
BRANDYWINE SCHOOL DISTRICT

Darley Rd Early Education Center
Boiler/Chiller Replacement
500 Darley Road, Claymont, DE 19703

Project Manual

BSA+A Project No. 25.008

GSS Submission
NOT FOR BIDDING

July 29, 2026



BRANDYWINE SCHOOL DISTRICT

Project Manual

Darley Road Early Education Center – Boiler/Chiller Replacement

BSA+A Project No. 25.008

OWNER

Brandywine School District
1311 Brandywine Boulevard
Wilmington, DE 19809

ARCHITECT

BSA+A, Inc.
954 Justison St.
Wilmington, DE 19801
(302) 658.9300

BRANDYWINE SCHOOL DISTRICT
CONTRACT # BSD270001-CHILLERDRD

SPECIFICATIONS
FOR

DARLEY ROAD EARLY EDUCATION CENTER
BOILER/CHILLER REPLACEMENT

IN

500 DARLEY ROAD
CLAYMONT, DE 19703

PREPARED
BY

BUCK SIMPERS ARCHITECT + ASSOCIATES

JULY 29, 2026
GSS SUBMISSION
NOT FOR BIDDING

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DESIGN PROFESSIONALS OF RECORD

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END OF SECTION

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INVITATION TO BID

Sealed bids for Darley Rd Early Education Center Boiler/Chiller Replacement Contract No. **BSD270001-CHILLERDRD**, will be received by Brandywine School District, Facilities Office at 1000 Pennsylvania Ave, Claymont, DE 19703 until **1:00 PM** local time on **September 24, 2026**, at which time they will be publicly opened and read aloud in the **Facilities Office at 1000 Pennsylvania Avenue, Claymont, DE 19703**. Bidder bears the risk of late delivery. Any bids received after the stated time will be returned unopened.

Project involves the Demolition and replacement of boiler, chiller, and cooling tower systems, and plumbing/HVAC/electrical work associated with these activities. New concrete boiler pads and structural reinforcement to the existing cooling tower dunnage.

A **MANDATORY** Pre-Bid Meeting will be held on **August 21, 2026**, at the Darley Rd Early Education Center at 500 Darley Road Claymont, DE 19703 at 10:00 AM 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 MANDATORY PREREQUISITE FOR BIDDING ON THIS CONTRACT.**

Sealed bids shall be addressed to Brandywine School District, Darley Rd EEC Boiler/Chiller Replacement, Attn John Read, Director of Facilities. The outer envelope should clearly indicate: **Brandywine School District CONTRACT NO. BSD270001-CHILLERDRD - SEALED BID - DO NOT OPEN."**

Contract documents will be made available for printing on the day of the Pre-Bid Meeting, **August 21, 2026**. Bidders shall withhold any questions until the Pre-Bid meeting. Contract documents will be available at the office of **RCI Printing & Graphics at 298 Churchmans Rd, New Castle, DE 19720** upon receipt of **\$40.00** per set (Non-refundable). Checks are to be made payable to "**RCI Printing and Graphics**".

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

END OF SECTION

SECTION 00 21 13 INSTRUCTIONS TO BIDDERS

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ARTICLE 1: GENERAL

1.1 DEFINITIONS

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

1.2 STATE: The State of Delaware.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ARTICLE 2: BIDDER'S REPRESENTATION

2.1 PRE-BID MEETING

2.1.1A 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 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.

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.

9. 3.4.2 Copies of Addenda will be made available for inspection wherever Bidding Documents are on file for that purpose.

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

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

ARTICLE 4: BIDDING PROCEDURES

4.1 PREPARATION OF BIDS

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

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

4.1.3 Execute all blanks on the Bid Form 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).

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.

10. 4.3.2 It is the responsibility of the Contractor to ensure that their Subcontractors are in compliance with the provisions of this law. Also, if a Contractor elects to list themselves as a Subcontractor for any category, they must specifically name themselves on the Bid Form and be able to document their capability to act as Subcontractor in that category in accordance with this law.

4.4 AFFIDAVIT OF CONTRACTOR QUALIFICATIONS

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

4.5 AFFIDAVIT OF CRAFT TRAINING COMPLIANCE

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

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

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

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

4.6 EQUALITY OF EMPLOYMENT OPPORTUNITY ON PUBLIC WORKS

4.6.1 During the performance of this contract, the contractor agrees as follows:

- A. The Contractor will not discriminate against any employee or applicant for employment because of race, creed, sex, color, sexual orientation, gender identity or national origin. The Contractor will take affirmative action to ensure the applicants are employed, and that employees are treated during employment, without regard to their race, creed, sex, color, sexual orientation, gender identity or national origin. Such action shall include, but not be limited to, the following: Employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places available to employees and applicants for employment notices to be provided by the contracting agency setting forth this nondiscrimination clause.
- B. The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, creed, sex, color, sexual orientation, gender identity or national origin."

4.7 PREVAILING WAGE REQUIREMENT

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

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

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

11. 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.

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;

- 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.

12. 5.4.2 Per Section 6962(d)(13)a., Title 29, Delaware Code, "The contracting agency shall award any public works contract within thirty (30) days of the bid opening to the lowest responsive and responsible Bidder, unless the Agency elects to award on the basis of best value, in which case the election to award on the basis of best value shall be stated in the Invitation To Bid. Any public school district and its board shall award public works contracts in accordance with this section's requirements except it shall award the contract within 60 days of the bid opening."

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

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

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

13. 5.4.6 If the successful Bidder fails to execute the required Contract, Bond and all required information, as aforesaid, within twenty (20) calendar days after the date of official Notice of the Award of the Contract, their Bid guaranty shall immediately be taken and become the property of the State for the benefit of the Agency as liquidated damages, and not as a forfeiture or as a penalty. Award will then be made to the next lowest qualified Bidder of the Work or readvertised, as the Agency may decide.

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

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

ARTICLE 6: POST-BID INFORMATION

6.1 CONTRACTOR'S QUALIFICATION STATEMENT

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

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.

END OF SECTION

BID FORM

Attn: John Read, Director of Facilities
1000 Pennsylvania Ave
Claymont, DE 19703

**DARLEY ROAD EARLY EDUCATION CENTER BOILER/CHILLER REPLACEMENT
500 DARLEY ROAD, CLAYMONT, DE 19703
BSD270001-CHILLERDRD**

BID FORM

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

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

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

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

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

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

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

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

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

(State of Corporation)

Business Address: _____

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

(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)

DARLEY ROAD EARLY EDUCATION CENTER BOILER/CHILLER REPLACEMENT
500 DARLEY ROAD, CLAYMONT, DE 19703
BSD270001-CHILLERDRD

BID FORM

SUBCONTRACTOR LIST

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

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

DARLEY ROAD EARLY EDUCATION CENTER BOILER/CHILLER REPLACEMENT
500 DARLEY ROAD, CLAYMONT, DE 19703
BSD270001-CHILLERDRD
BID FORM (Continued)

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

DARLEY ROAD EARLY EDUCATION CENTER BOILER/CHILLER REPLACEMENT
500 DARLEY ROAD, CLAYMONT, DE 19703
BSD270001-CHILLERDRD

BID FORM

NON-COLLUSION STATEMENT

This is to certify that the undersigned bidder has neither directly nor indirectly, entered into any agreement, participated in any collusion or otherwise taken any action in restraint of free competitive bidding in connection with this proposal submitted this date to Brandywine School District.

All the terms and conditions of the Lombardy Elementary Roof Replacement, Contract #BSD260001-LOMB_ROOF 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.

**AFFIDAVIT
OF
EMPLOYEE DRUG TESTING PROGRAM**

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

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

Contractor/Subcontractor Name: _____

Contractor/Subcontractor Address: _____

Authorized Representative (typed or printed): _____

Authorized Representative (signature): _____

Title: _____

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

My Commission expires _____. NOTARY PUBLIC _____.

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

DARLEY ROAD EARLY EDUCATION CENTER BOILER/CHILLER REPLACEMENT
500 DARLEY ROAD, CLAYMONT, DE 19703
BSD270001-CHILLERDRD

**AFFIDAVIT
OF
CONTRACTOR QUALIFICATIONS**

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

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

Contractor Name: _____

Contractor Address: _____

Authorized Representative (typed or printed): _____

Authorized Representative (signature): _____

Title: _____

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

My Commission expires _____. NOTARY PUBLIC _____.

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

BRANDYWINE SCHOOL DISTRICT

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. _____, to be paid to the **State** for the use and
benefit of _____ (*insert State agency name*) 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 _____ (*insert State agency name*) 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 _____
_____ (*insert State agency name*) this Contract to be entered into within twenty days after the date
of official notice of the award thereof in accordance with the terms of said proposal, then this obligation shall
be void or else to be and remain in full force and virtue.

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

SEALED, AND DELIVERED IN THE
Presence of

Name of Bidder (Organization)

Corporate
Seal

By:

Authorized Signature

Attest _____

Title

Name of Surety

Witness: _____

By:

Title

SECTION 00 52 13 - STANDARD FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

A101-2017

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

**SECTION 00 54 13 - SUPPLEMENT TO AGREEMENT BETWEEN OWNER AND
CONTRACTOR A101-2017**

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

ARTICLE 3: DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

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

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

ARTICLE 5: PAYMENTS

5.1 PROGRESS PAYMENTS

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

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

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

ARTICLE 6: DISPUTE RESOLUTION

6.2 BINDING DISPUTE RESOLUTION

Check the box “Other” – and add the following sentence:

"Any remedies available in law or in equity."

ARTICLE 7: TERMINATION or SUSPENSION

7.1.1.1 Delete paragraph 7.1.1.1 in its entirety.

ARTICLE 8: MISCELLANEOUS PROVISIONS

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

“The Contractor’s representative shall not be changed without ten days written notice to the Owner.”

END OF SECTION

SECTION 00 54 14 - SUPPLEMENT TO A101-2017 – EXHIBIT A - INSURANCE & BONDS

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

ARTICLE A.2 OWNER’S INSURANCE

A.2.1 General

Delete paragraph A.2.1 in its entirety.

A.2.2 Liability Insurance

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

A.2.3 Required Property Insurance

Delete paragraph A.2.3 in its entirety.

A.2.4 Optional Extended Property Insurance

Delete paragraph A.2.4 in its entirety.

A.2.5 Other Optional Insurance

Delete paragraph A.2.5 in its entirety.

ARTICLE A.3 CONTRACTORS INSURANCE AND BONDS

A.3.1.1 Strike the last sentence of the paragraph.

A.3.1.3 Additional Insured Obligations

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

Strike the remainder of the first sentence beginning at the semicolon “; and (2) the Owner” through the end of the sentence.

Delete the second sentence in its entirety.

- A.3.2.2.1** Insert “\$1,000,000.00” in the blank for each occurrence.
Insert “\$3,000,000.00” in the blank for general aggregate.
Insert “\$3,000,000.00” in the blank for aggregate for products-completed operations hazard.

A.3.2.3 Insert “\$1,000,000.00” in the blank for per accident.

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

SECTION 00 61 13.13 - 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 _____ ("**Owner**") (*insert State agency name*), 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 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:
(Corporate Seal)	Title:

SURETY

Name: _____

Witness or Attest: Address: _____

_____	By: _____(SEAL)
Name:	Name:
(Corporate Seal)	Title:

SECTION 00 61 13.16 - 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 _____ (“**Owner**”) (*insert State agency name*), 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**.

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: _____

Name:

(Corporate Seal)

By: _____(SEAL)
Name:
Title:

SURETY

Name: _____

Witness or Attest: Address: _____

Name:

(Corporate Seal)

By: _____(SEAL)
Name:
Title:

SECTION 00 72 13 GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION
A201 - 2017

The General Conditions of this Contract are as stated in the American Institute of Architects Document AIA A201 (2017 Edition) entitled General Conditions of the Contract for Construction as revised by the Supplementary General Conditions and is part of this project manual as if herein written in full.

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.

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 Section14.2.2.”

1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

1.2.1.1 Insert “if possible” at the end of the second sentence.

Add the following Sections:

“1.2.4 In the case of an inconsistency between the Drawings and the Specifications, or within either document not clarified by addendum, the better quality or greater quantity of work shall be provided in accordance with the Architect’s interpretation.”

“1.2.5The 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. 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:

- “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.”

“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:

“3.8.1.1 For costs to be covered under a project allowance, (included in the schedule of values) the Contractor shall submit a summary of those costs anticipated and an Allowance Access Authorization Form to the Architect and Owner, reflecting the projected costs. The Allowance Access Authorization Form must be signed by the Owner prior to initiating any work associated with the allowance.”

3.10 CONTRACTOR’S CONSTRUCTION AND SUBMITTAL SCHEDULES

3.10.1 Add “estimated” after “and the” and before “date of” in the second sentence.

3.10.2 Strike “and thereafter as necessary to maintain a current submittal schedule” in the first sentence.

3.11 DOCUMENTS AND SAMPLES AT THE SITE

Add the following Sections:

“3.11.1 During the course of the Work, the Contractor shall maintain a record set of drawings on which the Contractor shall mark the actual physical location of all piping, valves, equipment, conduit, outlets, access panels, controls, actuators, including all appurtenances that will be concealed once construction is complete, etc., including all invert elevations.”

“3.11.2 At the completion of the project, the Contractor shall obtain a set of the conformed contract drawings from the Architect, and neatly transfer all information outlined in 3.11.1 to provide a complete record of the as-built conditions.”

“3.11.3 Upon completion of the work noted in 3.11.2 the contractor shall schedule a meeting with the Architect/Engineer and Owner to review the final record drawings and closeout documents prior to submission. After this meeting the Contractor shall make adjustments per the review, and submit one (1) original markup and (2) copies of the red line drawings (as-built conditions, to the Owner and one (1) print to the Architect. In addition, attach one complete set of the as-built documents to each of the Operating and Maintenance Instructions/Manuals. The Contractor will include (2) USB drives, each containing all “red line drawings (as-built) and Closeout Documents properly tabbed in accordance with closeout requirements as defined elsewhere in the contract documents.”

3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

3.12.10.2 Strike “If the Contract Documents require” from the beginning of the sentence.

3.12.10.2 Strike “to” between “professional” and certify” and replace with “shall”.

3.17 Insert “indemnify and” between “shall” and “hold” in the second sentence.

ARTICLE 4: ADMINISTRATION OF THE CONTRACT

4.2 ADMINISTRATION OF THE CONTRACT

4.2.7 Strike the first sentence and replace with the following:

“The Architect will review and approve or take other appropriate action upon the Contractor’s submittals such as Shop Drawings, Product Data and Samples for the purpose of checking for conformance with the Contract Documents.”

4.2.7 Strike the second sentence and replace with the following:

“The Architect’s action will be taken with such reasonable promptness as to cause no delay in the Work in the activities of the Owner, Contractor or separate Contractors, while allowing sufficient time in the Owner’s professional judgment to permit adequate review.”

Add the following Section:

“4.2.10.1 There will be no full-time Project Representative provided by the Owner or Architect on this project.”

“4.2.13 Add “and in compliance with all local requirements.” to the end of the sentence.”

ARTICLE 5: SUBCONTRACTORS

5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

5.2.3 Strike Section 5.2.3 in its entirety and replace with the following:

“If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection, subject to the statutory requirements of 29 Delaware Code § 6962(d)(10)b.3 and 4.”

5.2.4 Strike Section 5.2.4 in its entirety and replace with the following:

”The Contractor may not substitute any Subcontractor listed in its Bid unless the Contractor complies with the requirements of 29 Delaware Code § 6962(d)(10)b.3 and 4. Failure to comply with this requirement shall subject the Contractor to a penalty as outlined in Section 5.2 of the Owner’s General Requirements.”

Add the following Section:

“5.2.5 The Contractor shall comply and shall ensure all Subcontractors comply with all requirements for drug testing as set forth in TITLE 19 LABOR DELAWARE ADMINISTRATIVE CODE 4000 Office of Management and Budget 4100 Division of Facilities Management **4104 Regulations for the Drug Testing of Contractor and Subcontractor Employees Working on Large Public Works Projects.**”

ARTICLE 6: CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

6.1 OWNER’S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

6.1.1 Strike “and waiver of subrogation” from the end of the second sentence.

6.1.4 Strike Section 6.1.4 in its entirety.

6.2 MUTUAL RESPONSIBILITY

6.2.3 Strike “shall” and replace with “may” in the second sentence.

ARTICLE 7: CHANGES IN THE WORK

(SEE ARTICLE 7: CHANGES IN WORK IN THE STATE OF DELAWARE DIVISION OF FACILITIES MANAGEMENT GENERAL REQUIREMENTS)

7.2 CHANGE ORDERS

Add the following Sections:

“7.2.2 In addition to the above:

7.2.2.1 The General Contractor is allowed a fifteen percent (15%) markup for overhead and profit for additional work performed by the General Contractor’s own forces.

7.2.2.2 For additional subcontractor work, the Subcontractor is allowed a fifteen (15) percent overhead and profit on change order work above and beyond the direct costs stated previously. To this amount, the General Contractor will be allowed a mark-up not exceeding seven- and one-half percent (7.5%) on the subcontractor’s work.

7.2.2.3 Where the Third Tier Contractor is going to be completing the additional work, the Third-Tier contractor will be allowed a markup of fifteen percent (15%) overhead and profit on changes order work above and beyond the direct costs stated previously. To this amount, the Subcontractor will be allowed a markup not to exceed seven and one-half percent (7.5%) on the Third-Tier Contractor’s work and the General Contractor will be allowed a markup not to exceed seven and one-half percent (7.5%) of the amount of the Subcontractor’s markup.

7.2.2.4 No additional costs shall be allowed for changes related to the Contractor’s onsite superintendent/staff, or project manager, unless a change in the work changes the project duration and is identified by the CPM schedule. There will be no other costs associated with the change order.

7.2.2.5 These markups shall include all costs including, but not limited to: overhead, profit, bonds, insurance, supervision, etc.”

7.3.4.1 Strike “and other employee costs approved by the Architect” after “worker’s compensation insurance,”

7.3.4.4 Add “work attributable to the” before “change” at the end of the sentence.

7.4 MINOR CHANGES IN THE WORK

Add “unless such changes are approved” at the end of the third sentence.

ARTICLE 8: TIME

8.2 PROGRESS AND COMPLETION

8.2.1 Add the following Section:

- “8.2.1.1 Refer to Project Specifications Section SUMMARY OF WORK for Contract time requirements.”
- 8.2.2 After “by the Contractor” strike “and” and insert “to”.
- 8.2.4 Add the following Section:
- “8.2.4 If the Work falls behind the Progress Schedule as submitted by the Contractor, the Contractor shall employ additional labor and/or equipment necessary to bring the Work into compliance with the Progress Schedule at no additional cost to the Owner.”
- 8.3 DELAYS AND EXTENSION OF TIME
- 8.3.1 Strike “binding dispute resolution” and insert “any and all remedies at law or in equity”.
- Add the following Section:
- “8.3.2.1 The Contractor shall update the status of the suspension, delay, or interruption of the Work with each Application for Payment. (The Contractor shall report the termination of such cause immediately upon the termination thereof.) Failure to comply with this procedure shall constitute a waiver for any claim for adjustment of time or price based upon said cause.”
- Strike Section 8.3.3 in its entirety and replace with the following:
- 8.3.3 “Except in the case of a suspension of the Work directed by the Owner, an extension of time under the provisions of Section 8.3.1 shall be the Contractor’s sole remedy in the progress of the Work and there shall be no payment or compensation to the Contractor for any expense or damage resulting from the delay.”
- Add the following Section:
- “8.3.4 By permitting the Contractor to work after the expired time for completion of the project, the Owner does not waive their rights under the Contract.”

ARTICLE 9: PAYMENTS AND COMPLETION

- 9.2 SCHEDULE OF VALUES
- Add the following Sections:
- “9.2.1 The Schedule of Values shall be submitted using AIA Document G703, Continuation Sheet to G702.”
- “9.2.2 The Schedule of Values is to include a line item for Project Closeout Document Submittal. The value of this item is to be no less than 1.5% of the initial contract amount.”
- 9.3 APPLICATIONS FOR PAYMENT

9.3.1 Strike Section 9.3.1 in its entirety and replace with the following:

“At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values for completed portions of the Work. The application shall be notarized, and supported by all data substantiating the Contractor’s right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage.”

Add the following Sections:

“9.3.1.3 Application for Payment shall be submitted on AIA Document G702 “Application and Certificate for Payment”, supported by AIA Document G703 “Continuation Sheet”. Said Applications shall be fully executed and notarized.”

“9.3.4 Until Closeout Documents have been received and outstanding items completed the Owner will pay 95% (ninety-five percent) of the amount due the Contractor on account of progress payments.”

“9.3.5 The Contractor shall provide a current and updated Progress Schedule to the Architect with each Application for Payment. Failure to provide Schedule will be just cause for rejection of Application for Payment.”

9.5 DECISIONS TO WITHHOLD CERTIFICATION

Add the following Subsections to 9.5.1:

- .8 failure to provide a current Progress Schedule;
- .9 a lien or attachment is filed;
- .10 failure to comply with mandatory requirements for maintaining Record Documents.

9.6 PROGRESS PAYMENTS

9.6.1 Strike Section 9.6.1 in its entirety and replace with the following:

“9.6.1 After the Architect has approved and issued a Certificate for Payment, payment shall be made by the Owner within 30 days after Owner’s receipt of the Certificate for Payment.”

9.6.8 Strike “Provided the Owner has fulfilled its payment obligations under the Contract Documents,” in the first sentence.

