cantilevered gate.

C. Submit color selections for powder coated finishes.

1.4 QUALITY ASSURANCE

A. The Contractor shall provide laborers and supervisors who are experienced and thoroughly familiar with the construction involved and the materials and techniques specified. Upon request, the Contractor shall demonstrate the successful installation five similar fences and gates within the last three years.

B. The manufacturer or fabricator shall warrant the ornamental steel fence for ten (10) years against defects in workmanship or materials. The powder-coated surface shall be warranted for twenty

(20) years against cracking, peeling, chipping, blistering, and corroding under normal usage. Cantilever slide gate shall be warranted from defects in workmanship or material for a period of fifteen (15) years from the date of purchase.

C. Fence and gates must be products of the same manufacturer.

NOT FOR BIDDING PURPOSES

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel material for fence panels, posts, and swing gates shall conform to the requirements of ASTM A787, with a minimum yield strength of 45,000 psi.

B. The steel shall be hot-dip galvanized to meet the requirements of ASTM A653/A653M with a minimum zinc coating weight of 0.90 ounces per square foot.

C. Aluminum Fence and Gates shall meet the requirements of ASTM B209 and ASTM B221, Temper T-6.

2.2 FABRICATION

A. Pickets, rails, and posts shall be pre-cut to specified lengths. Rails shall be pre-punched to accept pickets. Pickets shall be predrilled to accept retaining rods.

B. Pickets shall be installed into the pre-punched holes in the rails and shall be aligned to standard spacing using a specifically calibrated alignment. The aligned pickets and rails shall be joined at each intersection through fusion welding.

C. The manufactured panels, caps, rails, and posts shall be coated in a multi-stage process consisting of a pretreatment wash and a complete thermal stratification (multi-stage, high-temperature, multi-layer) electrostatic powder application system of both zinc rich epoxy and polyester. The color shall be black. The coated panels and posts shall be capable of meeting the performance requirements of ASTM D3359 for adhesion, ASTM B117 and B1654 for corrosion, ASTM D2794 for impact resistance, and ASTM D822 for weathering resistance.

2.3 SWING GATES

A. Swing gates shall be fabricated using welded ornamental panel material and gate ends of the size as shown on the Plans. All rail and upright intersections shall be joined by welding, as shall all picket and rail intersections.

B. Hardware shall be galvanized steel. Hinges shall grip post and frame firmly to prevent slippage. Hinges shall have a minimum load capacity of 1,000 pounds. Hinges shall allow gate leaf to swing 180-degrees.

PART 3 - EXECUTION

3.1 PREPARATION

A. Upon receipt at the job site, all materials shall be checked to ensure that no damage occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage, and to protect it from damage and weather. Damaged or weathered fence and materials shall not be installed.

B. All new installations shall be laid out by the contractor in accordance with the Plans.

3.2 INSTALLATION

A. Fence posts shall be spaced as shown on the Plans or as recommended by the manufacturer. Fence posts shall be set in concrete footers having a minimum depth of 36 inches, or as shown on the Plans. Fence panels shall be attached to posts with brackets supplied by the manufacturer.

B. Fence shall be installed in accordance with the manufacturer's written instructions. Exposed steel surfaces shall be sealed with primer and paint furnished by the manufacturer.

C. Gates shall be installed in accordance with the manufacturer's written instructions.

END OF SECTION 32 31 19

NOT FOR BIDDING PURPOSES

SECTION 32 31 23 – VINYL FENCE AND GATES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install rigid polyvinyl chloride (PVC) fence and gates, including foundations and appurtenances as shown on the Plans and described herein.

1.2 STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM D4216 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Related Plastic Building Product Compounds.
2. ASTM F964-09 - Standard Specification for Rigid Poly (PVC) Exterior Profiles Used for Fencing and Railing.

1.3 SUBMITTALS

A. Submit shop drawings and product literature in accordance with the conditions of the Contract.

B. Submit manufacturer's product data, installation instructions and certification of compliance with material specification.

C. Submit color selections.

1.4 QUALITY ASSURANCE

A. The Contractor shall provide laborers and supervisors who are experienced and thoroughly familiar with the construction involved and the materials and techniques specified. Upon request, the Contractor shall demonstrate the successful installation five similar fences and gates within the last three years.

B. The manufacturer shall warrant the vinyl fence for twenty (20) years against defects in workmanship or materials.

C. Fence and gates must be products of the same manufacturer.

PART 2 - PRODUCTS

2.1 MATERIALS

NOT FOR BIDDING PURPOSES

A. PVC Profiles, lineals & extrusions used as components must "meet or exceed" the minimum performance guidelines laid out in ASTM F964-09.

B. Pickets, rails, and posts prefabricated sections using Rigid Poly Vinyl Chloride (PVC) compounds for exterior-profile extrusions with cell classification of 1-32330-3 as defined by ASTM D4216, that meets or exceeds the following proprieties:

i. Color/Consistency Testing – The PVC compound in extruded section shall maintain uniform color and be free of any visual surface or structural changes, such as peeling, chipping, cracking, flaking, or pitting after weathering at intervals of six months and one year for white and for six months, one year, and two years for all other colors in a hot, dry climate such as Phoenix, AZ; a hot humid climate such as Miami, FL; and a temperate northern climate, when tested in accordance with ASTM Performance Weathering Requirements.

ii. Weathering Testing – The PVC compound shall have a minimum impact resistance of 0.6in.-lb/mil (2670 J/m) after weathering six months and one year in a hot, dry climate such as Phoenix, AZ; a hot, humid climate such as Miami, FL; and a temperate northern climate, when tested in accordance with ASTM Performance Weathering Requirements. The PVC compound shall have successfully met the weathering requirements prescribed for six months at each climatic testing site prior to use in production of exterior-profile extrusions, when tested in accordance with ASTM Performance Weathering Requirements.

iii. ASTM Specifications Met:
D256 – To determine Izod impact properties
D618 – Practice for Conditioning Plastics for Testing
D635 – Test Method for Rate of Burning and/or Extent and Time of Burning Plastics in a Horizontal Position
D638 – To determine tensile properties
D648 – To determine heat distortion temperature
D696 – Test Method for Coefficient of Linear Thermal Expansion of Plastics between Ø30°C and 30°C with a Vitreous Silica Dilatometer
D790 – To determine flexural properties
D792 – To determine specific gravity
D883 – Terminology Relating to Plastics
D1435 – Practice for Outdoor Weathering of Plastics
D1600 – Terminology for Abbreviated Terms Relating to Plastics
D1784 – Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
D1898 – Practice for Sampling of Plastics
D2240 – To determine Shore hardness values

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D2244 – Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
D2565 – Practice for Xenon-Arc Exposure of Plastics Intended for Outdoor Applications
D4216 – Material Class Number 1-32333-3. To establish Cell Classification of PVC Material. Illusions compounds have a higher cell classification because one or more properties are superior to those used in standard acceptable compounds.
D4226 – Test Methods for Impact Resistance of Rigid Poly (Vinyl Chloride) (PVC) Building Products
D4726 – Specification for Rigid Poly (Vinyl Chloride)

2.2 FABRICATION

A. Pickets, rails, and posts shall be pre-cut to specified lengths. Rails shall be pre-punched to accept pickets. Pickets shall be predrilled to accept retaining rods.

B. Pickets shall be installed into the pre-punched holes in the rails and shall be aligned to standard spacing using a specifically calibrated alignment. The aligned pickets and rails shall be joined at each intersection through fusion welding.

C. The manufactured panels, caps, rails and posts shall be coated in a multi-stage process consisting of a pretreatment wash and a complete thermal stratification (multi-stage, high-temperature, multi-layer) electrostatic powder application system of both zinc rich epoxy and polyester. The color shall be black. The coated panels and posts shall be capable of meeting the performance requirements of ASTM D3359 for adhesion, ASTM B117 and B1654 for corrosion, ASTM D2794 for impact resistance, and ASTM D822 for weathering resistance.

2.3 SWING GATES

A. Provide hardware and accessories for each gate.

B. Hardware shall be stainless steel. Hinges shall grip post and frame firmly to prevent slippage. Hinges shall have a minimum load capacity of 1,000 pounds. Hinges shall allow gate leaf to swing 180-degrees.

PART 3 - EXECUTION

3.1 PREPARATION

A. Upon receipt at the job site, all materials shall be checked to ensure that no damage occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage, and to protect it from damage and weather. Damaged or weathered fence and materials shall not be installed.

NOT FOR BIDDING PURPOSES

B. All new installations shall be laid out by the contractor in accordance with the Plans.

3.2 INSTALLATION

A. Fence posts shall be spaced as shown on the Plans or as recommended by the manufacturer. Fence posts shall be set in concrete footers as shown on the Plans. Fence panels shall be attached to posts with brackets supplied by the manufacturer.