9.7 FAILURE OF PAYMENT

Strike Section 9.7 in its entirety and replace with the following:

“If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within fourteen days after receipt of the Contractor’s Application for Payment, or if the Owner

- does not pay the Contractor within thirty days after the date established in the Contract Documents, the amount certified by the Architect, then the Contractor may, upon thirty additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents."
- 9.8 SUBSTANTIAL COMPLETION
- 9.8.3 At the end of Section 9.8.3, add the following sentence:
- "If the Architect is required to make more than 2 inspections of the same portion of work, the Contractor shall be responsible for all costs associated with subsequent inspections including but not limited to any Architect's fees."
- 9.8.5 Strike "shall" and insert "may" in the second sentence.
- 9.8.5 Insert "1/2 of the" after "make payment of" in the second sentence.
- 9.9 PARTIAL OCCUPANCY OR USE
- 9.9.1 Strike the the first sentence and replace with the following (the remainder of the Section remains as written):
- "The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use authorized by public authorities having jurisdiction over the Project."
- 9.10.2 Strike "to remain in force after final payment is currently in effect" after "required by the Contract Documents" and replace with "shall remain in force until final payment is completed" in the first sentence.
- 9.10.4.4 Strike "if permitted by the Contract Documents,"

ARTICLE 10: PROTECTION OF PERSONS AND PROPERTY

10.1 SAFETY PRECAUTIONS AND PROGRAMS

Add the following Sections:

- 10.1.1 Each Contractor shall develop a safety program in accordance with the Occupational Safety and Health Act of 1970. A copy of said plan shall be furnished to the Owner and Architect prior to the commencement of that Contractor's Work.
- 10.1.2 Each Contractor shall appoint a Safety Representative. Safety Representatives shall be someone who is on site on a full time basis. If deemed necessary by the Owner or Architect, Contractor Safety meetings will be scheduled. The attendance of all Safety Representatives will be required. Minutes will be recorded of said meetings by the Contractor and will be distributed to all parties as well as posted in all job offices/trailers etc.

10.2 SAFETY OF PERSONS AND PROPERTY

Add the following Section:

10.2.4.1 As required in the Hazardous Chemical Act of June 1984, all vendors supplying any material that may be defined as hazardous must provide Material Safety Data Sheets for those products. Any chemical product should be considered hazardous if it has a caution warning on the label relating to a potential physical or health hazard, if it is known to be present in the work place, and if employees may be exposed under normal conditions or in foreseeable emergency situations. Material Safety Data Sheets shall be provided directly to the Owner, along with the shipping slips that include those products.

10.2.5 Strike the second sentence in its entirety.

10.3 HAZARDOUS MATERIALS AND SUBSTANCES

10.3.3 Strike Section 10.3.3 in its entirety.

10.3.4 Insert "hazardous" in the last sentence after "handling of such" .

10.3.6 Strike Section 10.3.6 in its entirety.

ARTICLE 11: INSURANCE AND BONDS

11.1 CONTRACTOR'S INSURANCE AND BONDS

11.1.1 Strike "Owner" from the third sentence.

11.2 OWNER'S LIABILITY INSURANCE

Strike 11.2 in its entirety, except that in the case of school projects in which case Section 11.2 shall remain.

11.3 WAIVERS OF SUBROGATION

Delete Section 11.3 in its entirety

**11.4 LOSS OF USE, BUSINESS INTERRUPTION, AND DELAY IN COMPLETION
INSURANCE**

Delete Section 11.4 in its entirety

ARTICLE 12: UNCOVERING AND CORRECTION OF WORK

12.2.2 AFTER SUBSTANTIAL COMPLETION

Add the following Section:

- “12.2.2.1.1 At any time during the progress of the Work, or in any case where the nature of the defects will be such that it is not expedient to have corrected, the Owner, at its option, will have the right to deduct such sum, or sums, of money from the amount of the Contract as it considers justified to adjust the difference in value between the non-conforming work and that required under contract including any damage to the structure.”
- 12.2.2.1 Strike all references to “one year” or “one-year” and replace with “two years”.
- 12.2.2.2 Strike “one-year” and replace with “two years”.
- 12.2.2.3 Strike “one-year” and replace with “two years”.
- 12.2.5 Strike “one-year” and replaced with “two years”.

ARTICLE 13: MISCELLANEOUS PROVISIONS

13.1 GOVERNING LAW

Strike the last sentence.

13.4 TESTS AND INSPECTIONS

13.4.1 Strike the last sentence and replace with the following:

“The Owner shall pay for tests, inspections, or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor.”

13.5 INTEREST

Strike “the date payment is due at such rate as the parties may agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located” and replace with “30 days of presentment of the authorized Certificate of Payment at the annual rate of 12% or 1% per month.”

Insert the following Section:

“13.6 CONFLICTS WITH FEDERAL STATUTES OR REGULATIONS

13.6.1 If any provision, specifications or requirement of the Contract Documents conflict or is inconsistent with any statute, law or regulation of the government of the United State of America, the Contractor shall notify the Architect and Owner immediately upon discovery.”

ARTICLE 14: TERMINATION OR SUSPENSION OF THE CONTRACT

14.1 TERMINATION BY THE CONTRACTOR

14.1.1.4 Insert “, upon the Contractors’ request,” after “furnish to the Contractor”.

- 14.1.3 Strike “and profit on Work not executed, and” after “as well as reasonable overhead” and replace with “, profit, and reasonable”
- 14.3 SUSPENSION BY OWNER FOR CONVENIENCE
- 14.3.2 Strike “Adjustment of the Contract Sum shall include profit”.
- 14.4 TERMINATION BY THE OWNER FOR CONVENIENCE
- 14.4.3 Strike Section 14.4.3 in its entirety and replace with the following:

“In case of such termination for the Owner’s convenience, the Contractor shall be entitled to receive payment for Work executed, and reasonable costs incurred by reason of such termination along with reasonable overhead.”

ARTICLE 15: CLAIMS AND DISPUTES

- 15.1 CLAIMS
- 15.1.2 TIME LIMITS ON CLAIMS

Strike the last sentence.
- 15.1.3 NOTICE OF CLAIM

Strike all references to “21” and replace with “45”.
- 15.1.5 CLAIMS FOR ADDITIONAL COSTS

Strike the first sentence and replace with the following:

“Contractor shall not proceed to execute any portion of the Work that is subject to the Claim without prior approval of the costs or method of payment for the costs associated with the Claim as determined by the Architect and approved by the Owner.”
- 15.1.7 WAIVER OF CLAIMS FOR CONSEQUENTIAL DAMAGES

Strike Section 15.1.7 in its entirety.
- 15.2 INITIAL DECISION
- 15.2.1 Strike “and binding dispute resolution” in the fourth sentence and replace with “or any and all remedies at law or in equity”.
- 15.2.5 Strike Section 15.2.5 in its entirety and replace with the following:

- “The Architect will approve or reject Claims by written decision, which shall state the reasons therefore and shall notify the parties of any change in the Contract Sum or Contract Time or both. The approval or rejection of a Claim by the Architect shall be subject to mediation and any or all remedies at law or in equity.”
- 15.2.6 Strike Section 15.2.6 and its sub-Sections in their entirety.
- 15.3 MEDIATION
- 15.3.1 Strike “binding dispute resolution” and replace with “any or all remedies at law or in equity”.
- 15.3.2 Strike “, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedure in effect on the date of the Agreement,” in the first sentence.
- 15.3.2 Strike all references to “binding dispute resolution” and replace with “any or all remedies at law and in equity”.
- 15.3.3 Strike Section 15.3.3 in its entirety.
- 15.4 ARBITRATION
- Strike Section 15.4 and its Subsections in their entirety.

END OF SECTION



00 73 44 - RELEASE FORM FOR ELECTRONIC FILES

OWNER: Brandywine School District
PROJECT: Darley Road Early Education Center Boiler/Chiller Replacement
LIST OF DRAWINGS: _____
USAGE FEE: \$0.00 DATE: _____

Definitions:

All electronic information and other instruments of service provided by BSA+A and its consultants, 954 Justison Street, Wilmington, DE 19801, which include everything transmitted on electronic storage media, from a website, or via the Internet, is known as the Data. The Recipient is the undersigned firm or individual requesting the Data.

Terms:

In accepting and utilizing the Data, the Recipient agrees with the following Terms:

1. The General Contractor/Construction Manager, and every subcontractor using the Data shall each return one signed copy of this Release Form to BSA+A.
2. DISTRIBUTION AND COORDINATION: The Recipient will not distribute the Data to any other firm or individual, except for the Recipient's consultants or subcontractors. If BSA+A issues an update or change in the Data during the course of the project, the General Contractor/Construction Manager is responsible for distribution and coordination. Transfer of electronic data does not include subsequent updates and revisions
2. USE: The Data will be used only for the specific project and owner listed above. None of the Data will be used for any other project or purpose, at this or any other site. Indicia/Title Block may be removed at the discretion of the design professional. The
3. OWNERSHIP: Copyright and ownership of the Data are not transferred to the Recipient, or to any other party. BSA+A and/or Owner retain all rights to the Data.
4. ACCURACY: Design data is never perfect. The information is not guaranteed to be accurate. The method of data transfer cannot be guaranteed to be error-free, durable, or compatible with the Recipient's hardware, software or output systems. Any defects discovered by the Recipient shall be reported to BSA+A. **Contractors and subcontractors are not relieved of their normal responsibilities to independently check, coordinate & verify information and dimensions, and to familiarize themselves thoroughly with the project. The electronic data received should not be relied upon for existing building conditions, which must be verified as required.**
5. Electronic data (**REVIT 2023 Model and AutoCAD 2023 Files**) shall be provided for use as background plans only. Contractor shall be responsible for verification of all dimensions and revisions. Contractor shall not have, copy or reproduce details, elevations, sections, schedules or other similar data.
6. Neither BSA+A nor its consultants are not to be held liable for any damages attributable to the use of the Data, or changes and additions made to the Data by you or your consultants or subcontractors. The Undersigned agrees, to the fullest extent permitted by law, to indemnify and hold BSA+A and its consultants harmless from any damage, liability or cost, including reasonable attorney's fees and costs of defense, arising from any changes made by anyone other than the Firm or from any reuse of the drawings and data without the prior written consent of BSA+A and its consultants.
7. This agreement shall be governed by the laws of Delaware.
8. The Undersigned agrees to make payment of _____ processing fee for each consultant's electronic files to BSA+A prior to release of any electronic media release.

GENERAL CONTRACTOR, CONSTRUCTION MANAGER, OR SUBCONTRACTOR:

Print Clearly:

Company: _____

Name: _____

Address: _____

Phone: _____ **Email:** _____

Signed _____ **Date:** _____

SECTION 00 81 13 - GENERAL REQUIREMENTS

TABLE OF ARTICLES

1. GENERAL
2. OWNER
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ARTICLE 1: GENERAL

1.1 CONTRACT DOCUMENTS

1.1.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary and what is required by one shall be as binding as if required by all. Performance by the Contractor shall be required to an extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the intended results.

1.1.2 Work including material purchases shall not begin until the Contractor is in receipt of a bonafide State of Delaware Purchase Order. Any work performed or material purchases prior to the issuance of the Purchase Order is done at the Contractor's own risk and cost.

1.2 EQUALITY OF EMPLOYMENT OPPORTUNITY ON PUBLIC WORKS

1.2.1 For Public Works Projects financed in whole or in part by state appropriation the Contractor agrees that during the performance of this contract:

1. The Contractor will not discriminate against any employee or applicant for employment because of race, creed, sex, color, sexual orientation, gender identity or national origin. The Contractor will take positive steps to ensure that applicants are employed and that employees are treated during employment without regard to their race, creed, sex, color, sexual orientation, gender identity or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places available to employees and applicants for employment notices to be provided by the contracting agency setting forth this nondiscrimination clause.
2. The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, creed, sex, color, sexual orientation, gender identity or national origin."

ARTICLE 2: OWNER

(NO ADDITIONAL GENERAL REQUIREMENTS – SEE SUPPLEMENTARY GENERAL CONDITIONS)

ARTICLE 3: CONTRACTOR

3.1 Schedule of Values: The successful Bidder shall within twenty (20) days after receiving notice to proceed with the work, furnish to the Owner a complete schedule of values on the various items comprising the work.

3.2 Subcontracts: Upon approval of Subcontractors, the Contractor shall award their Subcontracts as soon as possible after the signing of their own contract and see that all material, their own

and those of their Subcontractors, are promptly ordered so that the work will not be delayed by failure of materials to arrive on time.

- 3.3 Before commencing any work or construction, the General Contractor is to consult with the Owner as to matters in connection with access to the site and the allocation of Ground Areas for the various features of hauling, storage, etc.
- 3.4 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions.
- 3.5 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Contract. The Contractor shall not permit employment of unfit persons or persons not skilled in tasks assigned to them.
- 3.6 The Contractor warrants to the Owner that materials and equipment furnished will be new and of good quality, unless otherwise permitted, and that the work will be free from defects and in conformance with the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved, may be considered defective. If required by the Owner, the Contractor shall furnish evidence as to the kind and quality of materials and equipment provided.
- 3.7 Unless otherwise provided, the Contractor shall pay all sales, consumer, use and other similar taxes, and shall secure and pay for required permits, fees, licenses, and inspections necessary for proper execution of the Work.
- 3.8 The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations, and lawful orders of public authorities bearing on performance of the Work. The Contractor shall promptly notify the Owner if the Drawings and Specifications are observed to be at variance therewith.
- 3.9 The Contractor shall be responsible to the Owner for the acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons performing portions of the Work under contract with the Contractor.
- 3.10 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work the Contractor shall remove from and about the Project all waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials. The Contractor shall be responsible for returning all damaged areas to their original conditions.
- 3.11 STATE LICENSE AND TAX REQUIREMENTS
- 3.11.1 Each Contractor and Subcontractor shall be licensed to do business in the State of Delaware and shall pay all fees and taxes due under State laws. In conformance with Section 2503, Chapter 25, Title 30, Delaware Code, "the Contractor shall furnish the Delaware Department of Finance within ten (10) days after entering into any contract with a contractor or subcontractor not a resident of this State, a statement of total value of such contract or contracts together with the names and addresses of the contracting parties."

- 3.12 The Contractor shall comply with all requirements set forth in Section 6962, Chapter 69, Title 29 of the Delaware Code.
- 3.13 During the contract Work, the Contractor and each Subcontractor, shall implement an Employee Drug Testing Program in accordance with OMB Regulation 4104 - "Regulations for the Drug Testing of Contractor and Subcontractor Employees Working on "Large Public Works Projects". "Large Public Works" is based upon the current threshold required for bidding Public Works as set by the Purchasing and Contracting Advisory Council.

ARTICLE 4: ADMINISTRATION OF THE CONTRACT

4.1 CONTRACT SURETY

4.1.1 PERFORMANCE BOND AND LABOR AND MATERIAL PAYMENT BOND

4.1.2 All bonds will be required as follows unless specifically waived elsewhere in the Bidding Documents.

4.1.3 Contents of Performance Bonds – The bond shall be in the form approved by the Office of Management and Budget. The bond shall be conditioned upon the faithful compliance and performance by the successful bidder of each and every term and condition of the contract and the proposal, plans, specifications, and bid documents thereof. Each term and condition shall be met at the time and in the manner prescribed by the Contract, Bid documents and the specifications, including the payment in full to every person furnishing materiel or performing labor in the performance of the Contract, of all sums of money due the person for such labor and materiel. (The bond shall also contain the successful bidder's guarantee to indemnify and save harmless the State and the agency from all costs, damages and expenses growing out of or by reason of the Contract in accordance with the Contract.)

4.1.4 Invoking a Performance Bond – The agency may, when it considers that the interest of the State so requires, cause judgement to be confessed upon the bond.

4.1.5 Within twenty (20) days after the date of notice of award of contract, the Bidder to whom the award is made shall furnish a Performance Bond and Labor and Material Payment Bond, each equal to the full amount of the Contract price to guarantee the faithful performance of all terms, covenants and conditions of the same. The bonds are to be issued by an acceptable Bonding Company licensed to do business in the State of Delaware and shall be issued in duplicate.

4.1.6 Performance and Payment Bonds shall be maintained in full force (warranty bond) for a period of two (2) years after the date of the Certificate for Final Payment. The Performance Bond shall guarantee the satisfactory completion of the Project and that the Contractor will make good any faults or defects in his work which may develop during the period of said guarantees as a result of improper or defective workmanship, material or apparatus, whether furnished by themselves or their Sub-Contractors. The Payment Bond shall guarantee that the Contractor shall pay in full all persons, firms or corporations who furnish labor or material or both labor and material for, or on account of, the work included herein. The bonds shall be paid for by this Contractor. The Owner shall have the right to demand that the proof parties signing the bonds are duly authorized to do so.

4.2 FAILURE TO COMPLY WITH CONTRACT

- 4.2.1 If any firm entering into a contract with the State, or Agency that neglects or refuses to perform or fails to comply with the terms thereof, the Agency which signed the Contract may terminate the Contract and proceed to award a new contract in accordance with this Chapter 69, Title 29 of the Delaware Code or may require the Surety on the Performance Bond to complete the Contract in accordance with the terms of the Performance Bond. Nothing herein shall preclude the Agency from pursuing 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:

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 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.

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 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 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 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.
- 9.4.1.8 The Owner reserves the right to retain payments, or parts thereof, for its protection until the foregoing conditions have been complied with, defective work corrected and all unsatisfactory conditions remedied.

ARTICLE 10: PROTECTION OF PERSONS AND PROPERTY

- 10.1 The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract. The Contractor shall take all reasonable precautions to prevent damage, injury or loss to: workers, persons nearby who may be affected, the Work, materials and equipment to be incorporated, and existing property at the site or adjacent thereto. The Contractor shall give notices and comply with applicable laws ordinances, rules regulations, and lawful orders of public authorities bearing on the safety of persons and property and their protection from injury, damage, or loss. The Contractor shall promptly remedy damage and loss to property at the site caused in whole or in part by the Contractor, a Subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable.
- 10.2 The Contractor shall notify the Owner in the event any previously unknown hazardous material such as PCBs, asbestos, etc. is encountered on the project. The Owner will arrange with a qualified specialist for the identification, testing, removal, handling and protection against exposure or environmental pollution, to comply with applicable regulation laws and ordinances. The Contractor and Architect will not be required to participate in or to perform this operation. Upon completion of this work, the Owner will notify the Contractor and Architect in writing the area has been cleared and approved by the authorities in order for the work to proceed. The Contractor shall attach documentation from the authorities of said approval to the closeout documents to be submitted at the end of the project.
- 10.2.1 Any activities with the potential to disturb lead-based materials should be performed by the Contractor in accordance with OSHA regulations pertaining to Lead in Construction, 29 CFR 1926.62, Lead.
- 10.2.1.1 The Contractor shall notify the Owner in the event they encounter previously unknown material that they suspect may contain "lead". The Owner will arrange with a qualified

specialist for identification and testing and advise the Contractor of the results. In the case that testing identifies potential lead based materials, the contractor shall continue performance of the work that has the potential to disturb associated in accordance with OSHA regulations pertaining to Lead in Construction, 29 CFR 1926.62, Lead.

- 10.3 As required in the Hazardous Chemical Information Act of June 1984, all vendors supplying any materials that may be defined as hazardous, must provide Material Safety Data Sheets for those products. Any chemical product should be considered hazardous if it has a warning caution on the label relating to a potential physical or health hazard, if it is known to be present in the work place, and if employees may be exposed under normal conditions or in any foreseeable emergency situation. Material Safety Data Sheets must be provided directly to the Owner along with the shipping slips that include those products.
- 10.4 The Contractor shall certify to the Owner that materials incorporated into the Work are free of all asbestos. This certification may be in the form of Material Safety Data Sheet (MSDS) provided by the product manufacturer for the materials used in construction, as specified or as provided by the Contractor.

ARTICLE 11: INSURANCE AND BONDS

- 11.1 The Contractor shall carry all insurance required by law, such as Unemployment Insurance, etc. The Contractor shall carry such insurance coverage as they desire on their own property such as a field office, storage sheds or other structures erected upon the project site that belong to them and for their own use. The Subcontractors involved with this project shall carry whatever insurance protection they consider necessary to cover the loss of any of their personal property, etc.
- 11.2 Upon being awarded the Contract, the Contractor shall obtain a minimum of two (2) copies of all required insurance certificates called for herein, and submit one (1) copy of each certificate, to the Owner, within 20 days of contract award.
- 11.3 Bodily Injury Liability and Property Damage Liability Insurance shall, in addition to the coverage included herein, include coverage for injury to or destruction of any property arising out of the collapse of or structural injury to any building or structure due to demolition work and evidence of these coverages shall be filed with and approved by the Owner.
- 11.4 The Contractor's Property Damage Liability Insurance shall, in addition to the coverage noted herein, include coverage on all real and personal property in their care, custody and control damaged in any way by the Contractor or their Subcontractors during the entire construction period on this project.
- 11.5 Builders Risk (including Standard Extended Coverage Insurance) on the existing building during the entire construction period, may be provided by the Contractor under this contract. The Owner shall insure the existing building and all of its contents and all this new alteration work under this contract during entire construction period for the full insurable value of the entire work at the site. Note, however, that the Contractor and their Subcontractors shall be responsible for insuring building materials (installed and stored) and their tools and equipment whenever in use on the project, against fire damage, theft, vandalism, etc.
- 11.6 Certificates of the insurance company or companies stating the amount and type of coverage, terms of policies, etc., shall be furnished to the Owner, within 20 days of contract award.

11.7 The Contractor shall, at their own expense, (in addition to the above) carry the following forms of insurance:

11.7.1 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
Property Damage	\$1,000,000	for each occurrence
	\$3,000,000	aggregate

11.7.3 Automobile Liability Insurance

Minimum coverage to be:

Bodily Injury	\$1,000,000	for each person
	\$1,000,000	for each occurrence
Property Damage	\$500,000	per accident

11.7.4 Prime Contractor's and Subcontractors' policies shall include contingent and contractual liability coverage in the same minimum amounts as 11.7.1 above.

11.7.5 Workmen's Compensation (including Employer's Liability):

11.7.5.1 Minimum Limit on employer's liability to be as required by law.

11.7.5.2 Minimum Limit for all employees working at one site.

11.7.6 Certificates of Insurance must be filed with the Owner guaranteeing fifteen (15) days prior notice of cancellation, non-renewal, or any change in coverages and limits of liability shown as included on certificates.

11.7.7 Social Security Liability

11.7.7.1 With respect to all persons at any time employed by or on the payroll of the Contractor or performing any work for or on their behalf, or in connection with or arising out of the

Contractor's business, the Contractor shall accept full and exclusive liability for the payment of any and all contributions or taxes or unemployment insurance, or old age retirement benefits, pensions or annuities now or hereafter imposed by the Government of the United States and the State or political subdivision thereof, whether the same be measured by wages, salaries or other remuneration paid to such persons or otherwise.

11.7.7.2 Upon request, the Contractor shall furnish Owner such information on payrolls or employment records as may be necessary to enable it to fully comply with the law imposing the aforesaid contributions or taxes.

11.7.7.3 If the Owner is required by law to and does pay any and/or all of the aforesaid contributions or taxes, the Contractor shall forthwith reimburse the Owner for the entire amount so paid by the Owner.

ARTICLE 12: UNCOVERING AND CORRECTION OF WORK

12.1 The Contractor shall promptly correct Work rejected by the Owner or failing to conform to the requirements of the Contract Documents, whether observed before or after Substantial Completion and whether or not fabricated, installed or completed, and shall correct any Work found to be not in accordance with the requirements of the Contract Documents within a period of two years from the date of Substantial Completion, or by terms of an applicable special warranty required by the Contract Documents. The provisions of this Article apply to work done by Subcontractors as well as to Work done by direct employees of the Contractor.

12.2 At any time during the progress of the work, or in any case where the nature of the defects shall be such that it is not expedient to have them corrected, the Owner, at their option, shall have the right to deduct such sum, or sums, of money from the amount of the contract as they consider justified to adjust the difference in value between the defective work and that required under contract including any damage to the structure.

ARTICLE 13: MISCELLANEOUS PROVISIONS

13.1 CUTTING AND PATCHING

13.1.1 The Contractor shall be responsible for all cutting and patching. The Contractor shall coordinate the work of the various trades involved.

13.2 DIMENSIONS

13.2.1 All dimensions shown shall be verified by the Contractor by actual measurements at the project site. Any discrepancies between the drawings and specifications and the existing conditions shall be referred to the Owner for adjustment before any work affected thereby has been performed.

13.3 LABORATORY TESTS

13.3.1 Any specified laboratory tests of material and finished articles to be incorporated in the work shall be made by bureaus, laboratories or agencies approved by the Owner and reports of such tests shall be submitted to the Owner. The cost of the testing shall be paid for by the Contractor.

- 13.3.2 The Contractor shall furnish all sample materials required for these tests and shall deliver same without charge to the testing laboratory or other designated agency when and where directed by the Owner.
- 13.4 ARCHAEOLOGICAL EVIDENCE
- 13.4.1 Whenever, in the course of construction, any archaeological evidence is encountered on the surface or below the surface of the ground, the Contractor shall notify the authorities of the State Historic Preservation Office and suspend work in the immediate area for a reasonable time to permit those authorities, or persons designated by them, to examine the area and ensure the proper removal of the archaeological evidence for suitable preservation by the Division of Historical and Cultural Affairs.
- 13.5 GLASS REPLACEMENT AND CLEANING
- 13.5.1 The General Contractor shall replace without expense to the Owner all glass broken during the construction of the project. If job conditions warrant, at completion of the job the General Contractor shall have all glass cleaned and polished.
- 13.6 WARRANTY
- 13.6.1 For a period of two (2) years from the date of substantial completion, as evidenced by the date of final acceptance of the work, the contractor warrants that work performed under this contract conforms to the contract requirements and is free of any defect of equipment, material or workmanship performed by the contractor or any of his subcontractors or suppliers. However, manufacturer's warranties and guarantees, if for a period longer than two (2) years, shall take precedence over the above warranties. The contractor shall 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

EMPLOYEE DRUG TESTING REPORT FORM

Period Ending:_____

4104 Regulations for the Drug Testing of Contractor and Subcontractor Employees Working on Large Public Works Projects requires that Contractors and Subcontractors who work on Large Public Works Contracts funded all or in part with public funds maintain testing data that includes but is not limited to the data elements below.

Project Number: _____

Project Name: _____

Contractor/Subcontractor Name: _____

Contractor/Subcontractor Address: _____

Number of employees who worked on the jobsite during the report period: _____

Number of employees subject to random testing during the report period: _____

Number of Negative Results _____ Number of Positive Results _____

Action taken on employee(s) in response to a failed or positive random test:

Date: _____

This form is not required to be submitted to the Owner. Included as a reference to show information required to be maintained by the Contractor. The Owner shall have the right to periodically audit all Contractor and Subcontractor test results at the Contractor's or Subcontractor's offices (or by other means to make the data available for inspection by the Owner).

**EMPLOYEE DRUG TESTING
REPORT OF POSITIVE RESULTS**

4104 Regulations for the Drug Testing of Contractor and Subcontractor Employees Working on Large Public Works Projects requires that Contractors and Subcontractors who work on Large Public Works Contracts funded all or in part with public funds to notify the Owner in writing of a positive random drug test.

Project Number: _____

Project Name: _____

Contractor/Subcontractor Name: _____

Contractor/Subcontractor Address: _____

Name of employee with positive test result: _____

Last 4 digits of employee SSN: _____

Date test results received: _____

Action taken on employee in response to a positive test result:

Authorized Representative of Contractor/Subcontractor: _____
(typed or printed)

Authorized Representative of Contractor/Subcontractor: _____
(signature)

Date: _____

This form shall be sent by mail to the Owner within 24 hours of receipt of test results.

Enclose this test results form in a sealed envelope with the notation "Drug Testing Form – DO NOT OPEN" on the face thereof and place in a separate mailing envelope.

DARLEY ROAD EARLY EDUCATION CENTER, BOILER/CHILLER REPLACEMENT,
500 DARLEY ROAD, CLAYMONT, DE 19703
BSD270001-CHILLERDRD

**AFFIDAVIT OF
CRAFT TRAINING COMPLIANCE**

We, the contractor, hereby certify that we and all applicable subcontractors will abide by the contractor and subcontractor craft training requirements outlined below for the duration of the contract. Craft training must be provided by a contractor and/or subcontractor for each craft on a project for which there are Delaware Department of Labor approved and registered training programs or, if the contractor and/or subcontractor meets the requirements under Title 29, Chapter 69, Section 6960A.(b)(1)c.1.-3., payment may be made in accordance with Title 29, Chapter 69, Section 6960A.(b)(1)d. A list of crafts for which there are approved and registered training programs is maintained by the Delaware Department of Labor and can be found at:

<https://laborfiles.delaware.gov/main/det/apprenticeship/DE%20Craft%20Training%20Occupation%20List%20Effective%20March%201%202022.pdf>. If you have questions regarding craft training programs, please submit all questions in writing to the Delaware Department of Labor at: apprenticeship@delaware.gov. ***This Affidavit of Craft Training Compliance must be submitted prior to contract execution.***

In accordance with Title 29, Chapter 69, Section 6960A.(a)(1), a contract relating to a public works project under § 6962 of Title 29 must include a craft training program for each craft in the project if at the time the contractor executes a public works contract, all of the following apply:

- a. A project meets the prevailing wage requirement under Section 6960 of Title 29.
- b. The contractor employs 10 or more total employees.
- c. The project is not a federal highway project, except for the project under Section 6962(c)(11) of Title 29.
- d. There is an apprenticeship program for a craft in the project on the list of crafts under Section 204(b)(2) of Title 19.

Pursuant to Title 29, Chapter 69, Section 6960A.(a)(2), ***a contractor must commit that all subcontractors provide craft training*** if paragraph (a)(1) of this section applies to the subcontractor. Failure to provide required craft training or payment on the project may subject the successful contractor and/or subcontractor(s) to penalties as outlined in Title 29, Chapter 69, Section 6960A.(d)(1)-(3).

Craft(s): _____

Contractor Name: _____

Contractor Address: _____

**Contractor Program
Registration Number(s)**

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

00 81 15 - 2

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 by Owner.
- 4. Access to site.
- 5. Coordination with occupants.
- 6. Work restrictions.
- 7. Specification and drawing conventions.
- 8. Miscellaneous provisions.

B. Related Requirements:

- 1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

A. Project Identification: Darley Road Early Education Center Boiler/Chiller Replacement

- 1. Project Location: 500 Darley Road, Claymont, DE 19703

B. Owner: Brandywine School District

- 1. Owner's Representative: John Read, Director of Facilities

C. Architect: BSA+A, 954 Justison Street, Wilmington, DE 19801

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of demolition and new construction for the following:

- 1. Boiler & Chiller replacement.

B. Type of Contract:

1. Project will be constructed under a single prime contract.

1.5 WORK BY OWNER

- A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.
- B. The owner will be responsible for any asbestos or hazardous materials testing or abatement discovered during the demolition phase, or if required by Regulatory agencies.

1.6 COORDINATION

- A. Contractor shall be responsible to coordinate their work with the work of others, including, but not limited to, the preparation of general coordination drawings, diagrams and schedules, and control of site utilization, from the beginning of activity, through project close-out and warranty periods.
- B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 1. Limits: Confine construction operations to areas within the Contract limits any additional areas where work is permitted by owner.
 2. Driveways, Walkways and Entrances: Keep driveway, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Coordinate with school administration to schedule deliveries to minimize use of driveways and entrances by construction operations.

1.7 COORDINATION WITH OCCUPANTS

- A. Full Owner Occupancy: Owner will occupy Project site and existing building(s) during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.
 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
 2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

1.8 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

- B. On-Site Work Hours: Limit work in conjunction with the existing surrounding building to normal business working hours of 6:30 a.m. to 4:30 p.m., Monday through Friday, unless otherwise indicated.
 - 1. Weekend Hours: Must be arranged in advance.
 - 2. Early Morning Hours: Provide 72 hours' notice.
 - 3. Hours for Utility Shutdowns: Must be arranged in advance.
- C. Contractor is responsible for having a competent project superintendent/foreman on-site during all work performed under its contract. In the event the Contractor has non-English speaking employees or subcontractors on the project, they shall have a superintendent or foreman on site, at all times, who speaks English and can communicate with Contractor's employees. Should the Contractor fail to meet this requirement, at any time, The Owner may direct all Work to stop until the proper supervision is on site. The Contractor will be responsible for maintaining the project work schedule and make up at its own expense, any delay to the Schedule resulting from the work stoppage.
- D. Nonsmoking site: Smoking, use of tobacco products and e-cigarettes is not permitted anywhere on the job site and school property. Violators of this policy are to be placed on notice for the first offense and removed from the job site with a second offense.
- E. Fire arms, ammunition, explosives, etc. are prohibited from anywhere on the property. Contractor employees, subcontractors or contract workers violating this policy are to be immediately removed from the site. Law enforcement official may be notified.
- F. Controlled Substances: Use or possession of controlled substances or illegal drugs is prohibited on the property. Contractor employees, subcontractors or contract workers violating this policy are to be immediately removed from the site. Law enforcement official may be notified.
 - 1. All public works contracts (paid) with public funds must include provisions requiring the contractor, its agents and employees to implement (a) mandatory drug testing program(s) for all employees or agents working on the job site in non-clerical positions. Provisions governing mandatory drug testing shall be incorporated into all public works contracts..." "The rules governing the administration of such tests by the contractor shall be promulgated by the Director of the Office of Management and Budget." [in accordance with 29Del.C.§6908(a)(b)]
- G. Employee Identification: The contractor will work with the school district to implement an employee badge program during the project. Employees of contractor, sub contractors, and suppliers are to be prepared to provide identification at all times while on school property including project area, other areas of the school, exterior open and parking areas.
 - 1. Maintain list of approved screened personnel with Owner's representative.
- H. Interaction or Photography of school employees, staff, students, or guests are prohibited. Violators are to be immediately removed from the construction site for the duration of the project.
- I. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than two days in advance of proposed utility interruptions.
 - 2. Obtain Owner's written permission before proceeding with utility interruptions.

- J. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
 - 1. Notify Owner not less than two days in advance of proposed disruptive operations.
 - 2. Obtain Owner's written permission before proceeding with disruptive operations.
- K. Radios are not permitted to be operated while students are in the building (see work restrictions). Radios are permitted after students leave and while administration is occupying the building, but volume is to be carefully monitored to not disturb school occupants.

1.9 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.
- B. Related Requirements:
 - 1. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
 - 2. Section 014000 "Quality Requirements" for general testing and inspecting requirements.

1.3 DEFINITIONS

- A. Unit price is a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, **applicable taxes**, overhead, and profit.
- B. Measurement and Payment: 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 schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

END OF SECTION 01 22 00

SECTION 01 25 00 - SUBSTITUTION PROCEDURES

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 substitutions.
- B. Related Requirements:
 - 1. Division 01 Section "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.
 - 2. Divisions 02 through 33 Sections for specific requirements and limitations for substitutions.

1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

- A. 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 facsimile of form provided in Project Manual.
 - 2. Documentation: Provide the following as applicable to show compliance with requirements for substitutions:
 - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
 - b. Coordination information, including a list of changes or revisions 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. Include annotated copy of applicable Specification Section. Significant qualities

- may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
- d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. Certificates and qualification data, where applicable or requested.
 - g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
 - j. 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 date of receipt of purchase order, lack of availability, or delays in delivery.
 - k. Cost information, including a proposal of change, if any, in the Contract Sum.
 - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
 - m. 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 Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
 - b. Use specified product if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
1. Conditions: Architect 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:
- a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Requested substitution provides sustainable design characteristics that specified product provided for achieving LEED prerequisites and credits.
 - c. Substitution request is fully documented and properly submitted.
 - d. Requested substitution will not adversely affect Contractor's construction schedule.
 - e. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - f. Requested substitution is compatible with other portions of the Work.
 - g. Requested substitution has been coordinated with other portions of the Work.
 - h. Requested substitution provides specified warranty.
 - i. 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.
- B. Substitutions for Convenience: Not allowed unless otherwise indicated.
- C. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after the commencement of the Work. Requests received after that time may be either considered or rejected at discretion of Architect.
1. Conditions: Architect 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:
- a. 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.
 - b. Requested substitution does not require extensive revisions to the Contract Documents.
 - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - d. Requested substitution provides sustainable design characteristics that specified product provided for achieving LEED prerequisites and credits.
 - e. Substitution request is fully documented and properly submitted.
 - f. Requested substitution will not adversely affect Contractor's construction schedule.
 - g. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - h. Requested substitution is compatible with other portions of the Work.
 - i. Requested substitution has been coordinated with other portions of the Work.

- j. Requested substitution provides specified warranty.
- k. 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.

PART 3 - EXECUTION (Not Used)

END OF SECTION



SUBSTITUTION REQUEST

Project: _____ Substitution Request Number: _____

From: _____
To: _____ Date: _____

A/E Project Number: _____
Re: _____ Contract For: _____

Specification Title: _____ Description: _____
Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____
Manufacturer: _____ Address: _____ Phone: _____
Trade Name: _____ Model No.: _____
Installer: _____ Address: _____ Phone: _____

History: ☐ New product ☐ 2-5 years old ☐ 5-10 yrs 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 ☐ _____



SUBSTITUTION REQUEST

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 the 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 01330.
☐ Substitution approved as noted - Make submittals in accordance with Specification Section 01330.
☐ Substitution rejected - Use specified materials.
☐ Substitution Request received too late - Use specified materials.

Signed by: _____ Date: _____

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

SECTION 01 26 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
 - 1. Division 01 Section "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the 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. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposal Request or] 20 days, when not otherwise specified, 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 costs of labor and supervision directly attributable to the change.
 - d. 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.
- e. Quotation Form: Use CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail." or forms acceptable to owner and / or Architect.
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
- 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 costs of labor and supervision directly attributable to the change.
 - 5. 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.
 - 6. Comply with requirements in Division 01 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
 - 7. Proposal Request Form: Use CSI Form 13.6A, "Change Order Request (Proposal)," with attachments CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail" or form acceptable to Owner and / or Architect.

1.5 ADMINISTRATIVE CHANGE ORDERS

- A. Allowance Adjustment: See Division 01 Section "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.
- B. Unit-Price Adjustment: See Division 01 Section "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.6 CHANGE ORDER PROCEDURES

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

1.7 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

SECTION 01 29 00 - PAYMENT PROCEDURES

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 necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Division 01 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 2. Division 01 Section "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.
 - 3. Division 01 sustainable design requirements Section for administrative requirements governing submittal of cost breakdown information required for LEED documentation.

1.3 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets.
 - b. Submittal schedule.
 - c. Items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
 - 3. Sub-schedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide sub-schedules showing values coordinated with each phase of payment.

4. Sub-schedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide sub-schedules showing values coordinated with each element.
 5. Sub-schedules for Separate Design Contracts: Where the Owner has retained design professionals under separate contracts who will each provide certification of payment requests, provide sub-schedules showing values coordinated with the scope of each design services contract as described in Division 01 Section "Summary."
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Architect's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 2. Arrange schedule of values consistent with format of AIA Document G703.
 3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
 4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
 - a. Include separate line items under Contractor and principal subcontracts for LEED documentation and other Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
 5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
 6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

- a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.
7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
9. Purchase Contracts: Provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate owner payments or deposits, if any, and balance to be paid by Contractor.
10. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
11. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment Application Times: Submit Application for Payment to Architect by the 30th of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.
 1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.
- D. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- E. Application for Payment Forms: Use forms provided by Owner for Applications for Payment. Sample copies are included in Project Manual.
- F. Application for Payment Forms: Use forms acceptable to Architect and Owner for Applications for Payment. Submit forms for approval with initial submittal of schedule of values.

- G. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
 4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
- H. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- I. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- J. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 2. When an application shows completion of an item, submit conditional final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

- K. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 2. When an application shows completion of an item, submit conditional final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 5. Waiver Forms: Submit executed waivers of lien on forms, acceptable to Owner.
- L. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values.
 3. LEED submittal for project materials cost data.
 4. Contractor's construction schedule (preliminary if not final).
 5. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
 6. Products list (preliminary if not final).
 7. LEED action plans.
 8. Schedule of unit prices.
 9. Submittal schedule (preliminary if not final).
 10. List of Contractor's staff assignments.
 11. List of Contractor's principal consultants.
 12. Copies of building permits.
 13. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 14. Initial progress report.
 15. Report of preconstruction conference.
 16. Certificates of insurance and insurance policies.
 17. Performance and payment bonds.
 18. Data needed to acquire Owner's insurance.
- M. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- N. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.

2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. Evidence that claims have been settled.
7. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
8. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

Application and Certificate for Payment

TO OWNER:	PROJECT: sample	APPLICATION NO: 001	Distribution to:
		PERIOD TO:	OWNER:
		CONTRACT FOR: General Construction	ARCHITECT:
FROM	VIA	CONTRACT DATE:	CONTRACTOR:
CONTRACTOR:	ARCHITECT:	PROJECT NOS: / /	FIELD:
			OTHER:

CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract. Continuation Sheet, AIA Document G703, is attached.

1. ORIGINAL CONTRACT SUM	\$ 0.00
2. NET CHANGE BY CHANGE ORDERS	\$ 0.00
3. CONTRACT SUM TO DATE (Line 1 ± 2)	\$ 0.00
4. TOTAL COMPLETED & STORED TO DATE (Column G on G703)	\$ 0.00
5. RETAINAGE:	
a. 0 % of Completed Work (Column D + E on G703)	\$ 0.00
b. 0 % of Stored Material (Column F on G703)	\$ 0.00
Total Retainage (Lines 5a + 5b or Total in Column I of G703)	\$ 0.00
6. TOTAL EARNED LESS RETAINAGE	\$ 0.00
(Line 4 Less Line 5 Total)	
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT	\$ 0.00
(Line 6 from prior Certificate)	
8. CURRENT PAYMENT DUE	\$ 0.00
9. BALANCE TO FINISH, INCLUDING RETAINAGE	
(Line 3 less Line 6)	\$ 0.00

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner	\$ 0.00	\$ 0.00
Total approved this Month	\$ 0.00	\$ 0.00
TOTALS	\$ 0.00	\$ 0.00
NET CHANGES by Change Order	\$	0.00

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

CONTRACTOR:

By: _____ Date: _____
State of: _____

County of: _____

Subscribed and sworn to before
me this _____ day of _____

Notary Public:

My Commission expires: _____

ARCHITECT'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based on on-site observations and the data comprising this application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED \$ 0.00

(Attach explanation if amount certified differs from the amount applied. Initial all figures on this Application and on the Continuation Sheet that are changed to conform with the amount certified.)

ARCHITECT:

By: _____ Date: _____

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.



Continuation Sheet

AIA Document G702, APPLICATION AND CERTIFICATION FOR PAYMENT, containing Contractor's signed certification is attached.

In tabulations below, amounts are in US dollars.

Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NO: 001

APPLICATION DATE: _____

PERIOD TO:

ARCHITECT'S PROJECT NO:

[illegible]

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

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 provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. Requests for Information (RFIs).
 - 4. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Related Requirements:
 - 1. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
 - 2. Division 01 Section "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 3. Division 01 Section "Closeout Procedures" for coordinating closeout of the Contract.
 - 4. Division 01 Section "General Commissioning Requirements" for coordinating the Work with Owner's Commissioning Authority.

1.3 DEFINITIONS

- A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

- A. 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.

- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
 - 1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
 - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 2. Coordinate installation of different components with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
 - 3. Make adequate provisions to accommodate items scheduled for later installation.
- C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Contractor's construction schedule.
 - 2. Preparation of the schedule of values.