B. Fence shall be installed in accordance with the manufacturer's written instructions. Exposed steel surfaces shall be sealed with primer and paint furnished by the manufacturer.

C. Gates shall be installed in accordance with the manufacturer's written instructions.

END OF SECTION 32 31 23

NOT FOR BIDDING PURPOSES

SECTION 32 91 15 – AMENDED PLANTING SOIL

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 SUMMARY

A. Section Includes:

1. Amending of existing soil to prepare for installation of planting beds, turf, and specimen trees.

B. Related Sections:

1. Section 329119 – Topsoiling
2. Section 329200 – Turf and Grasses
3. Section 329300 – Planting

1.3 STANDARDS

A. The quality of materials and performance of work specified in this section shall be in accordance with the Delaware Department of Transportation Standard Specifications for Road and Bridge Construction, January, 1998.

1. Section 733: Topsoiling

1.4 SUBMITTALS

A. Legal Documents

1. Submit a complete materials list of items to be provided under this section for approval by the Owner's Representative before the purchase of any material.
2. Submit a list of proposed methods of execution of work under this section for approval by the Owner's Representative when proposed methods are different from or supplementary to those specified herein.
3. Submit copies of soil test recommendations called for in this section.

B. Delivery Slips

1. Submit delivery slip for all shipments showing the product volume and name of supplier.

1.5 PRODUCT DELIVERY AND STORAGE

A. Obtain all legal rights or easements necessary from private owners on whose lands topsoil may be stored. Furnish rights or easements in written form and signed by both CONTRACTOR and property OWNER involved, or their duly authorized representatives.

1.6 JOB CONDITIONS

NOT FOR BIDDING PURPOSES

A. Existing Conditions

1. Perform work in this scope only after preceding work affecting ground surface is completed.
2. Verify locations of all underground utilities prior to start of work.

B. Environmental Requirements

1. Topsoil shall not be moved or spread in frozen or muddy condition.

C. Protection

1. Protect trees and shrubs to remain as part of final landscaping against damage.

PART 2 - PRODUCTS

2.1 COMPOST

A. Compost shall be certified by US Composting Council as STA Organic Compost. Laboratory results of submittal sample shall satisfy the following:

Soluble Salts no greater than 10 mmhos/cm

% solids content 50-60% (50-40% moisture)

Organic matter 30-60%

Nitrogen 0.5-2.5 %(dry weight basis)

pH 5.0 to 8.0

Total Carbon up to 55% by weight

C:N Ration less than 20% dry weight basis

Pass select pathogens and Trace Metals

Bio Assay >95%

2.2 SOIL AMENDMENTS TO ALTER pH AS PER SOIL TEST RECOMMENDATIONS

A. Dolomite Lime: Shall be agricultural grade mineral soil conditioner containing 35% minimum magnesium carbonate and 49% minimum calcium carbonate, 100% passing No. 65 sieve, Kaiser Dolomite 65 AG or approved equal.

2.3 TOPSOIL

If, after completion of soil amendments, soil volume is insufficient to meet finish grades then topsoil may be imported to job site. See Section 329119.13 - TOPSOILING.

PART 3 - EXECUTION

3.1 PREPARATION

A. Do not amend or place any soil or soil amendments until conditions are satisfactory. No work shall be performed when existing conditions are porous, wet, frozen or spongy.

B. Verify that clearing, earthwork, grading and other preceding work affecting ground surface have been completed and approved by Landscape Architect or Owner's Representative.

NOT FOR BIDDING PURPOSES

3.2 SOIL TESTING

A. Complete soil test through approved soil testing laboratory from a representative sample of all existing soil to remain on project site in planting beds or turf areas. The soil test should determine mechanical analysis, soluble salt level, N,P,K, levels, pH, organic matter content, cation exchange, micro- nutrient levels, and bulk density. Submit soil test results for approval by Landscape Architect.

B. Submit lab test results from an approved soil testing laboratory from a representative sample of the proposed imported compost to Landscape Architect for approval a minimum of 30 days in advance of plans to transport it to the site.

C. Submit source of compost (name and location) to Landscape Architect for approval.

D. Submit a physical sample of 1 gal. compost to be provided. This is in addition to submittals to analytical labs made by contractor.

3.3 COORDINATION

A. Coordinate work to maintain optimum moisture content of materials and existing soil to attain required compaction density.

1. Employ a placement method that does not disturb or damage other work, existing conditions, or surrounding soils.

2. Do not move or set heavy objects over proposed planting areas at any time during project sequence.

3.4 INSTALLATION FOR PLANTING BEDS ONLY (NOT PLANTERS)

A. Plan sequence of work to minimize compaction of soil and ensure that no heavy equipment will run across finished surfaces. Sequence of work must ensure a uniform profile and prevent localized compaction. (For example, work performed to back machines out of areas where work occurs.) Soil media shall be spread on these areas to a depth sufficiently greater than that specified on the plans. After natural settlement has taken place, the work must be in close conformity to acceptable compaction tolerances and finish grade or meet surrounding edge conditions.

B. Final soil grades in flat areas will result in slight crowning of the soil, while grades on other areas will be with the intent of guiding runoff to drainage

C. Remove stones, lumps, roots and other objects larger than one inch in any dimension from graded surface.

3.5 DEWATERING

A. See Section “Earth Moving” for dewatering measures

3.6 STORAGE OF MATERIALS

A. Stockpile materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust or importation of weed seed.

1. Stockpile materials away from edge of excavations. Do not store within drip line of remaining trees.

3.7 AMENDING SOIL FOR PLANTING BED AREAS

NOT FOR BIDDING PURPOSES

A. Loosen existing soil in planting beds to a minimum depth of 12 inches. Loosen existing soil in turf areas to a depth of 6 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

B. All planting beds shall be amended by spreading horticultural compost over loosened surface to uniform depth of 3". Incorporate compost with existing soil by tilling to a depth of 6 to 8 inches. If required to meet finish grades, place imported topsoil over amended planting soil. If required as per soil test results, apply soil amendments to alter pH and thoroughly blend into planting bed.

C. Grade planting beds to a smooth, uniform surface with loose, uniformly fine texture. Rake, remove ridges, and fill depressions to meet finish grades.

D. Restore planting beds if eroded or otherwise disturbed after finish grading and before planting.

3.8 MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

1. Do not place compost 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.

3.9 COMPACTION

A. See Section Earth Moving for specifications regarding backfill and fill.

B. Compact planting areas to 90 percent (90%) maximum dry density for soils which exhibit a well-defined moisture density relationship determined in accordance with ASTM D-1557.

3.10 FINE GRADING

A. General: Uniformly grade planting areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.

2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

3. Slope grades to direct water away from buildings and to prevent ponding.

3.11 PROTECTION

A. When required, erect temporary signs and barriers to protect work area.

3.12 MAINTENANCE

A. Immediately before establishment of planting material, regrade areas which become eroded, settled or otherwise disturbed.

B. Perform all maintenance work in accordance with the Specifications without additional compensation.

C. Maintenance period to extend until installation of planting material.

3.13 CLEANING

A. Immediately clean spills, soil, and conditioners on paved and finished areas.

NOT FOR BIDDING PURPOSES

B. Haul and dispose of materials in excess of the quantity required for the project off site.

C. Dispose of protective barricades and warning signs at termination of maintenance period.

END OF SECTION 32 91 15

NOT FOR BIDDING PURPOSES

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NOT FOR BIDDING PURPOSES

SECTION 32 91 19 – TOPSOILING

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 SUMMARY

A. Section Includes:

1. Prepare subsoil.
2. Furnish topsoil required from approved sources located outside the project limits, and place as shown on drawings.

B. Related Sections:

1. Section 329200- Turf and Grasses
2. Section 329300 – Planting

1.3 STANDARDS

A. The quality of materials and performance of work specified in this section shall be in accordance with the Delaware Department of Transportation Standard Specifications for Road and Bridge Construction, January, 1998.

1. Section 733: Topsoiling

1.4 SUBMITTALS

A. Legal Documents

1. Submit a complete materials list of items proposed to be provided under this section for approval by the Owner's Representative before the purchase of any material.
2. Submit a list of proposed methods of execution of work under this section for approval by the Owner's Representative when proposed methods are different from or supplementary to those specified herein.
3. Submit copies of soil test recommendations called for in this section.

B. Delivery Slips

1. Accompany all shipments of topsoil with delivery slip showing the product weight and name of supplier.

1.5 PRODUCT DELIVERY AND STORAGE

A. Obtain all legal rights or easements necessary from private owners on whose lands topsoil may be stored. Furnish rights or easements in written form and signed by both CONTRACTOR and property OWNER involved, or their duly authorized representatives.

NOT FOR BIDDING PURPOSES

B. Fertilizer and lime shall be delivered and stored in original unopened packages, kept dry, and not opened until needed for use. Damaged or faulty packages shall not be used.

1.6 JOB CONDITIONS

A. Existing Conditions

1. Perform topsoiling only after preceding work affecting ground surface is completed.

B. Environmental Requirements

1. Topsoil shall not be moved or spread in frozen or muddy condition.

C. Protection

1. Protect trees and shrubs to remain as part of final landscaping against damage.

NOT FOR BIDDING PURPOSES

PART 2 - PRODUCTS

2.1 TOPSOIL

A. Topsoil furnished from within or outside the project limits.

Contractor shall provide required quantity of topsoil to create a uniform depth of 8" after settlement on areas to be seeded or planted beds. If additional topsoil is required from off-site sources, it shall meet the following requirements:

1. Topsoil shall consist of natural loam topsoil free from subsoil, obtained from an area that has never been stripped. It shall be of uniform quality, free from hard clods, stiff clay, sods, stone, lime, cement, ashes, slag, or other undesirable material.
2. Topsoil shall contain a minimum of 5% organic matter, determined by loss of ignition of moisture-free samples dried in accordance with the current method of the Association of Official Agricultural Chemists. The acidity range shall be pH 5.0 to 7.0 inclusive. Maximum soluble salts: 500 ppm. The mechanical analysis of the soil shall be as follows:

Passing	Retained	Percentage
1" screen	--	100
1" screen	¼" screen (gravel)	3 (maximum)
¼" screen	No. 100 U.S.S. mesh sieve (sand)	40 – 60
No. 100 U.S.S. mesh sieve sand	Very fine sand, silt, or clay	40 – 60

3. The Contractor shall furnish certified report(s) of the testing laboratory showing the analysis of a representative sample of the topsoil for Lawn and Garden use he proposes to use. A separate report shall be furnished for each source of topsoil. The Contractor shall furnish the reports to the Owner's Representative before any topsoil is delivered to the site.
4. The Owner's Representative reserves the right to reject topsoil in which more than 60 percent of the material passing the No. 100 U.S.S. Mesh Sieve consists of clay as determine by the Bouyoucous hydrometer or by the Decantation method. All percentages are to be based on dry weight of sample. If the Owner's Representative directs, topsoil which varies only slightly from the Specifications may be acceptable by such corrections, as the Owner's Representative deems necessary.
5. If necessary, add peat, or approved composted leaf mold, at rate necessary to attain minimum organic content.

2.2 SOIL AMENDMENTS PER SOIL TEST RECOMMENDATIONS

A. Peat:

1. Shall be peat obtained from fresh water sites of sedge peat, reed peat, and sphagnum deposits consisting of organic matter of incompletely decomposed plant residues containing a negligible amount of woody matter, shredded to resemble texture of cultivated peats. Peat material, not cultivated or aged, shall meet the following requirements: minimum of 85% pure organic matter, maximum of 60% moisture by weight as received, minimum of 100% water absorption for each 24 hours submersion in water by weight, minimum of 350% water absorption from a dry basis by weight, maximum weight as received 30 pounds per cubic foot, equivalent to 2.47 cubic yards/ton.

   Material shall pass a 1-inch sieve and not less than 50% be retained on a 1/2-inch sieve.
2. At the discretion of the Owner's Representative, obtain analysis from an accredited soils lab at the Contractor's cost.
3. If required, add peat to topsoil obtained from sources project limits, at rate necessary to attain minimum organic content of 5 percent.

B. Mulch: Shall be shredded hardwood bark, 3/4" to 1 1/2" diameter as provided by the Contractor. It should be spread at 3" thick. There is to be no mulch at the crown of the plants. Note on color – not dyed mulch.

C. Dolomite Lime: Shall be agricultural grade mineral soil conditioner containing 35% minimum magnesium carbonate and 49% minimum calcium carbonate, 100% passing No. 65 sieve, Kaiser Dolomite 65 AG or approved equal.

2.3 PLANTING SOIL MIX

A. Planting Soil Mix: Mix topsoil with the following soil amendments and fertilizers in the following quantities:

   Ratio of Loose Compost to Topsoil by Volume: 1:4

   Weight of Slow-Release Fertilizer per 1000 Sq. Ft.: 1 to 2 pounds of water-insoluble nitrogen with a NPK ratio of either 3-1-2 or 3-1-1, unless otherwise indicated by soil tests.

PART 3 - EXECUTION

NOT FOR BIDDING PURPOSES

3.1 PREPARATION

A. Verify that clearing, earthwork, grading and other preceding work affecting ground surface have been completed.

B. Final subgrade elevation and contours shall be smooth and uniform. All variations, lumps, ridges, and depressions in subgrade shall be corrected before topsoil work is started. Do not move heavy objects over the proposed subgrade planting areas.

C. The subsoil shall be loosened to a depth of no less than 6", or as directed by the Owner's Representative.

D. Do not proceed with topsoiling until conditions are satisfactory.

E. Preparation of Subsoil

1. Shape and dress area to be topsoiled. This work includes grading to required lines and elevations; removal of all stones, clods, lumps two inches or larger in any dimension; removal of all wires, cables, pieces of concrete, tree roots, and debris or other unsuitable material.

2. Do not proceed with installation of topsoil until this work has been approved.

3.2 INSTALLATION

A. Place an even layer that will produce required thickness.

Planting Areas – as shown on drawings.

Lawn Areas – 4" topsoil + 2" organic matter, mixed thoroughly;

B. Adjust quantities of lime and fertilizer to correspond with soil test results.

C. Remove stones, lumps, roots and other objects larger than one inch in any dimension from graded topsoil surface.

3.3 DEWATERING

A. See Division 31 Section "Earth Moving" for dewatering measures.

3.4 STORAGE OF SOIL MATERIALS

A. Stockpile satisfactory salvaged surface soil materials as well as imported topsoil, compost, soil amendments, etc. Stockpile 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.

3.5 UTILITY TRENCH BACKFILL

A. After utility trench has been backfilled satisfactorily to subgrade, amend subsoil as specified below and fill trench to finished grade with topsoil. To the following depths:

1. Under proposed lawn areas: min. 6 inches of topsoil

2. Under proposed plant beds: min. 6 inches of topsoil.

3.6 FILL

A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.

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B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

C. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.

2. Under footings and foundations, use satisfactory soil material.

3.7 MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill 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.

3.8 COMPACTION OF BACKFILLS AND FILLS

A. See Division 02 Section Earth Moving for specifications regarding backfill and fill.

B. For the upper level of subgrades under lawn and plant bed areas, compact soil to the following percentages of maximum dry unit weight according to ASTM D 698:

1. Under lawn areas, compact the upper 12 inches below subgrade at 85 percent.

2. Under plant bed areas, compact the upper 24 inches below subgrade at 85 percent.

3.9 GRADING

A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.

2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 1 inch.

2. Walks: Plus or minus 1 inch.

3. Pavements: Plus or minus 1/2 inch.

3.10 SOIL PREPARATION FOR LAWN AREAS

A. Limit lawn subgrade preparation to areas to be planted.

B. Disturbed areas and areas stripped of topsoil:

Loosen subgrade to a minimum depth of 4 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Apply compost and fertilizer directly to subgrade before loosening.

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2. Thoroughly blend planting soil mix off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix.
    a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
    b. Mix lime with dry soil before mixing fertilizer.
3. Spread planting soil mix to a depth of 6 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
    a. Spread approximately one-half the thickness of planting soil mix over loosened subgrade. Mix thoroughly into 4 inches of subgrade. Spread remainder of planting soil mix.
    b. Reduce elevation of planting soil to allow for soil thickness of sod.

C. Undisturbed area: If lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare surface soil as follows:
1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
2. Loosen surface soil to a depth of at least of 4 inches. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 6 inches of soil. Till soil to a homogeneous mixture of fine texture.
    a. Apply fertilizer directly to surface soil before loosening.
3. Remove stones larger than 1 inch in any dimension and sticks, roots, trash, and other extraneous matter.
4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.

D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future.

E. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

F. Restore areas if eroded or otherwise disturbed after finish grading and before planting.

3.11 SOIL PREPARATION AT PLANTING BEDS

A. Loosen subgrade of planting beds to a minimum depth of 12 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
1. Spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix.
    a. Delay mixing fertilizer with planting soil if planting will not proceed within a few days.
    b. Mix lime with dry soil before mixing fertilizer if necessary from soil test recommendation.
2. Spread planting soil mix to a depth of 6 inches but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or

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excessively wet.

a. Spread approximately one-half the thickness of planting soil mix over loosened subgrade. Mix thoroughly into to 4 inches of subgrade. Spread remainder of planting soil mix.