3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Preinstallation conferences.
 7. Project closeout activities.
 8. Startup and adjustment of systems.
- E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.6 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, and Architect, within three days of the meeting.
- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after the execution of the Agreement.
1. Conduct the conference to review responsibilities and personnel assignments.
 2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule
 - b. Critical work sequencing and long-term lead items.
 - c. Designation of key personnel and their duties.
 - d. Lines of communication.
 - e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for RFI's.
 - g. Procedures for testing and inspecting.
 - h. Procedures for processing Applications for Payment.
 - i. Distribution of the Contract Documents.
 - j. Submittal Procedures.
 - k. Preparation of Record Documents.

- l. Us of the premises and existing buildings.
 - m. Work restrictions.
 - n. Working hours.
 - o. Owner's occupancy requirements.
 - p. Responsibility for temporary facilities and controls.
 - q. Procedures for moisture and mold control.
 - r. Procedures for disruptions and shutdowns.
 - s. Construction waste management and recycling.
 - t. Parking availability.
 - u. Office, work, and storage areas.
 - v. Equipment deliveries and priorities.
 - w. First aid.
 - x. Security.
 - y. Progress cleaning.
 4. Reporting: Record and distribute minutes of the meeting to each party present and to other parties requiring information.
- C. Progress Meetings: Conduct progress meetings at biweekly intervals.
1. Coordinate dates of meetings with preparation of payment requests.
 2. Attendees: In addition to representatives of Owner, and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Progress cleaning.
 - 10) Quality and work standards.
 - 11) Status of correction of deficient items.

- 12) Field observations.
 - 13) Status of RFIs.
 - 14) Status of proposal requests.
 - 15) Pending changes.
 - 16) Status of Change Orders.
 - 17) Pending claims and disputes.
 - 18) Documentation of information for payment requests.
4. Reporting: Record and distribute minutes of the meeting to each party present and to other parties requiring information.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Startup construction schedule.
 - 2. Contractor's construction schedule.
 - 3. Construction schedule updating reports.
 - 4. Daily construction reports.
 - 5. Material location reports.
 - 6. Site condition reports.
 - 7. Special reports.
- B. Related Requirements:
 - 1. Division 01 Section "Multiple Contract Summary" for preparing a combined Contractor's construction schedule.
 - 2. Division 01 Section "Submittal Procedures" for submitting schedules and reports.
 - 3. Division 01 Section "Quality Requirements" for submitting a schedule of tests and inspections.

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 Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.
- C. 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.

- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- E. Event: The starting or ending point of an activity.
- F. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time belongs to Owner.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. Working electronic copy of schedule file, where indicated.
 - 2. PDF electronic file.
- B. Startup construction schedule.
 - 1. Approval of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.
- C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
- E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
 - 1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
 - 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
 - 3. Total Float Report: List of all activities sorted in ascending order of total float.
 - 4. Earnings Report: Compilation of Contractor's total earnings from commencement of the Work until most recent Application for Payment.
- F. Construction Schedule Updating Reports: Submit with Applications for Payment.
- G. Daily Construction Reports: Submit at weekly intervals.

- H. Material Location Reports: Submit at weekly intervals.
- I. Site Condition Reports: Submit at time of discovery of differing conditions.
- J. Special Reports: Submit at time of unusual event.
- K. Qualification Data: For scheduling consultant.

1.5 QUALITY ASSURANCE

- A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.
- B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:
 - 1. Review software limitations and content and format for reports.
 - 2. Verify availability of qualified personnel needed to develop and update schedule.
 - 3. Discuss constraints, including work stages.
 - 4. Review delivery dates for Owner-furnished products.
 - 5. Review schedule for work of Owner's separate contracts.
 - 6. Review submittal requirements and procedures.
 - 7. Review time required for review of submittals and resubmittals.
 - 8. Review requirements for tests and inspections by independent testing and inspecting agencies.
 - 9. Review time required for Project closeout and Owner startup procedures, including commissioning activities.
 - 10. Review and finalize list of construction activities to be included in schedule.
 - 11. Review procedures for updating schedule.

1.6 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, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from entities involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. 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.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main 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. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - a. HVAC / Mechanical Equipment.
 - 3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 - 4. Startup and Testing Time: Include no fewer than **15** days for startup and testing.
 - 5. 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.
 - 6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
 - 7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Mockups.
 - e. Fabrication.
 - f. Sample testing.
 - g. Deliveries.
 - h. Installation.
 - i. Tests and inspections.
 - j. Adjusting.
 - k. Curing.
 - l. Building flush-out.
 - m. Startup and placement into final use and operation.

8. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - a. Structural completion.
 - b. Temporary enclosure and space conditioning.
 - c. Permanent space enclosure.
 - d. Completion of mechanical installation.
 - e. Completion of electrical installation.
 - f. Substantial Completion.
 - C. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.
 - D. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
 1. See Division 01 Section "Payment Procedures" for cost reporting and payment procedures.
 - E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
 1. Unresolved issues.
 2. Unanswered Requests for Information.
 3. Rejected or unreturned submittals.
 4. Notations on returned submittals.
 5. Pending modifications affecting the Work and Contract Time.
 - F. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.
 - G. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.
- 2.2 STARTUP CONSTRUCTION SCHEDULE
- A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within seven 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 for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days of date established for commencement of the Work. Base schedule on the startup construction schedule and additional information received since the start of Project.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
 - 1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.4 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, including presence of rain or snow.
 - 7. Accidents.
 - 8. Meetings and significant decisions.
 - 9. Unusual events (see special reports).
 - 10. Stoppages, delays, shortages, and losses.
 - 11. Meter readings and similar recordings.
 - 12. Emergency procedures.
 - 13. Orders and requests of authorities having jurisdiction.
 - 14. Change Orders received and implemented.
 - 15. Construction Change Directives received and implemented.
 - 16. Services connected and disconnected.
 - 17. Equipment or system tests and startups.
 - 18. Partial completions and occupancies.
 - 19. Substantial Completions authorized.
 - 20. Material stored prior to previous report and remaining in storage.
 - 21. Material stored prior to previous report and since removed from storage and installed.
 - 22. Material stored following previous report and remaining in storage.
- B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner within one day(s) 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. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.
 - 1. In-House Option: Owner may waive the requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
 - 2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.
- B. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before 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. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 - 3. As the Work progresses, indicate final completion percentage for each activity.
- C. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 - 1. Post copies in Project meeting rooms and temporary field offices.
 - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION

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. Section includes administrative and procedural requirements for the following:
 - 1. Preconstruction photographs.
 - 2. Periodic construction photographs.
 - 3. Final completion construction photographs.
 - 4. Preconstruction video recordings.
 - 5. Web-based construction photographic documentation.
- B. Related Requirements:
 - 1. Division 01 Section "Unit Prices" for procedures for unit prices for extra photographs.
 - 2. Division 01 Section "Submittal Procedures" for submitting photographic documentation.
 - 3. Division 01 Section "Closeout Procedures" for submitting photographic documentation as project record documents at Project closeout.
 - 4. Division 01 Section "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.
 - 5. Division 31 Section "Site Clearing" for photographic documentation before site clearing operations commence.

1.3 INFORMATIONAL SUBMITTALS

- A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- B. Digital Photographs: Submit image files within three days of taking photographs.
 - 1. Format: High Resolution, in unaltered original files, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
 - 2. Identification: Provide the following information with each image description in file metadata tag:
 - a. Name of Project.
 - b. Name and contact information for photographer.
 - c. Name of Architect.

- d. Name of Contractor.
- e. Date photograph was taken.
- f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
- g. Unique sequential identifier keyed to accompanying key plan.

1.4 QUALITY ASSURANCE

- A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

1.5 USAGE RIGHTS

- A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in High Resolution JPG format.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

- A. Photographer: Engage a qualified individual to take construction photographs.
- B. 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. Maintain key plan with each set of construction photographs that identifies each photographic location.
- C. Digital Images: High Resolution JPEG, without alteration, manipulation, editing, or modifications using image-editing software.
 - 1. Date and Time: Include date and time in file name for each image.
 - 2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect.
- D. Web-Based Image Access: Password-protected access for Project team administered by Contractor, providing current image access and archival image access by date and time, with images downloadable to viewer's device.

- E. Periodic Construction Photographs: Take photographs as necessary to document the construction progress.
- F. Architect-Directed Construction Photographs: From time to time, Architect will instruct photographer about number and frequency of 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.
- G. Final Completion Construction Photographs: Take 20 color photographs after date of Substantial Completion for submission as project record documents. Architect will inform photographer of desired vantage points.
- H. Additional Photographs: Architect may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.
 - 1. Three days' notice will be given, where feasible.
 - 2. In emergency situations, take additional photographs within 24 hours of request.
 - 3. Circumstances that could require additional photographs include, but are not limited to, the following:
 - a. Special events planned at Project site.
 - b. Immediate follow-up when on-site events result in construction damage or losses.
 - c. Photographs to be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
 - d. Substantial Completion of a major phase or component of the Work.
 - e. Extra record photographs at time of final acceptance.
 - f. Owner's request for special publicity photographs.

END OF SECTION

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
 - 1. Division 01 Section "Payment Procedures" for submitting Applications for Payment and the schedule of values.
 - 2. Division 01 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
 - 3. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 4. Division 01 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 5. Division 01 Section "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."
- C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
 4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for Architect's final release or approval.
 - g. Scheduled date of fabrication.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.
1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings.
 - a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
 - b. Digital Drawing Software Program: The Contract Drawings are available in Autocad, Release 2010.
 - c. Contractor shall execute a data licensing agreement in the form of Agreement included in Project Manual.
 - d. Digital data drawing files will be made available via email(s) to the contractor.
 - e. The following digital data files will be furnished for each appropriate discipline:
 - 1) Floor plans.
 - 2) Reflected ceiling plans.
 - 3) MEP plans.

- 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. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 4. 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 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 10 working 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 10 working 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 15 working days for initial review of each submittal.
 5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 10 working days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
- D. Paper Submittals: Place a permanent label or title block on each submittal item 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 for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Name of subcontractor.
 - g. Name of supplier.
 - h. Name of manufacturer.
 - i. 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., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
 - j. Number and title of appropriate Specification Section.
 - k. Drawing number and detail references, as appropriate.
 - l. Location(s) where product is to be installed, as appropriate.
 - m. Other necessary identification.
 4. Additional Paper 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.
 - a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.
 5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return without review submittals received from sources other than Contractor.
 - a. Transmittal Form for Paper Submittals: Use AIA Document G810.
 - b. Transmittal Form for Paper Submittals: Provide locations on form for the following information:
 - 1) Project name.
 - 2) Date.
 - 3) Destination (To:).
 - 4) Source (From:).
 - 5) Name and address of Architect.
 - 6) Name of Construction Manager.
 - 7) Name of Contractor.
 - 8) Name of firm or entity that prepared submittal.
 - 9) Names of subcontractor, manufacturer, and supplier.
 - 10) Category and type of submittal.
 - 11) Submittal purpose and description.
 - 12) Specification Section number and title.
 - 13) Specification paragraph number or drawing designation and generic name for each of multiple items.
 - 14) Drawing number and detail references, as appropriate.
 - 15) Indication of full or partial submittal.
 - 16) Transmittal number, numbered consecutively.
 - 17) Submittal and transmittal distribution record.
 - 18) Remarks.
 - 19) Signature of transmitter.
- E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 2. Name file with submittal number or other unique identifier, including revision identifier.

- a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software acceptable to Owner, containing the following information:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect.
 - d. Name of Construction Manager.
 - e. Name of Contractor.
 - f. Name of firm or entity that prepared submittal.
 - g. Names of subcontractor, manufacturer, and supplier.
 - h. Category and type of submittal.
 - i. Submittal purpose and description.
 - j. Specification Section number and title.
 - k. Specification paragraph number or drawing designation and generic name for each of multiple items.
 - l. Drawing number and detail references, as appropriate.
 - m. Location(s) where product is to be installed, as appropriate.
 - n. Related physical samples submitted directly.
 - o. Indication of full or partial submittal.
 - p. Transmittal number, numbered consecutively.
 - q. Submittal and transmittal distribution record.
 - r. Other necessary identification.
 - s. Remarks.
5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
 - a. Project name.
 - b. Number and title of appropriate Specification Section.
 - c. Manufacturer name.
 - d. Product name.
- F. Options: Identify options requiring selection by Architect.
- G. Deviations and Additional Information: 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 identification 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 with approval notation from Architect's action stamp.

- 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: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 1. Post electronic submittals as PDF electronic files directly to Architect's FTP site specifically established for Project.
 - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 - 2. Submit electronic submittals via email as PDF electronic files.
 - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 - 3. Action Submittals: Submit four paper copies of each submittal unless otherwise indicated. Architect, will return two copies.
 - 4. Informational Submittals: Submit two paper copies of each submittal unless otherwise indicated. Architect will not return copies.
 - 5. Certificates and Certifications Submittals: Provide a 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.
- 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 published 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 catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams showing factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:
 - a. PDF electronic file.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Architect's digital data drawing files is otherwise permitted.
 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 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 42 inches (750 by 1067 mm).
 3. Submit Shop Drawings in the following format:
 - a. PDF electronic file.
- 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 applicable Specification Section.
 - e. Specification paragraph number and generic name of each item.

3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. 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.
5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Architect will retain two 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 three sets of paired units that show approximate limits of variations.
- E. Product Schedule: 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 indicated in the Contract Documents or assigned by Contractor if none is indicated.
 2. Manufacturer and product name, and model number if applicable.
 3. Number and name of room or space.
 4. Location within room or space.
 5. Submit product schedule in the following format:
 - a. PDF electronic file.
- F. Coordination Drawing Submittals: Comply with requirements specified in Division 01 Section "Project Management and Coordination."
- G. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."
- H. Application for Payment and Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."

- I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Division 01 Section "Quality Requirements."
- J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 01 Section "Closeout Procedures."
- K. Maintenance Data: Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."
- L. LEED Submittals: Comply with requirements specified in Division 01 sustainable design requirements Section.
- M. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- N. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- O. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- P. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- Q. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- R. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- S. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- T. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- U. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. 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.
- V. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- W. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- X. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- Y. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

- B. Project Closeout and Maintenance Material Submittals: See requirements in Division 01 Section "Closeout Procedures."
- C. 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. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:
 - 1. Not Reviewed.
 - 2. Approved as Submitted.
 - 3. Approved as Noted.
 - 4. Revise and Resubmit.
 - 5. Rejected.
- B. 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.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. 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; and comparable products.
- B. Related Requirements:
 - 1. Division 01 Section "Substitution Procedures" for requests for substitutions.
 - 2. Division 01 Section "References" for applicable industry standards for products specified.

1.3 DEFINITIONS

- A. Products: Items obtained 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. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process 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. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," 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 additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

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

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
 - a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
 - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 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, select product 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 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 and vandalism. 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 determine compliance with the Contract Documents and to determine 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. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.
7. 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: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for 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 indicated form properly executed.
 3. See Divisions 02 through 33 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, 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. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.

6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures:
1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 3. Products:
 - a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
 - b. Non-restricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
 4. Manufacturers:
 - a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
 - b. Non-restricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
 5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated 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 requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division 01 Section "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect

will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require 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)

END OF SECTION

SECTION 01 62 00 - MATERIAL AND EQUIPMENT

1. GENERAL CONDITIONS

- 1.1 The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate apply to the Work specified in this Section.
- 1.2 Where work is to be executed under Separate Prime Contracts, the provisions of this Section apply to each Contract.

2. REQUIREMENTS INCLUDED

- 2.1 All materials and equipment incorporated into the Work shall:
 1. be new;
 2. conform to applicable specifications and standards; and
 3. comply with size, make, type and quality specified, or as specifically approved in writing by the Architect.
- 2.2 Manufactured and Fabricated Products shall conform to the following requirements:
 1. Designed, fabricated and assembled in accord with the best engineering and shop practices.
 2. Manufactured like parts of duplicate units to standard sizes and gauges, to be interchangeable.
 3. Two or more items of the same kind shall be identical, by the same manufacturer.
 4. Products shall be suitable for service conditions.
 5. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.
- 2.3 Contractor shall not use materials or equipment for any purpose other than that for which it is designated or is specified.
- 2.4 Materials removed from existing structures shall not be reused in the completed work unless specifically indicated or specified.
- 2.5 For materials and equipment specifically indicated or specified to be reused in the Work:
 1. Contractor shall use special care on removal, handling storage and reinstallation, to assure proper function in the completed Work.
 2. Arrange for transportation, storage and handling of products which require off-site storage, restoration or renovation. Pay all costs for such work.

3. MANUFACTURER'S INSTRUCTIONS

- 3.1 When Contract Documents require that installation of work shall comply with manufacturer's

printed instructions, Contractor shall obtain and distribute copies of such instructions to parties involved in the installation, including two copies to Architect.

1. Maintain one set of complete instructions at the job site during installation and until completion.
- 3.2 Contractor shall handle, install, connect, clean, condition and adjust products in strict accord with such instructions and in conformity with specified requirements.
 1. Should job conditions or specified requirements conflict with manufacturer's instructions, Contractor shall consult with Architect for further instructions.
 2. Contractor shall perform work in accord with manufacturer's instructions. Contractor shall not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents.

4. TRANSPORTATION AND HANDLING

- 4.1 Contractor shall arrange deliveries of Products in accord with construction schedules, coordinate to avoid conflict with work and conditions at the site.
 1. Deliver Products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.
 2. Contractor shall immediately on delivery, inspect shipments to assure compliance with requirements of Contract Documents and approved submittals, and that Products are properly protected and undamaged.
- 4.2 Contractor shall provide equipment and personnel to handle Products by methods to prevent soiling or damage to Products or packaging.

5. STORAGE AND PROTECTION

- 5.1 Contractor shall store Products in accord with manufacturer's instructions, with seals and labels intact and legible.
 1. Contractor shall store Products subject to damage by the elements in weathertight enclosures.
 2. Contractor shall maintain temperature and humidity within the ranges required by manufacture's instructions.
- 5.2 Exterior Storage
 1. Contractor shall store fabricated Products above the ground, on blocking or skids, to prevent soiling or staining. Cover Products which are subject to deterioration with impervious sheet coverings; provide adequate ventilation to avoid condensation.
 2. Contractor shall store loose granular materials in a well-drained area on soiled surfaces to prevent mixing with foreign matter.
- 5.3 Contractor shall arrange storage in a manner to provide easy access for inspection. Contractor shall make periodic inspections of stored Products to assure that Products are maintained under specified conditions, and free from damage or deterioration.

5.4 Contractor shall store flammable materials so as to prevent contact with flames and fire. Conform with manufacturer's recommendations and local laws. Pay particular attention to storage of:

1. Roof insulation.
2. Roofing materials, including solvents.
3. Paint materials.
4. Cleaning and other solvents.
5. Fuels.

5.5 Protection after Installation:

1. Contractor shall provide substantial coverings as necessary to protect installed Products from damage from traffic and subsequent construction operations. Remove when no longer needed.

6. SUBSTITUTIONS AND PRODUCT OPTIONS

6.1 Product List.

1. Within 30 days after Contract Date, Contractor shall submit to Architect a complete list of major products proposed to be used, with the name of the manufacturer and the installing Contractor.

6.2 Contractor's Options.

1. For Products specified only by reference standard, Contractor shall select any Product meeting that standard.
2. For Products specified by naming several Products or manufacturers, Contractor shall select any one of the Products or manufacturers named which complies with the specifications.
3. For Products specified by naming one or more Products or manufacturers and "or equal", Bidders must, during the bidding period, submit a request for substitutions for any Product or manufacturer not specifically named. See provisions in Paragraph 1.6.3.
4. For Products specified by naming only one Product and manufacturer, there is no option; and Contractor shall provide the precise Product specified.

6.3 Substitutions.

1. Until a date no later than ten (10) days before the date Bids are due, Architect will consider written requests from bidders for substitution of Products. Architect will review requests and will notify Bidders in an Addendum if the requested substitution is acceptable.
2. Should the Bidder desire a substitution, it shall submit a separate request for each Product, supported with complete data, with drawings and samples as appropriate, including:
 1. Comparison of the qualities of the proposed substitution with that specified.

2. Changes required in other elements of the Work because of the substitution.
 3. Effect on the construction schedule.
 4. Cost data comparing the proposed substitution with the Product specified.
 5. Any required license fees or royalties.
 6. Availability of maintenance service, and source of replacement materials.
3. Architect, in its sole discretion, shall be the judge of the acceptability of the proposed substitution.
 4. A request for a substitution constitutes a representation that Bidder:
 1. has investigated the proposed Product and determined that it is equal to or superior in all respects to that specified;
 2. will provide the same warranties or bonds for the substitution as for the Product specified;
 3. will coordinate the installation of an accepted substitution into the Work, and make such other changes as may be required to make the Work complete in all respects; and
 4. waives all claims for additional costs, under his responsibility, which may subsequently become apparent.
- 6.4 Architect will review requests for substitutions with reasonable promptness, and notify Bidders, in writing, of the decision to accept or reject the requested substitution. Any decision to accept a substitution must be confirmed in an Addendum issued during the bidding period in order to be valid. Oral approvals will not be binding.

END OF SECTION

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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.
- B. Related Sections include the following:
 - 1. Division 01 Section "Selective Structure Demolition" for demolition of selected portions of the building.
 - 2. Divisions 2 through 49 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
 - 3. Division 07 Section "Penetration Firestopping" for patching fire-rated construction.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place 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 SUBMITTALS

- A. Cutting and Patching Proposal: Submit a proposal describing procedures at least **10** days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
 - 1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
 - 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
 - 3. Products: List products to be used and firms or entities that will perform the Work.
 - 4. Dates: Indicate when cutting and patching will be performed.
 - 5. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.

6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
7. **Architect's Approval:** Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.5 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 operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. **Operating elements include the following:**
 1. Primary operational systems and equipment.
 2. Air or smoke barriers.
 3. Fire-suppression systems.
 4. Mechanical systems piping and ducts.
 5. Control systems.
 6. Communication systems.
 7. Conveying systems.
 8. Electrical wiring systems.
 9. Detention or electronic security systems.
- C. 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.
- D. 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.

1.6 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place 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 in-place 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 in-place finishes or primers.
 - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect in-place 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.
- D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to **prevent** interruption to occupied 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 in-place 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 in-place 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. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 3. **Concrete and 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 31 Sections where required by cutting and patching operations.
 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 6. 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.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 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.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 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 in-place 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 in-place 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.

- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 01 73 29

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.
- B. Related Requirements:
 - 1. Division 01 Section "Photographic Documentation" for submitting final completion construction photographic documentation.
 - 2. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 3. Division 01 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 4. Division 01 Section "Demonstration and Training" for requirements for instructing Owner's personnel.
 - 5. Divisions 02 through 33 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.2 ACTION SUBMITTALS

- A. Product Data: For cleaning agents.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest control inspection.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.5 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
 3. Submit closeout submittals specified in individual Divisions 02 through 33 Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 4. Submit maintenance material submittals specified in individual Divisions 02 through 33 Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Owner. Label with manufacturer's name and model number where applicable.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Owner's signature for receipt of submittals.
 5. Submit test/adjust/balance records.
 6. Submit sustainable design submittals required in Division 01 sustainable design requirements Section and in individual Division 02 through 33 Sections.
 7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 3. Complete startup and testing of systems and equipment.
 4. Perform preventive maintenance on equipment used prior to Substantial Completion.

5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Division 01 Section "Demonstration and Training."
 6. Advise Owner of changeover in heat and other utilities.
 7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
 8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 9. Complete final cleaning requirements, including touchup painting.
 10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect 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, that must be completed or corrected before certificate will be issued.
1. Re-inspection: Request re-inspection 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.

1.6 FINAL COMPLETION PROCEDURES

- A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
 2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: 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.
- B. Inspection: Submit a written request for final inspection to determine acceptance. On receipt of request, Architect 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.
1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization 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. Use CSI Form 14.1A.
 - 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. Submit list of incomplete items in the following format:
 - a. PDF electronic file. Architect will return annotated copy.

1.8 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: 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, or when delay in submittal of warranties might limit Owner's rights under warranty.
- 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, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) 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.
 - 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- C. Provide additional copies of each warranty to include in operation and maintenance manuals.

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.
 - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform 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 designated 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.
 - 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. Remove snow and ice to provide safe access to building.
 - f. 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.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
 - k. Remove labels that are not permanent.
 - l. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
 - p. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Division 01 Section "Temporary Facilities and Controls." Prepare written report.

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
 - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 - 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION

DIVISION 22 – PLUMBING

22 00 00	General Provisions – Plumbing
22 00 10	Basic Materials and Methods – Plumbing
22 00 30	Insulation & Covering – Plumbing
22 01 20	Domestic Water Systems – Plumbing
22 01 30	Gas Piping Systems – Plumbing
22 01 90	Testing – Plumbing

DIVISION 23 – HVAC

23 02 00	General Provisions – HVAC
23 02 10	Basic Materials and Methods – HVAC
23 02 15	Valves
23 02 30	Insulation & Covering – HVAC
23 03 00	Vibration Isolation – HVAC
23 04 00	Heating Generation Equipment
23 04 10	Heating Generation Auxiliary Equipment
23 04 50	Refrigeration Equipment – HVAC
23 05 00	Piping Systems & Accessories – HVAC
23 05 10	Water Treatment (HVAC)
23 06 00	Air Distribution & Accessories – HVAC
23 06 05	Fans
23 09 00	Automatic Temperature Controls (DDC)
23 09 50	Testing & Balancing of Mechanical Systems

SECTION 22 00 00 – GENERAL PROVISIONS - PLUMBING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to work of this Section.
- B. The contractor shall inform themselves of the specifications and drawings constituting the entirety of the project and shall adhere to all requirements affecting its work. In the event of a conflict between these conditions and other contract documents, the more restrictive standards shall govern.

1.2 WORK INCLUDED

- A. Provide labor, materials, equipment and supervision necessary to install complete operating Plumbing Systems as indicated the drawings and specified herein, including all work at the site and within the proposed construction areas to accomplish the required work.

1.3 REGULATIONS, CODES AND STANDARDS

- A. Work shall be performed in accordance with latest adopted codes, regulations and ordinances by authorities having jurisdiction. Observe all safety regulations.
- B. Latest editions of any referenced standards shall govern.
- C. Obtain all municipal and/or the Authorities Having Jurisdiction permits and inspection certificates and pay all charges.
- D. Make or arrange for any/or all inspection agency reviews or visits and pay all charges. This includes communication with each respective agency and/or utility to verify the project system work, coordination responsibilities, fees, back charges, etc., required.
- E. All fees and back charges shall be verified during the bidding phase of the work. Any discrepancy of this item between any utility, inspection agency and the Contractor shall be brought to the attention of the A/E prior to bid opening.
- F. Submission of a bid will be deemed evidence of having complied with these requirements.

1.4 RELATED WORK

- A. Refer to equipment shown or specified in all other applicable Divisions that will require Plumbing services.
- B. Refer to work related to Plumbing as shown on the following contract drawings:
 - Architectural & Structural
 - Mechanical
 - Electrical

1.5 COORDINATION

- A. The Mechanical, Plumbing and Electrical Contractors are responsible to coordinate all manufacturer's recommended circuit breakers, starters, disconnects and fuse sizes for all equipment. Submission of a shop drawing will certify that this has been completed. Any necessary changes required will be included as part of this contract.
- B. Plumbing Contractors shall coordinate scheduling, submittals and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of independent work elements, with provisions to accommodate items that may be installed at a later time.
- C. Plumbing Contractors shall verify utility requirements and all characteristics of operating equipment are compatible with the building utilities. Coordinate the work of all sections related and required for installing, connection and placing in service of all equipment.
- D. Plumbing Contractors shall coordinate all space requirements, supports and installation of all mechanical, electrical, plumbing and fire protection work, which are indicated diagrammatically on the Drawings. Verify routing of all pipes, ducts, conduits and equipment connections. Maximize accessibility for other work, and service requirements for maintenance and repairs.
- E. Obtain written confirmation from all related trade Contractors and the Owner or his representative that requirements, conflicts and coordination issues have been discussed and resolved.

1.6 SUBMITTALS

A. Shop Drawings & Product Data:

- 1. Shop drawings and product data shall be submitted in accordance with Division 1 of these specifications except where herein modified.

NOTE: Submittals will only be reviewed once and resubmittals will be reviewed once. Any other submittals will be billed to the Contractor at the Engineer's standard rates.

- 2. Listed are the required shop drawings and reports required for this project. The Engineer/Owner shall reserve the right to require additional submissions not listed below:
 - All fixtures, equipment and associated devices so listed on the Fixture Schedule on the drawings.
 - Sewage Pumps.
 - Insulation
 - All specified piping systems.
 - All specified valves.
 - Medical Gas Systems, certifier and report.
 - Gauges and thermometers
 - Recirculating pump.

- Hanger and supports including Sumner system.
 - Piping labels and identification.
 - Sump pumps.
 - Testing reports.
 - Sterilization report.
 - Operating/Maintenance manuals.
 - As-Built Drawings.
3. Submittals comprising complete catalog cuts, shop drawings and performance test data for Plumbing materials and equipment as required by other sections of Division 22, shall be submitted for review checking. The Contractor shall review these for conformance to contract documents prior to submission and affix contractor's signature to each submittal certifying that this review has been done. By approving and submitting shop drawings, product data, samples and similar materials, the Contractor represents that the Contractor has determined and verified materials, field measurements and field construction data that relates to the work, and has checked and coordinated this information with all of the requirements contained in the contract documents for the work of all trades.
- a. The Contractor an equipment manufacturer shall clearly identify in all submittals and shop drawings any and all applications standards which require additional work to accommodate this equipment and provide a complete and operational system as described in the contract documents.
 - b. The Contractor shall be completely responsible for any and all additional costs associated with the changes required by this and all other trades.
4. All submittals shall have the following identification data, as applicable, contained therein or permanently adhered thereto.
- a. Project name.
 - b. Project number.
 - c. Sub-contractor's, vendor's and/or manufacturer's name and address.
 - d. Product identification.
 - e. Identification of deviation from contract documents.
 - f. Applicable contract drawings and specification section number.
 - g. Shop drawing title, drawing number, revision number, and date of drawing and revision.
 - h. Resubmit revised or additional submittals as requested.
 - i. Wherever shop drawings or vendor's standard data sheets indicate work to be done "by

others", it shall be the responsibility of the contractor making the submission to identify by name, the contractor who is to do this work. If the contractor named is other than the contractor making the submission, the shop drawing submission must be reviewed by the named contractor and bear his mark of approval, prior to submission to the Architect/Engineer.

- j. Where equipment proposed differs from that shown on the drawings or specified, he shall submit for approval drawings showing the manner in which the layout is affected by the substitution.
 - k. The Contractor shall keep one copy of approved shop drawings at the job site,, filed in a suitable metal container. The shop drawings shall be cataloged and kept in good repair, and shall be available for use by the Owner, Architect and Engineer.
 - l. No equipment shall be ordered, fabricated, etc., before approval of shop drawings.
- B. Contractor is responsible for the shop drawing coordination and interface with the work of other contracts and adjacent work. The relationship of Contractor's work shall be verified as it relates to adjacent and critical features of the work of this and all contracts and materials.

1.7 WARRANTY/GUARANTEE

- A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in all other applicable Divisions, including Division 1, GENERAL REQUIREMENTS. In addition, refer to specifications for special guarantees.
- B. Wherever in the specification sections of this division, reference is made to a specific warranty period, this warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the contract documents.

1.8 SITE INSPECTION

- A. The Contractor shall visit the site, inspect, and become aware of all conditions which may affect the work during the estimation phase of his work and prior to bid openings. Investigate utilities, protection requirements for adjacent facilities, storage locations, and access to the construction area.
- B. Submission of a bid will be deemed evidence of having complied with this requirement.

1.9 SUBSTITUTIONS

- A. Whenever a material, article, piece of equipment or system is identified in the following specification or indicated on the drawings by reference to manufacturers' or vendors' names, trade names, catalog numbers or the like, it is so identified for the purpose of establishing the basis of the Bid.
- B. Substitution approval must be obtained and included as an addendum item prior to the submission of the bid. An approved substitution shall not be considered as an approval for the Contractor or an equipment vender to deviate from the written portion of the specifications unless so stated in the addendum.
- C. The drawings illustrate the space allocated for equipment and the Contractor shall install the equipment accordingly. If changes are required in the building or arrangement due to substitution of equipment, the Contractor making the substitution must pay for the necessary modifications.

- D. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements as indicated on all contract documents and as described within the specifications. This shall include, but shall not be limited to space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades, including all required ancillary items furnished and installed by other trades. If the manufacturer or related bidding contractor does not comply with these requirements, then they shall be responsible for any and all additional costs associated with the changes required by other trades.

1.10 LUBRICATION

- A. Furnish, install and maintain all required lubrication of any equipment operated prior to acceptance by the Owner. Lubrication shall be as recommended by the equipment manufacturer.
- B. Provide one year's supply of lubricants to Owner at date of acceptance.
- C. Verify that required lubrication has taken place prior to any equipment start-up.

1.11 EQUIPMENT START-UP

- A. Verify proper installation by manufacturer or his representative.
- B. Advise General Contractor 2 days prior to actual start-up.
- C. Verify proper operation. Obtain signed statement by manufacturer or his representative that equipment is operating within warranty requirements. Submit statement to General Contractor.

1.12 OPERATION & MAINTENANCE INSTRUCTIONS

- A. Properly and fully instruct Owner's personnel in the operation and maintenance of all systems and equipment.
- B. Ensure that the Owner's personnel are familiar with all operations to carry on required activities.
- C. Such instruction shall be for each item of equipment and each system as a whole.
- D. Provide report that instruction has taken place. Include in the report the equipment and/or systems instructed, date, contractor, Owner's personnel, vendor, and that a complete operating and maintenance manual has been reviewed.
- E. Manual shall include all instructions on operation, maintenance, repair parts list, lubrication requirements, brochures, catalogue cuts, wiring diagrams, piping diagrams, control sequences, service requirements, names and addresses of vendors, suppliers and emergency contacts. Two manuals shall be provided, one hard bound copy and one electronic copy.
- F. Submit manuals for review prior to operating instruction period. Hardcopy manual shall be 8-1/2 x 11" with hard cover, suitably bound. Electronic copy shall be pdf format, with drawings also as AutoCAD format.
- G. Provide to the Owner any special tools necessary for operation and routine maintenance of any of the equipment.

1.13 TOOLS

- A. All equipment furnished by the Contractor which requires special tools or devices other than those normally available to the maintenance or operating staff shall be furnished in duplicate to the Owner, sufficiently marked, packed or boxed for staff usage. The tools provided shall be listed by the Contractor identified as to their use or the equipment applicable in a written transmittal to the Owner.

1.14 CLEANING AND FINISHING

- A. After equipment start-up and all operating tests have been made and the system pronounced satisfactory, each respective Contractor shall go over the entire project, clean all equipment, etc., installed by him and leave in a clean and working condition. Any surfaces found marred after this final cleaning shall be refinished or replaced by each Contractor at no cost to the Owner.
- B. Provide for the safety and good condition of all materials and equipment until final acceptance by the Owner. Protect all materials and equipment from damage. Provide adequate and proper storage facilities during the progress of the work. Special care shall be taken to provide protection for bearings, open connections, pipe coils, pumps, compressors and similar equipment.
- C. All NEW fixtures, piping, finished surfaces and equipment installed shall have all grease, adhesive labels and foreign materials removed.
- D. All new piping installed shall be drained and flushed to remove grease and foreign matter. Pressure regulating assemblies, traps, flush valves and similar items shall be thoroughly cleaned. Remove and thoroughly clean and reinstall all liquid strainer screens after the system has been in operation ten (10) days.
- E. Gas piping shall be blown out with clean compressed air or inert gas.
- F. When connections are made to existing systems, the Contractor shall do all cleaning and purging of the existing systems required to restore them to the condition existing prior to the start of work.
- G. Clean-up: Remove from the premises, all unused material and debris resulting from the performance of work under this section.

PART 2 – PRODUCTS

2.1 GENERAL

- A. All material and equipment shall be new and of present day manufacture, and shall conform to accepted standards of the trade where such a standard has been established for the particular type of equipment or material.
- B. Whenever equipment or material is referred to in the singular, such as "the plumbing fixture", it shall be deemed to apply to as many such items as necessary to complete the work.

2.2 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. During loading, transporting and unloading exercise care to prevent damage to material.
- B. Store all materials in dry enclosures or under protective coverings out of way of work progress.
- C. Material shall not be allowed to be stored directly on ground.

- D. Deliver in manufacturer's original cartons or on skids.
- E. Handle and protect so as to prevent damage to product or any surrounding material.

2.3 CONCRETE

- A. Concrete, if used on this project, shall be in accordance with Section 03300.
- B. The 28-day minimum compressive strength shall be 3000 psi.

PART 3 – EXECUTION

3.1 PROTECTION

- A. Plug or cap open ends of piping systems.
- B. Stored materials shall be covered to prevent damage by inclement weather, sun, dust or moisture.
- C. Protect all installed work until accepted in place by the Owner.
- D. Plates, polished metal escutcheons and other finished devices shall not be installed until masonry, tile, and painting operations are complete unless otherwise protected.
- E. Protect all work from operations which may cause damage such as hauling, welding, soldering, painting, insulating and covering.
- F. Do not remove protective material until equipment is placed in service.

3.2 WORKMANSHIP

- A. Install all work neat, trim and plumb with building lines.
- B. Install work in spaces allocated.
- C. Cutting and patching shall be performed by skilled tradesmen normally employed for the work involved.
- D. Horizontal runs of pipe shall be installed as high as possible, unless noted otherwise.
- E. Trenching, excavation, and backfill for installations of underground plumbing piping shall be in accordance with the correct plumbing code and all local codes and ordinances.

3.3 FASTENERS, HANGERS AND SUPPORTS

- A. Furnish and install all hangers and supports required to suspend, mount, or hang the work.
- B. Furnish and install all miscellaneous steel angles, channels, beams, clips, brackets and anchors necessary to hang or support the work. Provide submissions for review.
- C. Install concrete inserts before concrete is poured.
- D. Drilled inserts shall not be loaded more than 1/4 rated capacity or 200 pounds.

- E. Power-driven fasteners shall not be allowed for piping larger than 2 inches, or equipment. When used they shall not be loaded more than 1/8 rated capacity or 200 pounds.
- F. All hangers, miscellaneous steel, braces and supports shall be galvanized, cadmium plated, or primed steel. Copper tubing shall be supported with copper hangers. No direct contact of dissimilar metals between the piping system and its hanger support shall be permitted.
- G. Piping shall be supported from adjustable clevis type hangers with insulation pipe saddles. Where hangers are 18” or longer, provide lateral bracing at every fourth hanger. See IPC Pipe Support Table below:

PIPE SUPPORT SPACING

Material	Horizontal Max. Feet	Vertical Max. Feet
ABS Pipe	4	10
Aluminum	10	15
Brass	10	10
Brass Tube up to 1-1/4”	6	10
Brass Tube over 1-1/2”	10	10
Cast Iron	5	15
Copper up to 1-1/4”	6	10
Copper over 1-1/4”	10	10
CPVC Up to 1”	3	10
CPVC Over 1”	4	10
Lead Pipe	Continuous	4
PB Pipe/Tubing	2.6 ft. (32”)	10
PVC Pipe	4	10
PEX	2.6 ft. (32”)	10
Steel Tubing	8	10
Steel Pipe	12	15

- H. Support vertical piping at floor levels using approved riser clamps. Clamp material shall be compatible with pipe material. Maximum vertical spacing shall be 10’-0”.
- I. All new piping shall be supported in accordance with the recognized and adopted plumbing and building codes, and their amendments for the township and/or authority having jurisdiction. All new piping hangers and supports furnished and installed shall meet the seismic requirements of the recognized and adopted plumbing and building codes for the township and/or authority having jurisdiction.
- J. Where earthquake loads are applicable in accordance with the locally adopted building code, plumbing hangers and supports shall be designed and installed for the seismic forces in accordance with the locally adopted building code.

3.4 SLEEVES

- A. Provide each pipe passing through a masonry or concrete wall, floor or partition with a sleeve made from standard weight steel pipe for pipe with smooth edges, securely and neatly cemented in place. Provide each pipe passing through a frame or metal partition with a sleeve made from No. 22 gauge galvanized sheet metal, securely fastened in place.

- B. Pipe passing through foundation wall or under foundation shall be provided with relieving arch or steel pipe per IPC Section 305.5.
- C. Be responsible for the proper location and alignment of all sleeves.
- D. Provide hydrostatic seals for sleeves passing through outside walls, below grade, or through hydrostatically sealed slabs or floors on grade. Provide fire-rated seals for all other sleeves.
- E. Install both piping and sleeve seals so as to maintain integrity of seals with expansion and contraction of piping.
- F. Set floor sleeves flush with floor surface in finished areas, 1" above the finished floor in kitchens, cafeterias, and similar service areas unless such areas are slab-on-grade; 1" above the floor in mechanical rooms, pipe chases, pipe spaces and other unfinished areas, unless otherwise indicated, and flush with the underside of slabs. Extend wall and partition sleeves through and cut flush with each surface unless otherwise indicated or specified.
- G. Select sleeves two pipe sizes larger than any pipe that is to remain uncovered, unless otherwise required by the sealing method specified. Where pipes are to be covered, provide sleeves large enough to allow the covering to pass through the sleeves with sufficient clearance for sealing as specified hereinafter. Size sleeves for branch piping from vertical risers large enough to permit vertical expansion at the riser.
- H. Place sleeves imbedded in concrete floors or walls in the forms before concrete is poured; sleeves shall have integral waterstop flanges, where they are to receive either watertight or hydrostatic seals.
- I. Install sleeves passing through above-grade floors of mechanical rooms, toilet rooms, kitchens or similar service areas where liquid leaks or spillover may occur in a watertight manner. Sleeves shall be such that waterproofing membrane can be flashed around and into the sleeve where necessary.
- J. Seal sleeves for pipes passing through ceiling air plenum walls or the floor above air tight in a manner similar to that specified for fire-rated sleeves.
- K. Hydrostatic Sealing Method: Provide compressible synthetic rubber seals, equivalent to LINK SEAL, manufactured by the Thunderline Corporation, or THRUWALL manufactured by O.Z. Gedney. Install seals in accordance with the manufacturer's recommendations to provide air tightness aboveground and hydrostatic sealing belowgrade. Caulking or other type mastic is not acceptable.

3.5 PLATES

- A. Furnish and install chrome plated plates wherever piping passes into finished area.
- B. Plates shall be securely fastened to piping or building construction.
- C. Floor plates shall cover 1 inch sleeve extension.

3.6 OFFSETS, TRANSITIONS, MODIFICATIONS

- A. Furnish and install all offsets necessary to install the work and to provide clearance for other trades.
- B. Maintain adequate headroom and clearance.

- C. Incidental modifications necessary to the installation of the systems shall be made as necessary and as approved by the Architect.

3.7 RECESSES

- A. Furnish information to the General Contractor as to sizes and locations of recesses required to install panels, boxes, and other equipment or devices which are to be recessed in walls.
- B. Make offsets or modifications as required to suit final locations.

3.8 LABELING

- A. All Plumbing equipment such as pumps, and devices requiring identification for operating procedures shall be provided with permanent black laminated micarta white core labels with 3/8 inch letters.
- B. This shall also apply to all controllers, remote start/stop pushbuttons and equipment cabinets.

3.9 FLASHING AND COUNTERFLASHING

- A. Roof drains, vents, roof curbs, etc., shall have counterflashing fittings. General Contractor shall provide flashing.
- B. Piping and conduit thru the roof shall be flashed by the General Contractor. Furnish and install counterflashing.