H. Finish Grading: Grade planting beds to a smooth, uniform surface plane with loose, uniformly fine texture. Rake, remove ridges, and fill depressions to meet finish grades.

I. Restore planting beds if eroded or otherwise disturbed after finish grading and before planting.

3.12 PROTECTION

A. When required, erect temporary signs and barriers to protect topsoiled area.

3.13 MAINTENANCE

A. Immediately before establishment of planting material, re-topsoil and re-grade areas which become eroded, settled or otherwise disturbed.

B. Perform all maintenance work in accordance with the Specifications without additional compensation.

C. Maintenance period to extend until installation of planting material.

3.14 CLEANING

A. Immediately clean spills, soil, and conditioners on paved and finished areas.

B. Haul and dispose of topsoil in excess of the quantity required for the project off site.

C. Dispose of protective barricades and warning signs at termination of maintenance period.

END OF SECTION 32 91 19

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SECTION 32 92 00 – SEEDING TURF AND GRASSES

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 SUMMARY

A. Section Includes:

1. Seeding of lawn areas as shown on drawings.
2. Lawn renovations

B. Related Sections:

1. Division 31 Section - Site Excavation, Filling, Grading
2. Division 32 Section - Topsoiling

1.3 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Manufactured Soil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

C. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Certification of Grass Sod: From sod vendor for each grass-seed monostand or mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of cutting.

C. Product Certificates: For soil amendments and fertilizers, signed by product manufacturer.

D. Qualification Data: For landscape Installer.

E. Planting Schedule: Indicating anticipated planting dates for each type of planting.

F. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of lawns until acceptance of substantial completion.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful lawn establishment.

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1. Installer's Field Supervision: Require Installer to maintain an experienced English speaking full-time supervisor on Project site when planting is in progress.

B. Topsoil Analysis: See Division 02 Section “Topsoil” for requirements regarding topsoil testing and analysis. Additionally, for topsoil intended for lawn areas:

1. Report suitability of topsoil for lawn growth. State recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory topsoil.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Sod: Per industry standards for delivery and storage.

1.7 SCHEDULING

A. Planting Restrictions: Permanent lawn plantings must occur during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion. For temporary seeding outside of the permanent planting periods, see Division 32 on Earthwork about Erosion Control.

Seeding:

1. Spring planting: up to May 15

2. Fall planting: up to September 30

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

1.8 LAWN MAINTENANCE

A. Begin maintenance immediately after each area is planted and continue until acceptable lawn is established, but for not less than the following periods:

1. Seeded Lawns: 60 days from date of Final Acceptance.

B. Maintain and establish lawn by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth lawn.

1. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch. Anchor as required to prevent displacement.

C. Watering: Provide and maintain temporary piping, hoses, and lawn-watering equipment to convey water from sources and to keep lawn uniformly moist to a depth of 4 inches (100 mm).

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.

2. Water lawn at a minimum rate of 1 inch (25 mm) per week.

D. Mow lawn as soon as top growth exceeds 3”. Repeat mowing to maintain specified height without cutting more than 40 percent of grass height. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become

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matted. Do not mow when grass is wet. Schedule subsequent mowings to maintain the following grass height:

1. Mow grass 2 to 3 inches (50 to 75 mm) high.

E. Lawn Post-fertilization: Apply fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that will provide actual nitrogen of 1 lb/1000 sq ft (0.45 kg/92.9 sq. m) to lawn area.

PART 2 - PRODUCTS

2.1 SEEDING

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species: Seed of grass species as follows, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than .5 percent weed seed:

1. Sun and Partial Shade: Proportioned by weight as follows:

a. 50 percent Tall Fescue: (*Festuca arundinacea*), a minimum of three cultivars.
b. 30 percent chewings red fescue (*Festuca rubra* variety).
c. 10 percent perennial ryegrass (*Lolium perenne*).
d. 10 percent redtop (*Agrostis alba*).

2.2 TOPSOIL, SOIL AMENDMENTS, SOIL MEDIA

A. Refer to Division 02 Section “Topsoil”.

2.3 PLANTING ACCESSORIES

A. Selective Herbicides: EPA registered and approved, of type recommended by manufacturer for application.

2.4 MULCHES

A. Straw Hay: Provide air-dry, clean, mildew- and seed-free, threshed straw of wheat, rye, oats, or barley.

B. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic; free of plant-growth or germination inhibitors; with maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

C. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

2.5 EROSION-CONTROL MATERIALS

A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.

B. Erosion-Control Fiber Mesh: Biodegradable twisted jute or spun-coir mesh, a minimum of 0.92 lb/sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.

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PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive lawns and grass for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect adjacent and adjoining areas from hydroseeding overspray.

B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Subsoil Preparation

1. Prepare sub-soil to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual and blend slopes into level areas. Remove foreign materials, stones, weeds and undesirable plants and their roots.

2. Remove contaminated sub-soil and rocks and debris larger than 2".

3. Scarify subsoil with a subsoiler to a depth of 6 inches where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted sub-soil prior to placement of topsoil.

D. Final Grade Preparation

1. Topsoil Addition. Spread topsoil to a minimum depth of 8 inches over area to be seeded.

a. Place topsoil during dry weather and on dry unfrozen sub-grade.

b. Power rake area to remove vegetative matter, stones, and foreign, non-organic material over ½" inch diameter.

c. Fine grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage. Maintain profiles and contour of sub-grade.

d. Manually spread topsoil close to plant materials and buildings to prevent damage.

e. Tolerances: Top of topsoil plus or minus ½" inch.

3.3 SEEDING

A. Seed Application

1. Apply seed at a rate specified by the specific seed mix evenly in two intersecting directions.

2. Seed application can be applied using one of the following methods after final soil preparation has been completed and accepted. Seed may be applied in one of two methods:

a. Hydroseeding by spraying an aqueous mixture on a prepared seedbed.

1) Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until

uniformly blended into homogeneous slurry suitable for hydraulic application.

2) Mix slurry with nonasphaltic tackifier.

3) Do not use wet seed or seed that is moldy or otherwise damaged.

4) Apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry application at a minimum rate of 500-lb/acre dry weight but not less than the rate required to obtain specified seed-sowing rate. Apply slurry cover coat of fiber mulch at a rate of 1000 lb/acre.

5) Protect seeded areas with slopes exceeding 1:6 with erosion-control fiber mesh and 1:4 with erosion-control blankets installed and stapled according to manufacturer's written instructions.

b. Dry Application

1) Seed installation either with culti-packer seeder or drop-type/ broadcast spreader.

2) Apply in two directions into the top ¼" of soil.

3) Rake in lightly.

4) Roll seeded area with roller not exceeding 50 lbs.

5) Immediately following seeding and compacting, apply mulch.

3.4 FERTILIZERS

A. Apply a starter fertilizer evenly at the rate of 1 c.y./1000 sq. ft. or otherwise as required by the results of the soil tests into the top 2 inches of soil by cross disking or the other appropriate method.

3.4 LAWN RENOVATION

A. Renovate any existing lawn damaged during construction or by Contractor's operations, such as storage of materials or equipment and movement of vehicles.

1. Reestablish lawn where settlement or washouts occur or where minor regrading is required.

B. Remove sod and vegetation from diseased or unsatisfactory lawn areas; do not bury in soil. Remove thatch as necessary.

C. Remove topsoil containing foreign materials resulting from Contractor's operations, including oil drippings, fuel spills, stone, gravel, and other construction materials, and replace with new topsoil.

D. Mow, dethatch, core aerate, and rake existing lawn. Mow turf at lowest setting without scalping the turf.

E. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.

F. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.

G. Topdress with ½" of approved organic material

H. Apply soil amendments and initial fertilizers required for establishing new lawns and mix thoroughly into top 6 inches of existing soil. Provide new planting soil to fill low spots and meet finish grades.

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I. Apply seed and protect with straw mulch or sod as required for new lawns.

J. Water newly planted areas and keep moist until new lawn is established.

K. Overseeding shall be completed in September with a seed mix and application rate approved by Owner's Representative.

L. Overseeding operations shall be performed with a vertiseeder

3.5 SATISFACTORY LAWNS

A. Satisfactory Seeded Lawn: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.

B. Reestablish lawns that do not comply with requirements and continue maintenance until lawns are satisfactory.

3.6 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by lawn work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades throughout maintenance period and remove after lawn is established.

C. Remove erosion-control measures and barricades after grass establishment period.

END OF SECTION 32 92 00

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SECTION 32 93 00 – PLANTING

PART 1 – GENERAL

1.1 SUMMARY

A. This section defines standards for plant selection, handling, installation and care from the project's start through substantial completion, guarantee period and final acceptance at end of the guarantee period.