3.10 ACCESS

- A. Locate all equipment, valves, devices and controllers which may need service in accessible places.
- B. Where access is not available, access panels shall be provided. Furnish access doors to the General Contractor for installation.
- C. Access doors shall be Elmdor, Karp Co., MIFAB or Controlled Air Manufacturing Limited, with 16 gauge frames and 14 gauge steel door, prime painted.
- D. Maintain required access clearances.

3.11 WIRING

- A. Packaged plumbing system equipment shall be furnished with disconnect switches, and magnetic starters, factory furnished and wired by the unit manufacturer.
- B. All control wiring shall be furnished and installed under this Division of the work.
- C. All wiring shall be in accordance with the National Electrical Code and as recommended by the equipment manufacturer.

3.12 UTILITIES

- A. Do not interrupt any utility or service to the Owner without adequate previous notice and schedule.
- B. Arrange and pay for the relocation, disconnection or removal of, or relocate, disconnect or remove

existing utilities and services where such work is shown or where such utilities or services interfere with new construction, whether or not shown. Provide all excavation, backfilling and paving required by such work.

- C. Perform alteration of utilities and services in accordance with the rules, regulations and requirements of the involved utility companies, regulatory agencies having jurisdiction.

3.13 CUTTING AND PATCHING EXTERIOR SURFACES

- A. This Contractor shall be responsible for returning disturbed paved and/or grass areas to original condition where excavation for utilities has been required.
- B. Cut and patch paved areas to match original surface.
- C. Properly tamp backfill before finishing or repairing disturbed area surfaces.

3.14 OPENINGS – CUTTING, REPAIRING

- A. This contractor shall cooperate with the work to be done under other sections in providing information as to openings required in walls, slabs and footings for all piping and equipment, including sleeves where required.
- B. Any drilling or cutting required for the performance of work under this Section, shall be the responsibility of this Contractor and the cost thereof shall be borne by him.
- C. Holes in Concrete: Sleeves shall be furnished, accurately located and installed in forms before pouring of concrete. This contractor shall pay all additional costs for cutting of holes as the result of the incorrect location of sleeves. All holes through existing concrete shall be either core drill or saw cut. All holes required shall have the approval of the Structural Engineer prior to cutting or drilling.
- D. It shall be the responsibility of this Contractor to ascertain that all chases and openings are properly located.

3.15 GUARANTEE

- A. All materials and equipment provided and/or installed under this section of the specifications shall be guaranteed for a period of one year from the date of acceptance of the work by the Owner unless otherwise specified in Division 1. Should any trouble develop during this period due to defective materials or faulty workmanship, the Contractor shall furnish all necessary labor and materials to correct the trouble without any cost to the Owner. Any defective materials or inferior workmanship noticed at time of installation and/or during the guarantee period shall be corrected immediately to the entire satisfaction of the Owner.

In the event of occupancy by the Owner prior to final acceptance of the project, the guarantee date for equipment placed in operation shall be mutually agreed to by the Contractor and the Owner's representative.

3.16 DRAWINGS

- A. The Plumbing Systems are indicated on the Contract Drawings. Certain pertinent information and details required by the Plumbing Work appear on the Architectural, Structural and Electrical Drawings; become familiar with all Drawings; and incorporate all pertinent requirements.

- B. Drawings are diagrammatic and indicate the general arrangement of systems and requirements of the Work. Do not scale Drawings. Exact locations of fixtures and equipment, not specifically shown shall be obtained before starting work.
- C. When indicated on the drawings, plumbing riser diagrams are completely diagrammatic and indicate the intent of the work for both the Contractor, L&I review agencies and/or Authorities Having Jurisdiction. Where valves, shock absorbers, incidental equipment, devices, etc., including execution notes are indicated on the riser diagrams, they shall be so required and installed as part of the system work.

3.17 RECORD DRAWINGS

- A. As-Built record drawings, showing dimensions, locations and depth of all buried and concealed piping, plugged outlets and equipment shall be kept up to date. Master copy shall be kept on the job. No backfilling of trenches shall be permitted until as-built drawings are approved as up-to-date by the Owner/Representative. No plumbing progress payments shall be approved unless as-built drawings are up- to-date. Depth of sewers shall be from a permanent bench mark as shown on the contract drawings. Refer to project record drawings under General Conditions.

END OF SECTION 22 00 00

SECTION 22 00 10 – BASIC MATERIALS AND METHODS - PLUMBING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this Section.

1.2 REFERENCE

- A. Install all piping, fixtures, equipment, etc., to meet the requirements of the following:

New Castle County Department of License and Inspection

New Castle County Department of Sewers

International Plumbing Code

Delaware State Fire Marshal's Office

International Plumbing Code (All applicable sections)

International Mechanical Code (All applicable sections)

International Fuel Gas Code (All applicable sections)

Gas Utility Company

Water Company

NFPA

OSHA

All requirements of the above governing agencies shall be in compliance with the latest issues, rules or regulations in effect.

- B. Appliances and materials governed by UL requirements shall meet such requirements and bear the label.

1.3 QUALITY ASSURANCE

- A. Provide adequate supervision of labor force to assure all aspects of specifications are being fulfilled.
- B. Insure that all work and equipment is installed in accordance with manufacturer's warranty requirements.
- C. Replace all pipes and fittings shown to be defective as a result of testing.

1.4 SUBMITTALS

- A. Submit shop drawings and product data in accordance with Section 220000.
- B. Submit the following:
 - 1. Manufacturer's Product Data on all pipe and fittings to be used in project.
 - 2. Manufacturer's Product Data on all valves to be used in project.
- C. All products and equipment designed for the dispensing of potable water shall be ANSI/NSF 61 and ANSI/NSF 372 certified as “lead free.” Lead free refers to the wetted surface of pipe, fittings and fixtures in potable water systems that have a weighted average lead content $\leq 0.25\%$ per the federal law of the safe drinking water act (sec. 1417) amended 1-4-2011 and other equivalent state regulations. The federal law does not apply to pipes, pipe fittings, plumbing fittings or fixtures that are used exclusively for non-potable services such as manufacturing, industrial processing, irrigation, outdoor watering, or any other uses where water is not anticipated to be used for human consumption. The law specifically excludes toilets, bidets, urinals, fill valves, flushometer valves, tub fillers, shower valves, service saddles, or water distribution main gate valves that are 2 inches in diameter or larger.

1.5 WARRANTY/GUARANTEE

- A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, GENERAL REQUIREMENTS.

PART 2 – PRODUCTS

2.1 STEEL PIPE & FITTINGS

- A. Pipe: ASTM A-53, Schedule 40.
- B. Fittings:
 - 1. Cast iron, threaded, 175 psi, ANSI B-16.4.
 - 2. Malleable iron, threaded, ASA B 16.3.
 - 3. Steel, socket weld, ASTM A-53.
 - 4. Wrought iron, socket weld, ASTM A-72.
- C. Thread tape shall be teflon tape, 3 mils minimum thickness. Teflon tape shall not be permitted for use on gas piping systems.
- D. See Section 220130 for Gas Piping Systems.

2.2 CAST IRON PIPE AND FITTINGS

(Note: Any cast iron piping made or marked “CHINA” will NOT be acceptable on this project)

- A. Aboveground:

1. Pipe & Fittings: Hubless cast iron, CISPI 301, ASTM A-74 and ASTM A-888 (epoxy-coated) shall be marked with the collective trademark of the Cast Iron Institute (soil pipe).
2. Joints: Neoprene sleeve and stainless steel shield and clamp assembly, CISPI 310, ASTM C-1277.

2.3 COPPER TUBING

A. Domestic hot, cold and recirculated water:

1. Aboveground:
 - a. Tubing: Hard-drawn, seamless ASTM B-88, Type "L".
 - b. Fittings: Solder joint wrought copper ANSI B-16.22.
 - c. Joints: Lead-free solder 410°, ASTM B-32 alloy designation "TC", ASTM B-828.
 - d. Flux: Non-toxic and non-corrosive, ASTM B-813.

B. Drainage and vent piping:

1. Aboveground:
 - a. Tubing: Hard-drawn seamless ASTM B-88, ASTM B-75, Type "M" and DWV as pipe size permits.
 - b. Fittings: Solder joint cast copper drainage type ANSI B-16.29.
 - c. Joints: Soldered, 95/5 tin-antimony ASTM B-828, ASTM B-32.
 - d. Flux: Non-toxic and non-corrosive, ASTM B-813.

C. Solder/Flux: See Paragraph 3.4 of this section for Soldering/Brazing.

2.4 VALVES (Copper Systems) – Solder ends of Threaded

- A. Valves listed below shall be for domestic water systems and comply with the latest requirements of NSF 61-8. Refer to individual sections for gas valves.
- B. Ball Valves: NIBCO two-piece, full port, 600 psi WOG rated, cold non-shock valve with reinforced TFE seals, 316 stainless steel ball, Eco-brass body, ASTM 584, Alloy C87850, solder ends, or threaded non-blowout stem design. Acceptable NIBCO figure numbers: T/S 685-80-66-LF; T/S 595-Y-66-LF (3 piece).
- C. Check Valves: NIBCO Class 125, Eco-brass body, ASTM 584, Alloy C87850, swing type, Y Pattern, threaded cap access. Acceptable NIBCO figure number: T/S 413-LF. (NIBCO figure number T/S-413-B for condensate drainage.)
- D. Gate Valves: NIBCO Class 125, Eco-Brass body, ASTM 584, Alloy C87850, Rising Stem. Acceptable NIBCO figure number: T/S 113-LF.

- E. Balance Valves: All balance valves shall be provided with a memory stop feature with calibrated name plate to assure specific valve setting. Bronze body/brass ball, carbon filled TFE seat rings. NIBCO, Bell & Gosset, Accu-Flow, Taco or Flow Design "Accusetter". Acceptable NIBCO figure numbers: T/S 1710, F/G 737.
- F. Strainers:
1. Class 125 Bronze Y-Strainer, body to be ASTM B584 or B62 bronze with threaded, solder or female press end connections and .033 inch perforated type 304 stainless steel screen or 20 mesh type 304 stainless steel screen accessible without removing the strainer from the line. Acceptable Figure numbers: NIBCO Fig. S/T-221, S/T-222, PF-221/222-A,B.
 2. Class 125 Flanged Cast Iron Y-Strainer, body to be ASTM A-126 Class B cast iron. End connections to be Class 125 flanged, tapped bolted bonnet with plug. Screen shall be .033 inch perforated type 304 stainless steel screen or 20 mesh type 304 stainless steel screen accessible without removing the strainer from the line. Acceptable Figure numbers: NIBCO Fig. F 721-A.
 3. Class 250 Threaded Cast Iron Y-Strainer: Strainer body to be ASTM A-126 Class B cast iron. End connections to be Class 250 threaded, tapped screw-in bonnet with plug. Screen shall be .033 inch perforated type 304 stainless steel screen or 20 mesh type 304 stainless steel screen accessible without removing the strainer from the line. Acceptable Figure numbers: NIBCO Fig. T-751-A
- G. VALVES (Copper Systems) – Press Fit
1. Valves listed below shall be for domestic water systems and comply with the latest requirements of NSF-61-8.
 - a. 2 Inch and Smaller Ball Valves (On/Off):

Ball Valves with male or female press to connect shall be rated at 200 PSI CWP to +225°F maximum. Valves shall be manufactured in accordance with MSS SP-110 and constructed of dezincification resistant cast bronze bodies. Brass with more than 15% zinc shall not be approved. Valve shall have reinforced PTFE Seats, Blow-out Proof Stem, Full Port Ball, Chrome/Nickel Plated or Stainless Steel Ball for aggressive water.
 - b. 2 Inch and Smaller Check Valves (Swing Type):

Check valves shall be swing type Y pattern with male or female press to connect ends and shall be rated 200 PSI CWP to + 250°F maximum. Valves shall be manufactured in accordance with MSS SP-80. Body & cap shall be manufactured of dezincification resistant cast bronze ASTM B62 or ASTM B584 Alloy C8440. Valves shall have PTFE seat disc.
 - c. 2 Inch and Smaller Check Valves (Lift or Spring Type):

Incline resilient disc, spring actuated, 250psi rating, non-shock cold working pressure, 2500F maximum working temperature, bronze ASTM B584 alloy C84400. Stainless steel stem and disc holder and spring, EDPM O-ring.
- H. Insofar as possible, all valves of the same type shall be of the same manufacturer.

- I. Valve Manufacturers: Subject to compliance with requirements, provide valves of one of the following:

Apollo/Conbraco

Stockham

Nibco

Milwaukee

Watts

Hammond

Webstone

- J. System Application:

1. Domestic Water:

- a. Check Valves - 2" & Smaller - threaded or soldered.
- b. Ball Valves - 3" & Smaller - threaded or soldered.
- c. Balance Valves - All sizes - threaded.
- d. Butterfly Valves - 4" and larger - flanged.
- e. Butterfly Valves – 3" and smaller – wafer type.

2.5 THERMOMETERS

- A. Separable socket, inserted into fluid flow, adjustable, hermetically sealed, red mercury, die-cast, baked enamel finish, double strength glass lens, white scale and black graduations.
- B. Scale: Select range of thermometer to indicate normal operating temperature at mid-point of scale for domestic water systems.
- C. Manufacturer: U.S. Gauge, H.O. Trerice, Moeller, Duro.

2.6 GAUGES

- A. Phosphor bronze bourdon tube, polypropylene case, gasketed glass crystal, aluminum dial, black graduations 4-1/2 inch diameter.
- B. Range: 0 to 150 psi, 5 pound intervals, 1/2 pound graduations.
- C. Manufacturers: Danton, U.S. Gauge, H.O. Trerice, Moeller.
- D. Install with bronze gauge cock.

2.7 ISOLATING FITTINGS

- A. Furnish isolating fittings between all sections of dissimilar piping materials or piping, general supports, equipment and supports, including piping hanger and rack supports where one material is ferrous and the other is non-ferrous.
- B. Install copper or brass piping or tubing in such a way as not to touch or come in contact with ferrous metals.
- C. Where ferrous piping or equipment is connected to copper or brass piping, make connection with insulating or dielectric unions to prevent electrolytic action between the ferrous and non-ferrous metals.
- D. Where copper or brass piping, tubing or fittings are anchored to, supported by or may come in contact with ferrous metal construction, provide an insulating nonconductor spacer of rubber, fiber or equivalent material to assure prevention of electrolysis.
- E. Manufacturer: Epco Sales, Inc., or insulated unions by Central Plastic Co.

2.8 ANCHORS AND GUIDES

- A. Anchors and guides shall be provided to support and maintain pipes in position and properly distribute expansion. The anchors and guides must be securely fastened to the building structure, and must be completely installed before the system is tested.
- B. Guides shall be as manufactured by J.J. McNally, Inc., Flexonics, Inc., Tube-Turns, American District Steam Co.

2.9 UNIONS

- A. Up to and including 2 inch pipe size: Screwed pattern, bronze-to- bronze seat.
- B. Above 2 inch pipe size: 125 Class Flanged pattern, A.S.A. sweat copper fitting, with gaskets, bolts and nuts.
- C. Copper tubing unions shall have sweated type ends. Flanged unions on copper tubing may be soldered connections.
- D. Materials and pressure ratings shall be the same as specified for the respective pipe and fitting system unless otherwise specified.

PART 3 – EXECUTION

3.1 PIPING SYSTEM INSTALLATION REQUIREMENTS

- A. Drawings are generally diagrammatic and due to small scale, it is impossible to indicate all fittings, valves, gauges and specialties required. Provide complete operating systems and all necessary fittings, valves gauges and specialties whether or not indicated.
- B. Install all piping in accordance with the best practices of the trade and latest code requirements. Use

uniform system materials throughout the building. All branch take-offs shall be off the top of the pipe.

- C. Pipe and fittings shall be clean from cutting burrs, foreign materials and defects in structure and threading. Make all cuts square. Ream after cutting. Clean off scale and dirt inside and outside, before assembly. Remove welding slag or other foreign material.
- D. **Keep all piping as high as possible**, consistent with proper pitch, to maintain maximum headroom. Cut piping accurately to measurements established at the building, work into place without springing, forcing or cutting of the building structure, and install as directly as possible between connecting points parallel with or at right angles to building construction, except as required to obtain pitch.
- E. Unless otherwise shown, run piping within the building, concealed in the walls, furred spaces, pipe spaces or above suspended ceilings. Unless otherwise noted, do not build in or bury horizontal piping in partitions. Install all exposed piping as closely as possible to walls, ceilings and columns, consistent with access and applicable insulation requirements.
- F. This project (may) includes a return air plenum ceiling. Regardless of materials specified, all system piping and/or materials within plenum spaces shall be non-combustible and shall be in full compliance with the requirements set forth in the IPC.
- G. All piping to drain to low points. Low points will be provided with drain valves with hose thread. All piping shall have high points vented with ball valve, nipple and threaded cap.
- H. Do not install trapped lines where water cannot be drained or air can accumulate without being vented.
- I. Piping shall run square with building lines.
- J. Piping shall not be insulated or covered until tested and until building is closed in.
- K. Necessary drains, off-sets, vents and drips shall be provided for coordination of the work as part of the contract.
- L. Piping shall not be installed over electrical transformers, panels, switchgear, substations, and control panels as per the National Electric Code. No piping shall be installed in elevator machine rooms unless it is directly related to the room's system equipment.
- M. Allow clearance for expansion and contraction.
- N. Install isolating fittings between sections of ferrous and non-ferrous pipe or connected equipment.
- O. Valves shall be installed with stems above horizontal.
- P. Valves shall be installed on all sides of equipment and control valves to allow isolation for repair.
- Q. Do not support piping from other piping, conduits or equipment. Provide additional bracing to prevent movement of trapeze piping, or any singular run of pipe to fixtures. Provide additional bracing on all piping through walls to flush valves to prevent movement during normal operation or performing maintenance on valves.
- R. Thermometers and gauges shall be installed where indicated on the drawings, required by equipment

specifications and where indicated elsewhere in the specifications. Gauges shall be located at an elevation that can be readable.

- S. Unions shall be provided adjacent to all valves, at equipment connections, and where necessary to facilitate dismantling of the piping system.
- T. Ball valves to be installed with the proper clearance for operating the valve handle. A minimum clearance of 10" from center of valve to wall must be maintained for ease of operation.
- U. Thermometers are to be located so they can easily be seen from the floor in front of unit. Make final adjustment by tilting thermometer. Locate bulb in waterway with an oversized tee or elbow fitting.
- V. Install pressure gauges on incoming services both domestic water and fire services. Locate pressure gauge after main shut-off valve and ahead of water meter if one is provided within building.
- W. All pipe unions installed shall be accessible. Unions shall not be concealed or located in places where they cannot be maintained.
- X. Support and bracing of 4" and above pipe shall be in accordance with the CISPI Standards and IPC Chapter 3.
- Y. All hangers, anchors, support and guides for piping and equipment shall be securely fastened to the building structure and/or floors with concrete decking with the following exception: Hangers, anchors, support and guides shall not be fastened to or through metal roof decking (i.e. bare metal decking or metal deck supporting a roofing system).
- Z. All new piping shall be supported in accordance with the recognized and adopted plumbing and building codes, and their amendments for the township and/or authority having jurisdiction. All new piping hangers and supports furnished and installed shall meet the seismic requirements of the recognized and adopted plumbing and building codes for the township and/or authority having jurisdiction. Where earthquake loads are applicable in accordance with the locally adopted building code, plumbing hangers and supports shall be designed and installed for the seismic forces in accordance with the locally adopted building code.
- AA. No piping shall be installed in exit stair towers unless directly related to stair tower system equipment.
- BB. Horizontal runs of plumbing piping shall be run as high as possible, unless noted otherwise.

3.2 TAGS, CHARTS, AND IDENTIFICATION

- A. All piping shall be labeled in accordance with IPC 303.1 and 303.4.
- B. Identify each valve in all systems with black, numbered and stamped 1-1/2" brass or aluminum tags fastened to valve by brass chain and S-hook.
- C. Piping Identification: Provide identification and safety products, semi-rigid plastic, wraparound pipe markers with flow arrows and conforming to ANSI A13.1. Locate marker at each valve, changes in direction, where pipes pass thru barriers and every 25' of horizontal runs. Lettering on background shall be in accordance with the following colors:

Legend	Background	Lettering

1. Gas	- Yellow	- Black
2. Fire Protection	- Red	- White
3. Domestic Cold Water	- Green	- White
4. Domestic Hot Water (110° ^ 140°)	- Yellow	- Black
5. Domestic Hot Water Return (110° ^ 140°)	- Yellow	- Black
6. Sanitary Drainage	- Green	- White
7. Condensate Drainage	- Yellow	- Black
8. Vent	- Yellow	- Black
9. Storm Drainage	- Green	- White
10. Medical Gas	Conform to NFPA-99 Regulations	
11. Plant Compressed Air	- Yellow	- Black

D. Provide 1/8" scale diagrams showing location, number and service or function of each tagged item.

1. Provide Owner with one (1) electronic copy of diagram.

a. Include one (1) additional copy in the Operation and Maintenance Manuals.

E. Available Manufacturers: Subject to compliance with requirements, manufacturer's offering identification markers which may be incorporated in the work are limited to the following:

Seton

Brimar

B-Line

Marking Services, Inc.

3.3 WELDING

A. All concealed and inaccessible black steel piping shall be welded.

B. All black steel piping larger than 2 inch shall be fusion welded.

C. All elevated pressure (above 14" WC) natural /propane gas piping within buildings shall be welded joints.

D. All elbows, tees and branch connections shall be made with welding fittings ANSI B16.9.

E. Welding shall be in accordance with the ASME Boiler and Pressure Vessel Code Section IX.

F. Furnish welder test certificate for review. Certificates of successful qualification by the following organizations shall be acceptable.

1. ASME Boiler and Pressure Vessel Code

2. ANSI Code for Pressure Piping

3. National Certified Pipe Welding Bureau

4. Military Specification MIL-STD-248

3.4 SOLDERING/BRAZING

- A. Connections between copper tubing and copper sweat fittings shall be made by soldering using Taramet Sterling or approved substitute. Flux shall be non-corrosive type “Nokorode” or approved substitute or as recommended by the manufacturer of the solder.
- B. All solder shall be “lead nickel and antimony free” in accordance with the Federal Safe Drinking Water Act Amendments of 1986 and 1996 as is ASTM B-32 Grade TC.

Composition:

Tin	95%
Copper	4.0 – 5.0%
Selenium	.04 - .2%
Tensile Strength	7,130 psi
Shear Strength	5,970 psi
Melting temperature	410°F

- C. Tubing shall be cut square and then reamed and deburred. End of tubing and inside of fitting cup shall be cleaned with steel wool and the flux shall be applied to the clean surface before soldering. After soldering, the excess solder shall be wiped off while still plastic.
- D. Silver brazing alloy shall be equal to and shall be used for joints in:
 - 1. Medical Gas Piping (All Systems)
 - 2. Medical Vacuum Piping
 - 3. All pressurized gas piping systems (min pressure compressed air, lab gases, etc) using copper piping.
- E. Brazed Joints:
 - 1. All brazed joints shall be cleaned. An approved flux shall be applied; joint filler metal shall conform to AWS A5.8.
 - 2. Flux shall meet AWS Standard A5.31, Type F83-A or F83-C.
- F. 410 solder shall be used for all joints in:
 - 1. Domestic cold water
 - 2. Domestic hot water

3. Domestic hot water return
 4. Copper drainage piping
 5. Plant compressed air
- G. Lead-Tin (50-50) solder or any solder containing lead shall NOT be used or permitted for joint connections on this project.
- H. Where the silver brazing is performed in a confined non-ventilated space, a non-toxic, cadmium-free brazing alloy such as Stay-Brite shall be used instead of Easy-Flo. Bring joint to solder temperature or brazing temperature in as short a time as possible.
- I. Form continuous solder bead or brazing filler bead around entire circumference of joint.
- J. Wipe excess solder from joint area while solder is still plastic.
- K. Solder joints shall be in accordance with IPC Section 605.2, 605.14.3 and ASTM B838. Flux shall conform to ASTM B-813.
- 3.5 PRESS-FIT SYSTEM
- A. All new domestic water piping installed on this project shall be a solderless, press-fit, domestic water system. The system shall be Viega/Rigid copper press fitting system. Fittings shall be rated 0°F to 250°F at 200 psi and tested to 600 psi.
- B. Fittings shall meet ANSI/NSF 61, – ASME B-16.22 and ASTM B88. Elastomeric seals shall meet ASTM D-2000.
- C. Mechanical joining shall be recognized by:
- IPC International Plumbing Code
- SBCCI Standard Plumbing Code
- IAPMO Uniform Plumbing Code
- PHCC National Standard Plumbing Code
- D. Copper and copper alloy press fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of IAPMO PS 117. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed or an alternative supplied by fitting manufacturer. Press end shall have SC (Smart Connect) feature design (leakage path). Smart Connect™ (SC Feature). In press-fit ½” to 4” dimensions, the Smart Connect Feature assures leakage of liquids and/or gases from inside the system past the sealing element of an unpressed connection. This feature shall provide the installer quick and easy identification of connections which have not been pressed prior to putting the system into operation.
- E. Press Connections: Copper press fitting joints shall be made in accordance with the manufacturer’s installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool

approved by the manufacturer.

- F. Installer shall be a qualified installer, licensed within the jurisdiction, and familiar with the installation of press-fit copper press joint systems. Press-fit copper press fittings shall be installed using the proper tool, actuator, jaws and rings as instructed by the press fitting manufacturer. The installation of copper tubing for hot and cold water distribution systems shall conform to the requirements of the ICC International Plumbing Code or IAPMO Uniform Plumbing Code.
- G. Note: Viega “ProPress”, Nibco “Press-fit”, and Apollo “Xpress” installation shall only be permitted on this project. Push-on shark-teeth, or any type connection fittings that are not press-fit, shall NOT be approved.
- H. T-drill mechanically formed tee fittings shall be used in conjunction with the press-fit copper system in accordance with the IPC Chapter 6 Section 605.5.1, 605.5.1.2 and 605.14.1. Use caution around combustible material and follow all safety guidelines for open flame during silver brazing.

END OF SECTION 22 00 10

SECTION 22 00 30 – INSULATION & COVERING – PLUMBING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the Work specified in this Section.

1.2 DESCRIPTION OF WORK

- A. This section includes insulation and covering furnished and installed on the following piping systems and equipment:
 - 1. Domestic cold water.
 - 2. Condensate waste piping from air conditioning units.

1.3 REFERENCE STANDARDS

- A. Refer to Section 220000 for a general description of requirements applying to this section.
- B. Materials shall conform to the requirements of the NFPA Code.

1.4 QUALITY ASSURANCE

- A. Refer to Section 220010 for a general description of requirements applying to this section.

1.5 SUBMITTALS

- A. Submit shop drawings and product data in accordance with Section 220000.
- B. Submit the following:
 - 1. Product data on all insulation and covering.

1.6 WARRANTY/GUARANTEE

- A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, GENERAL REQUIREMENTS.

PART 2 – PRODUCTS

2.1 PIPE INSULATION MATERIAL

- A. Fiberglass:
 - 1. Material: Preformed fiberglass bonded with resins to form circular pipe sleeves with factory applied, white all-service jacket bonded to reinforced foil vapor barrier jacketing. The jacket shall have factory-applied double pressure-sensitive adhesive closure and vapor sealing of longitudinal joints. Thermal Conductivity: .25 per inch at 100 degrees F. Flame spread of 25

- and developed smoke of 50 or less.
2. All Valves and Fittings:
 - a. Class fiber insert and premolded PVC cover, Manville "Zeston" and "Hi-Lo Temp Inserts" for valves and fittings.
 - b. Factory molded fibrous glass fitting covering for fittings.
 - c. Mitered sections of pipe covering for valves.
 3. Manufacturers: Johns-Manville, Certain-Teed, Owens-Corning.
- B. Closed Cell:
1. Material: Flexible elastomeric foamed plastic closed cell structure insulation 25/50 rated with a flame spread rating of 25 or less and a smoke developed rating of 50 or less.
 2. Flexible pipe insulation shall be a foamed plastic closed cell structure material, with a thermal conductivity of not more than 0.27 Btu/Hr./Sq. Ft./Inch at a mean temperature of 75 degrees F. The insulation shall have an average density of at least 2 pounds per cubic foot, shall be self-extinguishing, and shall have a water vapor transmission rating of not more than 0.1 perms. Between temperature limits of -40 degrees F and plus 220 degrees F, the insulation shall not indicate any deviation from its original state.
 3. Manufacturers: Armacel, Insul-Tube, Nomaco Insulation.
 4. Specification Compliance: (Latest accepted Standards and Codes)

IECC 804.5:	Insulation thickness for domestic hot and recirculation mains.
ASTM-E-84	Flame spread and smoke developed.
NFPA 255:	Standard method of test of surface burning of building materials.
ASTM C177:	Thermal conductivity.
NFPA 90A, 90B:	Flame & smoke rating
ASTM-C-534 Type 1 Tubular Grade, Self-Sealing	
UL 181	Factory made air ducts and air connectors. (Armacell UL181 has to do with mold growth)
UL723	Test for surface burning characteristics of building materials.
ASTM G21/C1338:	Fungi resistance
ASTM G2:	Bacterial Resistance
ASTM D1056, 2B1:	Standard spec for flexible cellular materials.

MIL-P-15280J, FORMT

MIL-C-3133B (MIL STD 670B) Grade SBE-3

MEA 96-85M

C. Covering of Pipe Insulation Outdoors:

1. Wrapping: Wrap insulation with embossed .016" aluminum jacket.
2. Fastenings: Cover shall be held in place with soft aluminum bands on 12" centers.
3. Valves and Fittings: Weatherproof all valves and fittings.
4. Manufacturers: Johns-Manville, Certain-Teed, Owens-Corning, Knauf.

D. Protective cover for insulation in wet areas indoors:

1. PVC heavy duty fitting covers and jacketing for kitchen wet areas.
2. Fitting covers shall be glossy white, high impact, UV resistant PVC.
3. Operating Temperature Limit: Up to 150°F.
4. Flame Spread: 25 or less.
5. Smoke Developed: 50 or less.
6. Grade: Weatherable.
7. Color: White
8. Finish: Gloss
9. Fitting covers and jacketing shall be "Zeston" 300 Series PVC, heavy duty covers and "Zeston" PVC jacketing.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Do not install until systems have been tested and meet requirements.
- B. Heavy work which may damage insulation shall have been completed in the vicinity of the insulation work.
- C. All installations shall be made by skilled craftsmen regularly engaged in this type of work.
- D. Insulation shall be continuous thru-wall, ceiling and floors.
- E. Pipe and equipment to be clean and dry prior to insulating.

- F. Install all insulation in strict conformance with manufacturer's instructions.
- G. Install pipe insulation by slitting tubular sections and applying onto piping or tubing. Alternately, whenever possible, slide unslit sections over the open ends of piping or tubing. All seams and butt joints shall be adhered and sealed using Armaflex 520 or 520 BLV Adhesive. If when using AP Armaflex SS, only the butt joints shall be adhered using Armaflex 520 or 520 BLV Adhesive, Armaflex HT 625 Adhesive shall be used with HT Armaflex.
- H. Insulation shall be pushed onto the pipe, never pulled. Stretching of insulation may result in open seams and joints.
- I. Tape the ends of the copper tubing before slipping the Armaflex insulation over the new pipes to prevent dust from entering the pipe.
- J. All edges shall be clean cut. Rough or jagged edges of the insulation shall not be permitted. Proper tools such as sharp, non-serrated knives must be used.
- K. On cold piping, insulation shall be adhered directly to the piping at the high end of the run using a two-inch strip of Armaflex 520 or 520 BLV Adhesive on the ID of the insulation and on the pipe. All exposed end cuts of the insulation shall be coated with Armaflex 520 or 520 BLV Adhesive. All penetrations through the insulation and termination points must be adhered to the substrate to prevent condensation migration.
- L. Sheet insulation shall be used on all pipes larger than 6" IPS. Insulation shall not be stretched around the pipe. On pipes larger than 12" IPS, adhere insulation directly to the pipe on the lower 1/3 of the pipe.
- M. Seams shall be staggered when applying multiple layers of insulation.

3.2 VALVES, FLANGES AND FITTINGS:

- A. All fittings shall be insulated with the same insulation thickness as the adjacent piping. All seams and mitered joints shall be adhered with Armaflex 520 or 520 BLV Adhesive. Screwed fittings shall be sleeved and adhered with a minimum 1" overlap onto the adjacent insulation. Armaflex HT 625 Adhesive shall be used with HT Armaflex.
- B. Valves, flanges, strainers and Victaulic couplings shall be insulated using Armaflex donuts that shall then be covered with sheet or oversized tubular insulation.

3.3 HANGERS

- A. Support piping system using high density inserts with sufficient compressive strength. The pipe support insulation shall be elastomeric foam with the same or greater thickness than the pipe insulation. All joints shall be sealed with Armaflex 520 or 520 BLV adhesive.
- B. Standard and split hangers: Piping supported by ring hangers shall have hangers insulated with the same insulation thickness as the adjacent pipe. All seams and butt joints shall be sealed with Armaflex 520 or 520 BLV Adhesive. Armaflex HT 625 Adhesive shall be used with HT Armaflex. Ring hangers may be sleeved using oversized tubular insulation. On cold piping, insulation shall extend up the hanger rod a distance equal to four times the insulation thickness. Insulation tape may be used to a thickness equal to the adjacent insulation thickness.

- C. Clevis Hangers or other pipe support systems: Saddles shall be installed under all insulated lines at unistrut clamps, clevis hangers or locations where the insulation may be compressed due to the weight of the pipe. All piping shall have wooden dowels or blocks of a thickness equal to the insulation inserted and adhered to the insulation between the pipe and the saddle.

It is highly recommended for continuous insulation protection to use hanger sizes equal to the outer diameter of the pipe plus insulation thickness

- D. Armafix IPH or Armafix NPH can be used to prevent compression of insulation at standard split, clevis hangers or other pipe support systems. To minimize the movement of Armafix, it is recommended that a pair of non-skid pads be adhered to the clamps. In addition, to prevent loosening of the clamps, use of an antivibratory fastener, such as a nylon-locking nut, is also recommended.

3.4 PIPE COVERING (FOAMED PLASTIC TYPE)

- A. All joints and seams shall be sealed with a compatible adhesive. Approved adhesives are as follows:

Armcel No. 520 (Low VOC use 520 BLV

Benjamin Foster Company No. 85-75 up to 200 degrees F.

Contractor may use self-sealing insulation in lieu of above.

- B. Fitting covers shall be fabricated from the foamed plastic pipe insulation or from sheet insulation of the identical material. The fabrication shall be in accordance with manufacturer's instructions, and all seams mitered joints shall be joined using the adhesives described.

3.5 PIPE INSULATION – TYPES & THICKNESSES

- A. Flexible Closed Cell:

Piping System	Up to 3"	Over 3" to 6"	Over 6"
Cold Water	1/2"	1/2"	3/4"
Hot Water (105°F - 140°F)	1"	1"	1-1/2"
Hot Water Return (105°F - 140°F)	1"	1"	1-1/2"
Hot Water (>140°)	1"	1"	1-1/2"
Hot Water Return (>140°)	1"	1"	1-1/2"
Condensate Waste	1/2"	1/2"	-
Horizontal Storm (Primary)	1/2"	1/2"	3/4"
Horizontal Storm (Secondary) -----Not Required-----			
Underside of Roof Drains	1/2"	1/2"	3/4"
Branch Waste From EWC's	1/2"	---	---
Handicap Lav Waste & Water	1/2"	---	---
Soil/Waste Piping Above Noise/Wet Sensitive Spaces	1/2"	1/2"	3/4"

- B. Fiberglass:

Piping System	Up to 3"	Over 3" to 6"	Over 6"
Cold Water	1/2"	1/2"	3/4"
Hot Water (105°F - 140°F)	1"	1"	1-1/2"
Hot Water Return (105°F - 140°F)	1"	1"	1-1/2"

Hot Water (>140°F)	1"	1"	1-1/2"
Hot Water Return (>140°F)	1"	1"	1-1/2"
Condensate Waste	1/2"	1/2"	---
Horizontal Storm (Primary)	1/2"	1/2"	3/4"
Horizontal Storm (Secondary)	1/2"	1/2"	3/4"
Underside of Roof Drains	1/2"	1/2"	---
Soil/Waste Piping Above Noise/Wet Sensitive Spaces	1/2"	1/2"	3/4"

END OF SECTION 22 00 30

SECTION 22 01 20 – DOMESTIC WATER SYSTEMS – PLUMBING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this Section.

1.2 DESCRIPTION OF WORK

- A. This Section includes:
 - 1. Domestic water piping systems work is indicated on drawings and schedules and by requirements of this section.
- B. Applications for water piping systems include the following:
 - 1. Domestic cold-water piping.
- C. Insulation for domestic water piping as specified in Section 220030 is included as work of this section.

1.3 REFERENCE STANDARDS

- A. Refer to Section 220000 for a general description of requirements applying to this section.

1.4 QUALITY ASSURANCE

- A. Refer to Section 220010 for a general description of requirements applying to this section.

1.5 SUBMITTALS

- A. Submit shop drawings and product data in accordance with Section 220000.
- B. Submit the following:
 - 1. Product data on all specialties and systems equipment.

1.6 WARRANTY/GUARANTEE

- A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, GENERAL REQUIREMENTS.

PART 2 – PRODUCTS

2.1 DOMESTIC WATER PIPING MATERIALS AND PRODUCTS

- A. Provide piping materials and factory fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes and types matching

piping and equipment connections; provide fittings of materials which match pipe materials used in domestic water piping systems. Where more than 1 type of materials or products are indicated, selection is Installer's option.

- B. All products and equipment designed for the dispensing of potable water shall be ANSI/NSF 61 and ANSI/NSF 372 certified as “lead free.” Lead free refers to the wetted surface of pipe, fittings and fixtures in potable water systems that have a weighted average lead content $\leq 0.25\%$ per the federal law of the safe drinking water act (sec. 1417) amended 1-4-2011 and other equivalent state regulations. The federal law does not apply to pipes, pipe fittings, plumbing fittings or fixtures that are used exclusively for non-potable services such as manufacturing, industrial processing, irrigation, outdoor watering, or any other uses where water is not anticipated to be used for human consumption. The law specifically excludes toilets, bidets, urinals, fill valves, flushometer valves, tub fillers, shower valves, service saddles, or water distribution main gate valves that are 2 inches in diameter or larger.

2.2 BASIC PIPE, TUBE AND FITTINGS

- A. Provide pipe, tube, and fittings complying with Division 22 Basic Materials and Methods section "Pipe, Tube, and Fittings", in accordance with the following listing:
- B. Interior Domestic Water Piping (See Appendix):
 - Tube Size 4" and Smaller: Copper tube.
 - Wall Thickness: Type "L" hard-drawn temper.
 - Fittings: Wrought-copper, solder-joints.

2.3 BASIC PIPING SPECIALTIES

- A. Provide piping specialties complying with Section 220010 Basic Materials and Methods in accordance with the following listing:
 - Pipe escutcheons
 - Dielectric unions
 - Drip pans
 - Pipe sleeves
 - Sleeve seals

2.4 SPECIAL PIPING SPECIALTIES

- A. Water Hammer Arresters: Provide bellows or piston type water hammer arresters, pressure rated for 250 psi, tested and certified in accordance with PDI Standard WH-201.

2.5 BASIC VALVES

- A. Provide valves complying with applicable Division 22 sections "Valves", in accordance with the following listing:

B. Sectional Valves:

2-1/2" and Smaller:	Ball Valves. Gate Valves.
3" and Larger:	Ball Valves. Butterfly Valves.

C. Shutoff Valves:

2-1/2" and Smaller:	Ball Valves. Gate Valves
3" and Larger:	Ball Valves. Butterfly Valves.

D. Drain Valves:

All	Hose End Threaded Gate or Ball Valves.

E. Balancing Valves:

2" and Smaller:	Ball Valves (Circuit Setter Type). (w/ Memory Stop)

F. Check Valves:

All Sizes:	Swing Check Valves. Horizontal Installations Spring Check Valves. Vertical Installations

2.6 SPECIAL VALVES

A. Special valves required for domestic water piping systems include the following types:

2.7 BASIC THERMOMETERS AND GAUGES

A. Provide thermometers and gauges complying with Division 22 Basic Materials and Methods Section "Meters and Gauges", in accordance with the following listing:

Pressure gauges

Glass thermometers

Pressure and temperature connections

2.8 BACKFLOW PREVENTERS

- A. Provide, of the type indicated on the drawing schedule, reduced pressure principal type, backflow preventers shall consist of an assembly including shutoff valves on inlet and outlet, and strainer on inlet. Backflow preventers shall include test cocks, and pressure-differential relief valve located between two positive seating check valves. Construct in accordance with ASSE Standard.
- B. On dead-end services (HVAC make-up) provide a spring-loaded check valve ahead of the backflow preventer assembly.

2.9 SYSTEMS EQUIPMENT MANUFACTURERS

- A. Refer to Plumbing Fixture and Equipment Schedule for type, number, size and manufacturer of all equipment and accessories.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering equipment which may be incorporated in the work are limited to the following:

Shock Absorbers:

Zurn

Josam

Watts

Smith

PPP Inc.

MIFAB

Sioux Chief

Oatey

Automatic Trap Primers

PPP Inc.

Sloan

Sioux Chief

MIFAB

Hose Bibbs

Woodford

Zurn

Josam

Watts

J.R. Smith

MIFAB

Wall Hydrants

Woodford

Zurn

Josam

Watts

J.R. Smith

MIFAB

Lawn Boxes

Woodford

Zurn

Josam

Watts

J.R. Smith

MIFAB

Roof Hydrants

Woodford

Zurn

Josam

Watts

J.R. Smith

MIFAB

Backflow Preventers

Conbraco

Febco

Cla-Val

Wilkins

ITT Grinnell

Neptune

Watts

Relief Valves

Rockwell

Fisher

DeZurik

Pressure Reducing Valves

Conbraco

Jamesbury

DeZurik

Fisher

ITT Bell & Gossett

Apollo

Cla-Val

PART 3 – EXECUTION

3.1 INSTALLATION OF BASIC IDENTIFICATION

- A. Install mechanical identification in accordance with Section 220010 Basic Materials and Methods.
- B. Support vertical piping at floor levels using approved riser clamps. Clamp material shall be compatible with pipe material. Maximum vertical spacing shall be 10'-0". Domestic water piping shall be supported in accordance with the International Mechanical Code, Section 305 and Table 305.4 Spacing Intervals, or in accordance with MSS-SP-69. International Plumbing Code's latest edition, Section 308.5, accept as follows:
 - 1. Copper tubing ½" to 1-1/4" nominal size, not to exceed 6 ft. horizontal intervals.
 - 2. Copper tubing 1-1/2" and larger nominal size, not to exceed 10 ft. horizontal intervals.

3. Copper tubing ½” to 1-1/4” nominal size, not to exceed 10 ft. vertical intervals.
4. Copper tubing 1-1/2” and larger nominal size not to exceed 10 ft. vertical intervals.
5. CPVC pipe or tubing ¼” to 1” nominal size, not to exceed 3 ft. horizontal spacing.
6. CPVC pipe or tubing 1-1/4” and larger nominal size not to exceed 4 ft. horizontal spacing.
7. CPVC pipe or tubing ¼” to 1” nominal size not to exceed 10 ft. vertical.
8. CPVC pipe or tubing 1-1/4” and larger nominal size not to exceed 10 ft. vertical.”

*Mid-Story Guide.