B. Section Includes:

1. Furnish all labor, materials, equipment, and supplies and perform all operations required to complete landscaping work as shown on the drawings and hereinafter specified.
2. Excavation of tree pits and planting beds to the required depth. Backfill & disposal of all excavated materials as required.
3. Furnishing and planting of all plants, including woody and herbaceous plants.
4. Installing, watering, staking, guying, and pruning (if directed) all plants until acceptance by Owner.
5. Furnishing and placing of mulch.
6. Maintaining all installed plantings, including watering, until acceptance of the completed work under this Section.
7. Guaranteeing and replacing of sickly, dying and dead plants through a period of Two (2) year following acceptance of the completed work under this Section.
8. Protecting all existing site features from damage during the work of this Section.
9. Maintaining a clean work site throughout duration of planting operations. Clean up of site and removal of any debris at completion of work of this Section.

C. Related Sections:

1. Section 329113 - Topsoiling
2. Section 329115 - Amended Planting Soil
3. Section 329200 – Lawn Turf and Grasses

1.2 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Balled and Burlapped Stock: Exterior plants dug with firm, natural balls of earth in which they are grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of tree or shrub required; wrapped, tied, rigidly supported, and drum-laced as recommended by ANSI Z60.1.

C. Bare-Root Stock: Exterior plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root spread according to ANSI Z60.1 for kind and size of exterior plant required.

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D. Container-Grown Stock: Healthy, vigorous, well-rooted exterior plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for kind, type, and size of exterior plant required.

E. Finish Grade: Elevation of finished surface of planting soil.

F. Planting Soil: See Section 329115 – Amended Planting Soil

G. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

H. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

I. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

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1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.

2. Plant Photographs: Submit color photographs in digital format of each required species and size of plant material as it will be furnished to Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 20 plants are required, include a minimum of three photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.

B. Samples for Verification: For each of the following:

1. Trees and Shrubs: Three Samples of each variety and size delivered to site for review. Maintain approved Samples on-site as a standard for comparison. Where not feasible, Landscape Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality.

2. Mulch: 1-quart volume of each organic mulch required; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.

3. Staking and components.

1.4 INFORMATIONAL SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Materials Lists: Within 45 days after award of the Contract, submit a complete list of all materials proposed to be furnished and installed (including sources) under this Section, demonstrating

conformance with the requirements specified.

C. Product certificates signed by manufacturers certifying that their products comply with specified requirements.

1. Manufacturer's certified analysis for standard products.

2. Analysis for other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

3. Label data substantiating that plants, trees, and planting materials comply with specified requirements.

D. Qualification data for firms and persons to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Owner's representatives and owners, and other information specified.

E. Submit project schedule for approval by Owner's representative at least five days prior to planned start of work. Schedule must include milestone dates that are coordinated with other site trades and locations of work.

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1.5 QUALITY ASSURANCE

A. Codes and Standards: Perform all work in compliance with applicable requirements of governing authorities having jurisdiction.

B. Installer Qualifications: Engage an experienced Installer who has completed landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful landscape establishment.

C. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on the Project site during all times. Provide at least one English speaking person present at all times during execution of this portion of the work, who is thoroughly familiar with the type of plants being installed and the proper materials and methods for their installation, to direct all work performed under this Section. This person shall have a minimum of 5 years experience in handling the specified plants, and should have a set of prints of the project on site.

D. Provide quality, size, genus, species, and variety of plants indicated on the Plans, in accordance with the applicable requirements of ANSI Z60.1 American Standard for Nursery Stock, revised 2014. The highest horticultural standards shall be practiced from the time of plant purchase though delivery and installation on site to ensure health, vigor and establishment of all plants.

E. Measurements: Measure trees according to ANSI Z60.1, revised 2014. Do not prune to obtain required sizes.

1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container-grown stock. Take caliper measurements 6 inches (150 mm) above ground for trees up to 4-inch (100-mm) caliper size, and 12 inches (300 mm) above ground for larger sizes. Measure main body of tree for height and spread; do not measure branches or roots tip-to-tip.

2. Other Plants: Measure with stems and foliage in their normal position.

F. All plants are subject to approval by Owners Representative (OR) who may inspect plants either

at place of growth or at site before planting, for compliance with requirements for genus, species, variety, size, and quality. Owners Representative retains the right to further inspect plants for size and condition of balls and root systems, insects, injuries and latent defects, and to reject unsatisfactory or defective material at any time during progress of work and during contract period. Contractor shall remove rejected plants from project immediately and replace with approved replacement, at appropriate planting time, at no cost to Owner.

1. Notify Landscape Architect of sources of planting materials seven days in advance of delivery to site. For woody plants and trees: Label at least one (1) plant of each variety and size with a securely attached, waterproof tag bearing legible designation of botanical and common name.

G. All plants are to be provided as specified. Requests to use plant substitutes, whether for size or species/cultivar, shall be submitted in writing to the Owner's representative for client review and approval, prior to delivery to the job site.

H. Nomenclature and interpretation of plant names shall reference the following. Where the names of plant descriptions disagree, the most current information will prevail:

1. The Royal Horticultural Society Horticultural Database (http://www.rhs.org.uk/).
2. USDA – The Germplasm Resources Information Network.
3. http://www.ars-grin.gov/
6. Manual of Woody Landscape Plants; Michael Dirr; Stipes Publishing, Champaign, Illinois; Most Current Edition.

I. Plants of a larger size may be used if acceptable to Owner's Representative with a proportionate increase in size of roots or balls, and at no additions to the Contract Price

J. All plants shall comply with State and Federal laws, including quarantines with respect to inspection, plant diseases and insect infestation

K. Collected plants may be used only when approved by the Owner's Representative.

L. Equipment:

1. Provide machinery and equipment necessary for the prompt, professional completion of the work. Such machinery and equipment shall be adequate to the task required and shall be operated by a person skilled and experienced in both operation of the equipment and the implementation of the task.
2. Upon request, promptly furnish satisfactory evidence of the organization and equipment to be made available for the performance of the work.
3. Comply with all Federal and State Department of Agriculture regulations for pest control which, in general, require that contractors operating in infested areas thoroughly clean all equipment units before moving them to non-infested areas. Full information can be obtained from Federal and State Pest Control Personnel.

M. Documentation and Coordination:

1 Submit, upon request, documentation prior to the start of work under this Section that all plants and related materials have been ordered.

2 Plant delivery to site and timing of installation is to be coordinated with Owner's

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Representative prior to delivery of plants to site.

3 Coordination with Lawns: Plant trees and shrubs after finish grades are established and before planting lawns. If lawns are already established, protect with ¾" plywood, to be removed in manner that ensures viability of existing lawn.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.

B. Trees: Deliver freshly dug trees. Do not prune before delivery, except as approved by Owner's Representative.. Protect bark, branches, and root systems from sun scald, desiccation and drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees in such a manner as to destroy natural shape. Provide protective covering during delivery to prevent wind burn.

C. Handle balled and burlapped stock by the root ball only; do not stand on or tamp directly on root balls.

D. Container Plants: Deliver all plants to site in containers that ensure the protection of entire plant including roots and other plant parts against climatic and other injuries. Plants shall be grown or established in containers in which they will be delivered for at least 8 months but not for more than 24 months in advance of final planting. Plants shall be fully rooted into container but not root-bound. Plants with cracked or broken balls of earth when taken from the containers shall not be planted unless acceptable to the Owner's Representative. Do not lift or handle container plants by tops, stems, or trunks at any time.

E. Deliver trees and plants after preparations for planting have been completed and install immediately. If planting is delayed more than 6 hours after delivery, set planting materials in shade, protect from weather and mechanical damage, and keep roots moist. Properly protect plants with soil, moist mulch, etc.,

1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material, if not installed within six hours from delivery.

2. Root balls/plants shall not be permitted to remain un-installed or exposed during periods of freezing weather or extreme weather conditions.

3. Do not remove container-grown stock from containers before time of planting.

4. Water root systems of trees stored on site as often and thoroughly as necessary to maintain root systems in a moist condition.

1.7 PROJECT CONDITIONS

A. Utilities: Determine location of above grade and underground utilities and perform work in a manner that will avoid damage. Hand excavate, as required. Maintain grade stakes until removal is mutually agreed upon by parties concerned. The Contractor shall be responsible for the location and protection of all utilities and for repair of any utilities damaged by Contractor's work. Any damage shall be replaced/repaired to Owner's satisfaction at the Contractor's expense.

B. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill,

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adverse drainage conditions, or obstructions, notify Owner's representative before planting.

C. Work notification: Notify Owner's Representative at least five (5) working days prior to the start of work of this Section.

1.8 COORDINATION AND SCHEDULING

A. Planting times shall be during one of the following periods. Coordinate planting periods with maintenance periods, as applicable, to provide required maintenance through date of final acceptance.

Spring Planting: April 26 – June 15 (frost-hardy and acclimatized plant material may be planted prior to April 26 and when not restricted by inclement weather limitations).

1. Fall Planting: September 1 – October 15 (plant material may be planted after October 15 and when not restricted by inclement weather limitations).
2. Summer Planting: to be performed on a project by project basis when not restricted by extreme heat and drought conditions, and when a water source and watering equipment are provided and are easily accessible.
3. Dig trees according to the best recommended time, as per fall and/or spring dig hazards. Coordinate planting periods with maintenance periods to provide required maintenance thru date of Substantial Completion.

B. Proceed with planting only when existing and forecasted weather conditions permit. If projected or current weather will stress plants, reschedule planting/installation times and dates

1.9 PLANT MATERIAL QUANTITIES

A. In the event that quantity discrepancies or material omissions occur between the Plant List and Planting Plan, Contractor is to immediately notify Owner's Representative for clarification and to receive instruction about how to proceed.

1.10 MAINTENANCE

A. Maintain for the following maintenance period by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray as required to keep trees and shrubs free of insects and disease. Revise duration of maintenance period below to suit Project. Revise starting date of maintenance period to date of planting completion if preferred.

B. Maintenance Period: Until date of Final Acceptance, as confirmed in writing by the Owner.

1.11 SOIL ANALYSIS

A. Soil Analysis: Upon request, obtain analysis of soil from an accredited soil laboratory at the cost of the Landscape Contractor or Project to determine pH and necessary amendments and fertilizers.

1.12 SUBSTANTIAL COMPLETION AND START OF GUARANTEE PERIOD

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A. Upon written notice from the Contractor, the Owner's Representative shall review the work and make a determination if the work is substantially complete.

B. The date of Substantial Completion of the planting shall be the date when the Owner's Representative accepts that all work in Planting is complete.

C. All plants must be in a vigorous growing condition at the time of Substantial Completion.

D. The Plant Guarantee period begins at the date of written notification of Substantial Completion from the Owner's Representative. The date of Substantial Completion for planting may be different than the date of substantial completion for the other sections of the project.

1.14 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Warrant the following living planting materials for a period of two (2) years after the date of Acceptance of Installation, against defects including death and unsatisfactory growth, except for defects resulting from neglect or abuse by Owner, abnormal weather conditions unusual for warranty period, or incidents that are beyond Contractor's control.

1. Trees and Shrubs
2. Herbaceous and groundcover plants

C. Replace at the direction of the Owner's Representative and in accordance with the Drawings and Specifications, all plants that are dead (all material that is at least 25% dead, and any tree with a main leader that has died back), plants that are in unhealthy or unsightly condition, plants that have lost their natural shape due to dead branches, or other causes due to the Contractor's negligence.

D. All replacements shall be plants of the same kind, size, and quality as originally specified.

E. Warranty shall not include damage or loss of plants caused by fires, floods, freezing rains, lightning, winds over 75 miles per hour, winter kill caused by severe winter conditions not typical of the planting area, by acts of vandalism, or by negligence on the part of the Owner.

F. Replaced plants shall be furnished, planted, mulched, and watered as part of the warranty.

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PART 2 – PRODUCTS

2.1 GENERAL

A. All plants shall be the kind and size indicated on the plant list and shall be true to name. All plants shall be sound, healthy, vigorous, nursery stock with a normal habit of growth, shall be subjected to nursery root and top spraying, transplanting, etc., and shall have been inspected and approved for sale, transporting and transplanting by all governmental agencies authorized to administer such control. Plants shall be subject to inspection and approval by the Owner's Representative at place of growth and upon delivery to project site for conformity to specifications. Such approval shall not impair the right of inspection and rejection during process of the work. All trees will be tagged in the nursery by the Owner's Representative.

B. All plants shall be subject to inspection and approval by the Owner's Representative throughout Contract period. All plants are subject to approval by Owner's Representative. The Contractor must submit to the Owner's Representative a letter of certification from the supplying nurseries that plants supplied to the contractor conform to the requirements listed below:

1. Provide trees of sizes and grades conforming to ANSI Z60.1 for type of trees required. Trees of a larger size may be used if acceptable to Owner's representative with a proportionate increase in size of roots or balls, and at no additions to the Contract Price.

C. Prior to delivery to the site, the Contractor shall arrange with the Owner's Representative a minimum of two nursery visits for the purpose of selecting and tagging plants proposed for the project. This will include all trees as specified. The Owner's Representative shall inspect proposed plants before plants will be permitted on site.

D. Label at least one (1) tree of each variety and caliper with a securely attached, waterproof tag bearing legible designation of botanical and common name.

E. Trees with multiple leaders, unless specified, will be rejected.

2.2 SHADE AND FLOWERING TREES

A. Shade trees: Single-stem trees with straight trunk, well-balanced crown, and intact leader, free of branches to about 50% of their height, of height and caliper indicated, conforming to ANSI A300 Section 6 for type of trees required.

B. Provide balled and burlapped trees except where indicated.

1. Container-grown trees will be accepted in lieu of balled and burlapped trees subject to meeting ANSI A300 Section 6 limitations for container stock.

2.3 DECIDUOUS SHRUBS

A. Form and Size: Deciduous shrubs with not less than the minimum number of canes required by and measured according to ANSI A300 Section 6 for type, shape, and height of shrub.

2.4 CONIFEROUS EVERGREENS

A. Form and Size: Normal-quality, well-balanced, coniferous evergreens, of type, height, spread, and shape required, complying with ANSI A300 Section 6.

B. Form and Size: Specimen-quality, exceptionally heavy, tightly knit, symmetrically shaped coniferous evergreens:

1. Provide balled and burlapped trees.

2.5 BROADLEAF EVERGREENS

A. Form and Size: Normal-quality, well-balanced, broadleaf evergreens, of type, height, spread, and shape required, complying with ANSI A300 Section 6.

1. Provide balled and burlapped or container plants as per plant schedule.

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2.6 GROUNDCOVER PLANTS

A. Groundcover: Provide groundcover of species indicated, established and well rooted in pots or similar containers, and complying with ANSI Z60.1.

2.7 HERBACEOUS PLANTS

A. Annuals: Provide healthy, disease-free plants of species and variety shown or listed. Provide only plants that are acclimated to outdoor conditions before delivery and that are in bud but not yet in bloom.

B. Perennials: Provide healthy, field-grown plants from a commercial nursery, of species and variety shown or listed.

C. Vines: Provide vines of species indicated complying with requirements in ANSI Z60.1 as follows:

1 Two-year or older plants with heavy, well-branched tops, with not less than 3 runners 18 inches or more in length, and with a vigorous well-developed root system.

2 Provide field-grown vines. Vines grown in pots or other containers of adequate size and acclimated to outside conditions will also be acceptable.

2.8 REQUIREMENTS FOR BALLED AND BURLAPPED STOCK

A. Where indicated to be balled and burlapped, provide trees dug with firm, natural ball of earth in which they are grown free of noxious weed matter.

B. Provide ball size of not less than diameter and depth recommended by ANSI Z60.1 for type and size of tree required. Increase ball size or modify ratio of depth to diameter as required to encompass fibrous and feeding root system necessary for full recovery of trees subject to unusual or non-typical conditions of growth, soil conditions or horticultural practice.

C. No balled and burlapped plant will be accepted if the ball is cracked or broken either before or during the process of planting. Root balls shall be firmly wrapped with burlap and bound with natural twine or wire mesh

D. Wrap and tie earth ball as recommended by ANSI Z60.1 for size of balls required. Drum-lace balls with a diameter of 30" or greater.

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2.9 CONTAINER STOCK

A. Container stock shall be grown in its delivery container for not less than six (6) months but not more than 2 years.

B. Plants shall have well established root systems but not be root-bound.

C. Plants with cracked or broken balls of earth when taken from the containers shall not be planted.

2.10 BARE-ROOT STOCK

A. Bare-root stock should have a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than minimum root

spread according to ANSI Z60.1 for kind and size typical of its species.

B. Plants should be sufficiently packaged and stored to preserve moisture in fibrous root systems to ensure the health and vigor of the plant.

2.11 MULCHES

A. Mulch is to be 100% natural, free from deleterious materials, and suitable as a top dressing for plants.

B. Double shredded hardwood bark mulch.

C. Substitutions may be used only with prior approval from Owner's Representative.

2.12 LANDSCAPE HAND EDGING

A. Planting beds and tree rings are to be vertically edged with a hand spade or mechanical edger to a minimum depth of 4". The elevation of the planting bed starts at the low point of the cut edge and angles back towards the planting at a 45-degree angle until it reaches the finish grade of the planting bed. Work excess soil back into planting bed.

2.13 TOPSOIL

A. See Section 329113 - Topsoiling

2.14 SOIL AMENDMENTS:

A. Fertilizer: "dryROOTS2" root growth enhancer and soil conditioner or approved equal. Apply to soil surface at manufacturer's recommended rates after planting.

2.15 ANTI-TRANSPIRANT:

A. Shall be "Wilt-Pruf" by Nursery Specialty Products, Inc., 207 East 47th Street, New York, NY 10017, or approved equal, applied as specified by the manufacturer to species as indicated in drawings.

2.16 PLANTING SOIL

A. See Section 329115 – Amended Planting Soil

2.17 EROSION-CONTROL MATERIALS

B. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.

C. Erosion-Control Fiber Mesh: Biodegradable twisted jute or spun-coir mesh, a minimum of 0.92 lb/sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches long.

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2.18 WATERING EQUIPMENT

A. Watering Equipment – to be provided on a project-by-project basis, and to remain the property of the Owner at the completion of the project:

1. Gator Bags

2. Ooze Tubes sufficient for watering multi-stem trees or shrubs.

3. Soaker Hose -should be black or dark color which could blend with mulch, and that can be used above or below soil/mulch surface, will not burst if frozen and provides even distribution of water throughout the planting bed. Installed as per manufacturer's specifications and as directed by project.

2.19 STAKES AND GUYS FOR TREES

A. Stakes, anchors, and wires shall be of sufficient strength to maintain the tree in an upright position in the conditions in which the tree will be installed.

B. Guy wires shall be galvanized, multi-strand, twisted wire.

C. At the location where guy wires are attached around the tree, the trunk shall be protected with 20-mm (3/4 in.) diameter rubber hose, black or dark green in color, and of sufficient length to extend past the trunk by more than 105 mm (6 in).

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine areas to receive landscaping for compliance with requirements and for conditions affecting performance of work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Verify that planters have been waterproofed and inspected.

C. Verify the required drainage and irrigation rough-in has been installed and is fully operational.

D. Verify that subgrades are accurately established before spreading planting soil.

E. Once bed preparation has been approved, the Landscape Contractor assumes responsibility for subgrades and finish grades in the areas affected.

3.2 PLANT PRUNING

A. Prune, thin, and shape trees according to standard horticultural practice and as directed by owner's representative. Prune trees to retain required height and spread. Unless otherwise directed by Owner's Representative, do not cut tree leaders; remove only crossing, injured or dead branches.

3.3 PLANTING BED PREPARATION

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A. Loosen subgrade of planting beds, as needed, to promote adequate drainage and soil conditions promoting plant health and root establishment, but which prevents settlement below finished grade of topsoil layers or plantings. Remove all trash from subgrade along with stones and extraneous debris larger than 1" or that will prevent proper installation and establishment of plantings.

B. All stumps, weeds, vegetation not being retained are to be grubbed out and/or removed.

C. Install planting soil mix in 6" lifts, gently compacted using hand tamping, to a depth that meets finished grades after natural settlement, but which ensures root and plant establishment. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet. Do not over compact planting soil; compaction is subject to review and alteration.

1. Thoroughly blend any soil amendments or fertilizer needed, as per soil test results, into planting soil either before installation of soil lifts, or as lifts are being installed and before tamping. Delay mixing fertilizer with planting soil if planting will not occur within a few days.

D. Finish Grading: Grade planting beds to a smooth, uniform surface plane with loose, uniformly fine texture, ensuring soil surface is free from debris. Rake, remove ridges, and fill depressions to meet finished grades.

E. Restore planting beds if eroded or otherwise disturbed after finish grading and before planting.

F. Minimize soil disturbance in areas under existing tree canopy or on sloped areas.

G Planting beds and tree rings are to be vertically edged with a hand spade or mechanical edger to a minimum depth of 4". The elevation of the planting bed starts at the low point of the cut edge and angles back towards the planting at a 45-degree angle until it reaches the finish grade of the planting bed. Work excess soil back into planting bed.

3.4 PLANTING PIT PREPARATION FOR TREES

A. Verify that subgrades are accurately established before digging tree pit.

B. Dig a hole so that depth will enable tree to be installed in a manner that allows the root flare to be at or slightly above Finished Grade after normal compaction, and at the same relationship to finished grade as they were to the ground from which they were dug.

1. C. Planting hole should be 2 – 3x wider than the size of the root ball.

3.5 DELIVERY, STORAGE AND HANDLING

A. Plants must be sufficiently containerized, packaged, tarped, etc. to ensure viability of plants and the protection of roots and other plant parts against sun scald, drying, sweating, whipping, and other handling damage as well as climatic seasonal and other injuries.

B. Trees: Deliver freshly dug trees. Do not prune before delivery, except as approved by Owner's Representative. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees in such a manner as to destroy natural shape. Provide protective covering during delivery to prevent wind burn. Do not drop trees during delivery.

C. Water all trees and plants as needed from time of pick up through substantial completion.

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D. Do not lift or handle container plants by tops, stems or trunks at any time.

E. Handle balled and burlapped stock by the root ball only; do not stand on or tamp directly on root balls.

F. Deliver trees and plants after preparations for planting have been completed and install immediately. If planting is delayed more than 6 hours after delivery, set planting materials in shade, protect from weather and mechanical damage, and keep roots moist. Properly protect plants with soil, moist mulch, etc., in a manner acceptable to Owner's Representative.

1. Set balled stock on ground and cover ball with soil, peat moss, sawdust or other acceptable material, if not installed within six hours from delivery.

2. Root balls/plants shall not be permitted to remain un-installed or exposed during periods of freezing weather or extreme weather conditions.

3. Do not remove container-grown stock from containers before time of planting.

4. Water root systems of trees stored on site as often and thoroughly as necessary to maintain root systems in a moist condition.

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3.6 LAYOUT

A. Layout specifications and area and perimeter measurements are provided as guidelines only, and are to be confirmed in the field by Contractor(s) and adjusted as necessary and collaboratively with Owner's Representative.

B. The location of new plants and new planting beds are to be staked out in collaboration with and approved by the Owner's Representative prior to installation.

3.7 PLANT INSTALLATION

A. All root balls removed from containers will be scarified and roots thoroughly separated prior to planting.

B. All plastic or no-rot burlap or twine are to be completely removed from the plant ball prior to backfilling with planting soil. Biodegradable burlap and twine and wire cage material shall be cut away from the top 1/3 of the root ball and remove from the site.

C. When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, stop work and notify Owner's Representative for additional direction.

D. Set plant plumb and in center of planting pit or trench with top of ball raised just above adjacent finish grade enough to allow for normal compaction and sufficient final planting depth, and so surface of root system will be flush with adjacent finished grades after normal settling.

E. Maintain full depth of planting soil around root system of plants.

F. Place soil around ball in layers, tamping gently to settle backfill and eliminate voids and air pockets -do not over tamp. When pit is approximately half backfilled, water thoroughly before placing remainder of backfill

3.8 MULCH INSTALLATION

A. Install mulch on top of raked and prepared planting bed to a depth of 2", see details.

B. Mulch is to be raked smooth, eliminating pockets and low points.

C. Mulch is not to be applied so that it touches the bark of woody plants or tree trunks.

D. For tree rings: At the time of planting, provide 3 inches high continuous soil saucer around perimeter of planting hole. Prior to end of guarantee period, but not sooner than 8 months after planting, contractor is required to shave off the saucer around the mulch ring area and top dress with new mulch. Cover root ball with no more than 1" (depth) of mulch, installed so that mulch does not touch the bark/trunk.

3.9 STAKING AND GUYING – TREES:

A. Guy and stake trees more than 2.5 -3-inch (75-mm) caliper unless otherwise indicated, or in situations such as sandy or poor soils, in windy locations, or on slopes. Trees that settle out of plumb due to inadequate soil compaction either under or adjacent to the root ball shall be excavated and reset. Trees that have settled out of plumb shall never be pulled straight using guy wires.

3.10 PROTECTION, CLEAN-UP AND MAINTENANCE

A. During landscape installation, keep pavements clean and work area in an orderly condition. Place 3/4" plywood as needed to protect existing turf, paved areas, etc.

B. Install plastic safety fencing as needed to provide barrier protection for newly planted areas or areas to be preserved.

C. Protect new plantings and plants to remain from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damage to new or existing plantings at the expense of the Landscape Contractor.

D. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of it off the Owner's property.

E. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray as required to keep trees free of insects and disease. Maintain throughout project work period until Substantial Completion. All plantings which appear to be in distress or defective shall be removed immediately and replaced or replanted according to planting times and quality as defined in this section, with specimens of the same species and size as originally specified:

F. Watering:

1. The contractor shall be fully responsible to ensure that adequate water is provided to all plants throughout the work period until the date of Substantial Completion.

2. Hand water root balls of all plants to ensure that the root balls have moisture above wilt point and below field capacity, and appropriate for the species. As needed, moisture content in each root ball and soil outside the root ball can be tested to determine water content.

G. Guy Wires and Stakes are to be maintained by Contractor until the end of the Guarantee Period

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(see section 3.10) to avoid girdling throughout the first growing season, and removed after the first growing season if site conditions and adequate plant establishment permit.

3.11 ACCEPTANCE AND GUARANTEE

A. Plants are to be guaranteed as per the following list, starting from the time of Substantial Completion. Defective materials shall be removed immediately and replaced according to planting times and quality as defined in this section, with specimens of the same species and size as originally specified, with new guarantee for the replacement plant starting at time of replacement. Written Final Acceptance shall be provided at the end of the guarantee period by Owner Representative once all conditions of this Section have been met. All plants must be in a vigorous growing condition at the end of the guarantee period:

1. Minimum of 2-year guarantee on all newly installed plant material.

B. When Maintenance after Substantial Completion is by others, and not awarded to the Contractor:

1. After Substantial Completion Acceptance, the Contractor shall make sufficient site visits to observe the Owner's maintenance and notify the Owner's Representative in writing if maintenance, including watering, is not sufficient to maintain plants in a healthy condition. Such notifications must be made in a timely period so that the Owner can take corrective action and/or schedule a time to review with the Contractor prior to taking corrective action. Notification must define the maintenance needs observed, include a date and request for site review.

2. In the event that the Contractor fails to visit the site and/ or notify the Owner's Representative in writing, with confirmation that Owner's Representative received the notification, lack of maintenance shall not be used as grounds for voiding or modifying the provisions of the warranty.

C. Contractor is to be responsible for contacting Owner's Representative defined at the start of this section (1) one month prior to end of guarantee period to review health and successful establishment of plantings. Guarantee remains in effect until this final review takes place.

END OF SECTION 32 93 00

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SECTION 33 42 11 – STORMWATER GRAVITY PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install polyvinyl chloride (PVC) storm pipe and appurtenances as shown on the Plans and described herein.

B. Furnish and install high density polyethylene (PE) gravity storm sewer pipe and appurtenances as shown on the Plans and described herein.

C. Furnish and install reinforced concrete storm sewer pipe and appurtenances as shown on the Plans and described herein.

D. Furnish and install ductile iron storm sewer pipe and appurtenances as shown on the Plans and described herein.

1.2 STANDARDS

A. American Society for Testing and Materials (ASTM):

1. ASTM D-3034: Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.
2. ASTM D-3212: Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
3. ASTM 1785: Schedule 40 Polyvinyl Chloride (PVC) pipe.
4. ASTM C-76: Reinforced Concrete Culvert Storm Drain and Sewer Pipe.
5. ASTM C-270: Mortar for Unit Masonry.
6. ASTM C-443: Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

B. The quality and performance of work specified in this section shall be in accordance with the Delaware Department of Transportation Standard Specifications for Road and Bridge Construction, dated June 2022 (hereinafter referred to as the "Standard Specifications").

Section 601: Pipe Culverts
Section 1031: Pipe Culverts (Materials)

1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Storage and Materials

1. Store materials to prevent physical damage.
2. Store pipe and fittings off of the ground to prevent dirt and debris from entering.

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3. Store flexible gasket materials and joint primer or adhesive compounds in cool, dry place. Keep rubber gaskets clean, away from oil, grease, excessive heat, and out of direct sunlight.

B. Handling of Materials

1. Protect materials during transportation and installation to avoid physical damage.
2. Do not install out-of-round pipe.
3. Unload pipe to prevent abrasion.
4. Do not drag or push pipe while handling or distributing on project site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. P.V.C. Pipe and Fittings

1. ASTM D-3034: SDR 35.
2. ASTM D-2241: Polyvinyl Chloride (PVC) Pressure-Rated Pipe.
3. ASTM 1785: Schedule 40.
4. Joint material: Elastomeric ring rubber gasket, ASTM D-3212.
5. Joint material Primer/Adhesive: As provided or specified by pipe manufacturer.

B. High Density Polyethylene Pipe and Fittings

1. All polyethylene pipe shall have a corrugated outer wall and an integrally formed smooth interior, and shall meet AASHTO M294 and DelDOT specifications for Type "S" high density polyethylene pipe.
2. Pipes, couplings, and fittings shall meet the requirements of AASHTO M294, modified as follows: Minimum pipe stiffness shall be 35 psi at 5% deflection and 30 psi at 10% deflection, when tested in accordance with ASTM D-2412.
3. Pipe shall have an integral built-in bell and factory-installed gasket. Joints for all polyethylene pipe greater than 12 inches in diameter shall be watertight in accordance with ASTM 1417.

C. Reinforced Concrete Pipe

1. Reinforced Concrete Pipe shall conform to the requirements of Sections 601 and 1031 of the Standard Specifications. All Reinforced Concrete Pipe shall conform to ASTM C-76, Class III or IV.
2. Joint design for round reinforced concrete pipe and fittings shall conform to AASHTO C-443. Conic surface of spigot or tongue shall be designed to properly contain and seat the gasket, or gasket shall be designed so that it is properly contained and seated on conic surface of spigot or tongue.
3. Joint Material shall be flexible rubber gaskets, meeting the criteria of ASTM C-443. Joint material primer or adhesive shall be as provided or specified by pipe manufacturer.

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D. Ductile Iron Pipe

1. Shall conform to AWWA C-151, and shall be manufactured in eighteen or twenty foot nominal lengths.
2. Use push-on joints, conforming to AWWA C-151 and AWWA C-111, except where mechanical joints are indicated on the plans.

PART 3 - EXECUTION

3.1 MATERIAL INSPECTION

A. The following information shall be clearly marked on each pipe section of P.V.C. pipe:

1. Pipe type and SDR number.
2. Nominal pipe size.
3. The PVC cell classification.
4. Name or trademark of manufacturer.
5. The ASTM Specification designation.

B. P.V.C. Fittings shall have the follow marking:

1. The ASTM Specification designation.
2. Manufacturer's name or trademark.
3. Nominal size.
4. The material designation.

C. Polyethylene pipe shall be marked with the pipe class, date of manufacture, and the name or trademark of the manufacturer.

D. The following information shall be clearly marked on each section of reinforced concrete pipe:

1. Specification designation (ASTM).
2. Pipe class or strength designation.
3. Date of manufacture.
4. Name or trademark of manufacturer.
5. For reinforced pipe with elliptical or quadrant reinforcement the letter E or Q, respectively.

E. Inspect pipe for defects prior to placement in trench. The pipe and fittings shall be free from visible cracks, holes, foreign inclusions or other injurious defects.

F. Assure that all materials are of the type specified and are not defective. Unmarked pipe or pipe and materials not meeting Specifications requirements shall be removed from the site as directed by the Engineer.

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3.2 INSTALLATION

A. Concrete pipe shall be installed in accordance with Section 601 of the Standard Specifications.

B. Fine grade trench bottom so that pipe is supported for its full length.

C. Install piping beginning at the low point of the system, true to grades and alignment indicated on the Plans. Place the bell ends of the pipe facing upstream.

D. Do not lay pipe on unsuitable material, in wet trench, or in same trench with another pipe or utility.

E. General Procedure for Joining Pipe

1. Do not use excavating equipment to force pipe sections together.
2. Hold pipe securely and in proper alignment when joining.
3. Do not disturb previously made joints. Check completed piping to assure joints are intact. Insure placement of backfill over pipe is accomplished without disturbing pipe position.
4. Do not allow earth, stones, or other debris to enter pipe or fittings.
5. Method of installing joint materials and joining piping shall be in strict accordance with manufacturer's printed instructions.

F. Polyethylene pipe shall be installed in accordance with the manufacturer's written instructions or as directed by the Engineer. Joints for all polyethylene pipes greater than 12 inches in diameter shall be watertight in accordance with ASTM 1417.

3.3 BACKFILL AND COMPACTION

A. Bedding and Initial Backfill

1. Bedding and initial backfill shall be as shown on the Plans or in accordance with the manufacturer's written instruction, or in absence of said instructions, in accordance with Section 31 20 00 of these Specifications.
2. Install initial backfill material as shown on the Plan details for the type of pipe being used.
3. When required, material shall be placed under the pipe haunch to provide adequate side support. Material shall be installed for entire trench width and shall be tamped and rodded to insure full contact with pipe at haunch up to the spring line.
4. Little or no tamping of the initial backfill directly over the pipe shall be done.

B. Final Backfill

1. Final backfill shall be in accordance with Section 31 20 00 of these Specifications.

END OF SECTION 33 42 11

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