3.2 INSTALLATION OF VALVES

- A. Install valves in accordance with Division 22 Basic Materials and Methods section, "Valves".
- B. Sectional Valves: Install on each branch and riser, close to main, where branch or riser serves 2 or more fixtures, equipment connections, and elsewhere as indicated.
- C. Shutoff Valves: Install on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated.
- D. Drain Valves: Install on each plumbing equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere where indicated or required to completely drain domestic water piping system.
- E. Check Valves: Install on discharge side of each pump, and elsewhere as indicated.
- F. Balance Cocks: Install in main recirculating loop and in each branch hot water recirculating loop. Install a ball valve and check valve at each balance valve installation.
- G. Hose Bibbs: Install on exposed piping where indicated, with vacuum breaker.

3.3 INSTALLATION OF BACKFLOW PREVENTERS

- A. Install backflow preventers where indicated, and where required by International Plumbing Code. Locate in same room or area as equipment being protected.
- B. RPZ type backflow preventers to be piped from the relief outlet to nearest floor drain.
- C. A check valve is required on the upstream side of all RPZ installations.

3.4 INSTALLATION OF THERMOMETERS AND GAUGES

- A. Install thermometers and gauges in accordance with Section 220010 Basic Materials and Methods.

3.5 SPARE PARTS

- A. Furnish to Owner, with receipt, one valve key for each key operated hydrant, bibb, or faucet installed.

PART 4 – APPENDIX

Design and calculations of interior domestic water piping systems are all based on using Type “L” copper pipe. If PEX plastic pipe and/or tube is used as a substitute material for interior domestic water pipe, the contractor will be responsible for confirming pipe sizes and domestic water piping equipment are adequate for flow and hydraulic friction loss for all cold water, hot water, and hot water circulation systems. It should be noted that the respective nominal pipe sizes internal diameters of PEX piping compared to Type “L” copper pie are significantly small. As a result, at equal flows (gpm) friction loss and flow velocities will be higher for PEX pipe. The following table, *Type “L” Copper Pipe vs PEX Tube*, has been approved as an acceptable substitution for the specified domestic water piping material. As noted in the Section 220000 General Provisions – Plumbing/Fire Protection, all substitutions must be submitted and approved by the Owner, Architect, and/or Design Engineer.

END OF SECTION 22 01 20

Type "L" Copper Pipe vs PEX Tube															
			Hot Water (HW) maximum velocity and friction loss				Cold Water (CW) maximum velocity and friction loss				Hot Water Recirculation (HWR) maximum velocity and friction loss			Internal Pipe Diameters	
Nominal Pipe Size	PEX approximate equivalent length of 100 ft of "L" Coper Pipe	PEX ft/100 ft "L" Copper Ratio	"L" Copper flow (GPM) of max velocity of 5 fps	"L" Copper friction loss at max velocity of 5 fps	PEX flow (GPM) of max velocity of 5 fps	PEX flow friction loss at max velocity of 5 fps	"L" Copper flow (GPM) of max velocity of 8 fps	"L" Copper friction loss at max velocity of 8 fps	PEX flow (GPM) of max velocity of 8 fps	PEX flow friction loss at max velocity of 8 fps	Flow (GPM) "L" Copper at 3 fps max. PEX at approx. 4 fps max.	"L" Copper friction loss at velocity of 3 fps	PEX flow friction loss at max velocity approx. of 4 fps	Type "L" Copper	PEX
Inches	Feet		GPM	ft/ft	GPM	ft/ft	GPM	ft/ft	GPM	ft/ft	GPM	ft/ft	ft/ft	Inches	Inches
1/4	24	0.24	1.2	0.435	0.67	0.616	1.94	1.057	1.08	1.490				0.315	0.235
3/8	42	0.42	2.25	0.305	1.9	0.531	3.6	0.729	2.53	0.902				0.430	0.360
1/2	72	0.72	3.63	0.233	3.15	0.248	5.8	0.555	5.05	0.594				0.545	0.510
5/8	53	0.53	5.42	0.184	4.17	0.215	8.67	0.440	6.67	0.514				0.666	0.584
3/4	49	0.49	7.5	0.151	5.6	0.176	12	0.360	9	0.423	4.5	0.059	0.117	0.785	0.681
1	45	0.45	12.8	0.111	9.3	0.133	25.7	0.402	14.9	0.317	7.7	0.043	0.094	1.025	0.875
1-1/4	44	0.44	19.5	0.087	13.9	0.105	31.2	0.209	22.3	0.252	11.7	0.034	0.076	1.265	1.069
1-1/2	43	0.43	27.7	0.071	19.5	0.087	44.2	0.169	31.2	0.208	16.5	0.027	0.064	1.505	1.263
2	42	0.42	48.2	0.052	33.4	0.064	77.1	0.123	53.5	0.152	28.9	0.020	0.049	1.985	1.653
2-1/2	41	0.41	72.5	0.038	50.9	0.05	116.1	0.091	81.5	0.119	44.6	0.016	0.039	2.465	2.041
3	39	0.39	106.1	0.032	72.3	0.041	169.8	0.078	115.7	0.097	63.7	0.013	0.032	2.945	2.431

Friction Head Loss = $[4.52 \times (Q)^{1.85}] / [(C)^{1.85} \times (D)^{4.87}] \times 2.31 = Pf$ (ft/ft)

Velocity = $(0.4085 \times Q) / D^2 = ft$ per second (fps)

Q = flow (GPM); C = Hazen-Williams coefficient (140 for copper and PEX); D = internal diameter of pipe (inches)

SECTION 22 01 30 – GAS PIPING SYSTEMS – PLUMBING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this Section.

1.2 DESCRIPTION OF WORK

- A. This Section includes:
 - 1. Natural gas piping system as indicated on drawings and schedules, and by requirements of this section.
 - 2. Applications for natural gas piping systems include the following:
 - a. Gas service from street main to building meter by Delmarva Gas Division.
 - b. Elevated pressure (psi) gas from meter location to rooftop gas-fired equipment.
 - c. Low pressure (WC) from the meter location to all other equipment and outlets, requiring gas service.
 - 3. Applications for propane gas piping systems include the following:
 - a. All gas piping from the exterior secondary regulator assembly location to all equipment and outlets, requiring gas service.
 - 4. Trenching and backfill required in conjunction with exterior gas distribution as specified in Section 220000 is included as work of this section. Refer to Division 1.

1.3 REFERENCE STANDARDS

- A. Refer to Section 220000 for a general description of requirements applying to this Section.

1.4 QUALITY ASSURANCE

- A. Refer to Section 220010 for a general description of requirements applying to this section.

1.5 SUBMITTALS

- A. Submit shop drawings and product data in accordance with Section 220000.
- B. Submit the following:
 - 1. Product data on gas valves.

1.6 WARRANTY/GUARANTEE

- A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, GENERAL REQUIREMENTS.

PART 2 – PRODUCTS

2.1 NATURAL GAS PIPING MATERIALS AND PRODUCTS

- A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with ANSI B31.2 where applicable, base pressure rating on natural gas piping system maximum design pressures. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match piping materials used in natural gas piping systems. Where more than 1 type of material or product is indicated, selection is Installer's option.

2.2 BASIC IDENTIFICATION

- A. Provide identification complying with Division 22 Sections and in accordance with the following listing:

Building Distribution Piping: Plastic pipe markers.

Gas Service: Underground type plastic line markers with detectable wire..

Gas Valves: Plastic valve tags.

2.3 BASIC PIPE, TUBE AND FITTINGS

- A. Provide pipe, tube and fittings complying with Section 220010 Basic Materials and Methods - Plumbing and in accordance with the following listing:

1. Interior Piping: Schedule 40 black steel ASTM A-53, A-106

Fittings: Malleable black iron, threaded (NCC)

2.4 BASIC PIPING SPECIALTIES

- A. Provide piping specialties complying with applicable Division 22 Sections and in accordance with the following listing:

Pipe escutcheons

Pipe sleeves

Sleeve seals

2.5 SPECIAL VALVES

- A. Valves required for gas piping systems on this project shall be the following types:

Gas Valves: (Up to 3”)

1. Apollo 80-100 Series bronze gas ball valve. Threaded, 600 PSIG WOG, cold non-shock. 250 PSIG LP-Gas. 150 PSIG saturated steam. Vacuum service to 29 inches Hg. Federal Specification: WW-V-35C, Type: II, Composition: BZ, Style: 3.
2. Features:
 - UL Listed for LP-Gas and natural gas.
 - Large ports to reduce pressure drop
 - Reinforced TFE seats and seals
 - Blow-out-proof stem design
 - Optional tee handle available
 - Quarter turn on-off
 - Adjustable packing gland
 - One piece bronze body
 - Chromium plated ball
3. UL Listings:
 - Guide YRPV: Gas shut-off valve for use with natural and manufactured gases.
4. This valve shall be used for all pipe sizes up to 3” in the system.

Gas Valves (4” and Larger)

1. Apollo 88A-100 Series carbon steel, ANSI Class 150 flanged standard port ball valves.

Standards of Compliance:

IFGC: Section 409 (Valves)

ASME B16.5 – Pipe Fittings and Flanges

ASME B16.33 – Manual Operated Metal Gas Valves up to 125 psig

ASME B16.38 – Large Metal Valve Gas Distribution

ASME B31.8 – Gas Transmission and Distribution Piping Systems

UL 125

- B. Manufacturers: Subject to compliance with requirements, provide gas valves of one of the following:

Apollo/Conbraco

Stockham

Milwaukee

NIBCO, Inc.

Watts

2.6 GAS PRESSURE REGULATORS

- A. ANSI Z21.18, single-stage, steel-jacketed, corrosion-resistant pressure regulators. Include atmospheric vent, elevation compensator, with threaded ends conforming to ASME B1.20.1 for 2 inch NPS and smaller and flanged ends for 2-1/2" NPS and larger. Regulator pressure ratings, inlet and outlet pressures, and flow volume in cubic feet per hour of natural gas at specific gravity are as indicated.

1. Service Pressure Regulators: Inlet pressure rating not less than natural gas distribution system service pressure.
2. Line Gas Pressure Regulators: Inlet pressure rating not less than system pressure.
3. Appliance Gas Pressure Regulators: Inlet pressure rating not less than system pressure.
4. Gas Pressure Regulator Vents: Factory or field installed corrosion-resistant screen in opening when not connected to vent piping.
5. Regulators shall be as manufactured by Fisher (no equal substitute permitted).

B. AVAILABLE MANUFACTURES

1. Subject to compliance with the requirements, manufacturer of gas equipment products other than as identified on the Schedule but is selected from the available manufacturers listed above, a cover sheet shall be included with the submission of shop drawings indicating the cross-referenced manufacturer and model number.
2. Shop drawings shall not be reviewed or accepted if not in compliance with this requirement.

Fisher

Sensus

Emerson

PART 3 – EXECUTION

3.1 INSTALLATION OF BASIC IDENTIFICATION

- A. Install mechanical identification in accordance with applicable Division 22 Sections.

3.2 INSTALLATION OF NATURAL GAS PIPING (INTERIOR)

- A. Install natural gas distribution piping in accordance with Section 220010 Basic Materials and Methods - Plumbing and in accordance with applicable codes IFGC latest edition, and local Utility Company requirements.
- B. Use sealants on metal gas piping threads which are chemically resistant to natural gas. Use sealants sparingly, and apply to only male threads of metal joints.
- C. Remove cutting and threading burrs before assembling piping.
- D. Do not install defective piping or fittings. Do not use pipe with threads which are chipped, stripped or damaged.
- E. Plug each gas outlet, including valves, with threaded plug or cap immediately after installation and retain until continuing piping or equipment connections are completed.
- F. Install drip-legs in gas piping where indicated, and where required by code or regulation.
- G. Install "Tee" fitting with bottom outlet plugged or capped at bottom of pipe risers.
- H. Use dielectric unions where dissimilar metals are joined together.
- I. Install piping with 1" drop in 60' pipe run (0.14%) in direction of flow.
- J. Install piping parallel to other piping, but maintain minimum of 12" clearance between gas piping and steam or hot water piping above 200 degrees F (93 degrees C).
- K. For piping buried in building substrate, or below floor slabs, install in welded conduit, ventilated to outdoors on both ends, and tested to same requirements as gas piping.
- L. Gas valves shall not be installed above ceilings without access and signage.
- M. Supports:
 - 1. All pipe, fittings, valves, installation and testing shall be in accordance with the IFGC, Chapter 4.
 - 2. Gas piping shall be supported in accordance with the International Fuel Gas Code's latest accepted 2003 Edition, Section 407, as follows:
 - 3. Support intervals shall be in accordance with the IFGC listed above and in Section 415, Table 415.1 as follows:
 - a. Steel pipe ½" nominal size – not to exceed 6 ft.
 - b. Steel pipe ¾" to 1" nominal size – not to exceed 8 ft.
 - c. Steel pipe 1-1/4" and larger nominal size horizontal – not to exceed 10 ft.
 - d. Steel pipe 1-1/4" and larger nominal size, vertical not to exceed every floor.

4. Support and spacing of CSST Systems shall be in accordance with CSST manufacturer's instructions.
5. All hangers, anchors, support and guides for piping and equipment shall be securely fastened to the building structure and/or floors with concrete decking with the following exception: Hangers, anchors, support and guides shall not be fastened to or through metal roof decking (i.e. bare metal decking or metal deck supporting a roofing system).

3.3 INSTALLATION OF VALVES

- A. Gas valves: Provide at connection to gas train for each gas-fired equipment item; and on risers and branches where indicated.
- B. Locate gas valves where easily accessible, and where protected from possible damage.

3.4 EQUIPMENT CONNECTIONS

- A. Connect gas piping to each gas-fired equipment item, with drip leg, union and shutoff gas valve. Comply with equipment manufacturer's instructions. Drip legs shall not be installed on any exterior gas piping.
- B. Equipment furnished by the Owner, or Contractors other than this Contractor: After equipment has been set in place, this Contractor shall furnish all labor and material required to make final connections between roughing-in and the equipment. Install valves, fittings, trim and appurtenances furnished with the equipment. Piping shall be of the same material as the system to which it connects.
- C. All HVAC, gas-fired equipment shall be provided with gas pressure regulating valve to reduce gas pressure from 5 psi to 6-14" WC. All regulators shall be provided with relief vent discharge piping of lengths as required for minimum distance of equipment air intake grilles.

3.5 INSTALLATION OF GAS PRESSURE REGULATORS

- A. This Contractor shall furnish and install gas pressure regulating valves for all shown on the drawings. Installation shall be in strict accordance with the requirements of the Utility Company and the Canadian Gas Association.
- B. All regulators installed shall be tagged with data noting the inlet and outlet pressure for each individual regulator installed.
- C. Medium or High Pressure (MP) (HP) Regulators shall comply with the following:
 1. The MP regulator shall be approved and shall be suitable for the inlet and outlet gas pressures for the application.
 2. The MP regulator shall maintain a reduced outlet pressure under lockup (no flow) conditions.
 3. The capacity of the MP regulator, determined by published ratings of its manufacturer, shall be adequate to supply the appliances served.

4. The MP pressure regulator shall be provided with access. Where located indoors, the regulator shall be vented to the outdoors or shall be equipped with a leak-limiting device, in either case complying with Section 410 of the IFGC.
5. A tee fitting with one opening capped or plugged shall be installed between the MP regulator and its upstream shutoff valve. Such tee fitting shall be positioned to allow connection of a pressure-measuring instrument and to serve as a sediment trap.
6. A tee fitting with one opening capped or plugged shall be installed not less than 10 pipe diameters downstream of the MP regulator outlet. Such tee fitting shall be positioned to allow connection of a pressure-measuring instrument.

3.6 EXTERIOR GAS PIPING

- A. All rooftop or exterior gas piping shall be weatherproof with and epoxy resin approved by the Gas Company.
- B. Uncoated, threaded or socket welded joints shall not be used in piping in contact with soil or where internal or external service corrosion is known to occur.
- C. Protective Coatings and Wrapping: Pipe protective coatings and wrappings shall be approved for the application and shall be factory applied.

OR

- A. All exterior gas pipe and fittings installed , including all welded joints, shall be provided with weatherproof coatings. The coatings shall be a two-layer PE “Pritec” coating as manufactured by Liberty Coating. The coatings shall be Butyl rubber adhesive with a polyethylene topcoat.
- B. Component Properties:

Adhesive

Polyethylene

ADHESIVE		
Softening Point	ASTM E28	190°F
Water Absorption	ASTM D570	<0.1%
Adhesive		Compounded Butyl Rubber

POLYETHYLENE		
Color		Black
Density	ASTM D1505	>0.950
Elongation	ASTM D638	>600%
Tensile Strength	ASTM D638	>2,800 psi
Outdoor Exposure		>2 years
Hardness, Shore D	ASTM D2240	>60

PRITEC®		
Operating Temperature		-40°F to +180°F

BRANDYWINE SCHOOL DISTRICT
DARLEY RD EEC – BOILER/CHILLER REPLACEMENT

NOT FOR BIDDING
BSA+A PROJECT No. 25.008
JULY 2026

*Peel Strength	ASTM D1000	>20 lbs lineal
Field Bending	Arctic Service Equipment	1.9 deg. per pipe dia.
Water Absorption	ASTM D570	0.06%
Impact Resistance	ASTM G14	33.65 in/lbs (10/40 sys.)
Volume Resistivity	ASTM D257	10×10^{16} Ohm cm
Dielectric Strength	ASTM D149 @73°F	700 Volts/Mil
Cathodic Disbondment	1.5v/3%/70°F/24 Hrs.	6 mm radius

END OF SECTION 22 01 30

SECTION 22 01 90 – TESTING – PLUMBING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other conditions, if any) and Division 1 as appropriate, apply to the work specified in this Section.

1.2 DESCRIPTION OF WORK

- A. Extent of plumbing systems to be tested is indicated on the drawings and by requirements of this section.
- B. Applications of tests include the following:
 - 1. Interior Piping
 - a. Domestic cold, hot & hot water return piping
 - b. Gas piping
 - c. Sanitary and condensate waste drainage piping
 - 2. Exterior Piping
 - a. Sanitary drainage piping
 - b. Domestic water service
 - c. Gas service
 - d. Storm drainage piping

1.3 REFERENCE STANDARDS

- A. Refer to Section 220000 for a general description of requirements applying to this section.

1.4 QUALITY ASSURANCE

- A. Refer to Section 220010 for a general description of requirements applying to this section.

1.5 SUBMITTALS

- A. Submit test reports in accordance with Section 220000.

1.6 WARRANTY/GUARANTEE

- A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, GENERAL REQUIREMENTS.

PART 2 – PRODUCTS

2.1 PIPE & FITTING REPLACEMENTS

- A. Refer to Section 220010 for replacement of any defective pipe or fittings. Replacement shall include all required uncovering, excavating, recovering and backfilling.

PART 3 – EXECUTION

3.1 GENERAL

- A. All exterior or interior piping shall be tested and approved before backfilling or concealing. Failure to secure the approval of the Municipal Inspector, Utility Company's Inspector or the Inspector of the Architect/Engineer makes it mandatory for the Contractor to completely expose the piping for testing. All expense involved in the uncovering of the piping for the test and recovering shall be borne by the respective Contractor with no change in Contract.
- B. All equipment, material and labor required for testing a plumbing system or part thereof shall be furnished by the Plumbing Contractor responsible for installing the work.

3.2 INTERIOR PIPING

- A. Drainage Piping:

Rough Plumbing: The piping of all plumbing storm, condensate waste, sanitary drainage and venting systems shall be tested upon completion of the rough piping installation by water or air and proved watertight. Where required by the code official, the cleanout plugs shall be removed to ascertain if the pressure has reached all parts of the system. Either of the following methods shall be used:

1. Water Test: The water test shall be applied to the drainage system either in its entirety or in sections after rough piping has been installed. If applied to the entire system, all openings in the piping shall be closed, except the highest opening, and the system filled with water to the point of overflow. If the system is tested in sections, each opening shall be plugged except the highest opening of the section under test, and each section shall be filled with water, but a section shall not be tested with less than a 10-foot head of water.

In testing successive sections, at least the upper 10 feet of the next preceding section shall be tested, so that a joint or pipe in the building (except the uppermost 10 feet of the system) shall not have been subjected to a test of less than a 10-foot head of water. The water shall be kept in the system or in the portion under test for a minimum of 15 minutes before inspection starts. The system shall then be tight at all points.

2. Air Test: The air test shall be made by attaching an air compressor testing apparatus to an opening, and, after closing all other inlets and outlets to the system, forcing air into the system until there is a gauge pressure of 5 pounds per square inch (5 psi) or a minimum of 10-inch column of mercury. This pressure shall be held without introduction of additional air for a minimum period of 15 minutes.

Precautionary Note: The compressibility of air and/or other gases result in tremendous amounts of stored energy, even at lower pressures. Over-pressurizing creates a substantial hazard to personnel and property near the area should a failure occur. Consult with the Plastic Pipe Institute (PPI) for statements and alerts, along with State and local safety offices.

Finished Plumbing: Where required by the code official, after the plumbing fixtures have been set and their traps filled with water, their connections shall be tested and proved gas and water-tight by one of the following test methods.

1. The final test for gas and water-tightness of the completed drainage and vent systems shall be made by a smoke test or other approved method. The test shall be made by filling all traps with water, and then introducing into the system smoke produced by one or more smoke machines. When the smoke appears at stack openings on the roof, the stack openings shall be closed and a pressure equivalent to a 1" water column shall be built and maintained for the period of the inspection.
2. After the plumbing fixtures have been set and their traps filled with water, their connections shall be tested and proven gas and water-tight by plugging the stack openings on the roof and building drain where the drain leaves the building and with air introduced into the system equal to the pressure of a 1-inch water column. This shall be accomplished by the use of a "U" tube or manometer inserted in the trap of a water closet. Such pressure shall remain constant for the period of inspection without the introduction of additional air.

Building sewer test: The building sewer shall be tested by insertion of a test plug at the point of connection with the public sewer or individual sewage disposal system. The building sewer shall then be filled with water under a head of not less than 10 feet. The water level at the top of the test head of water shall not drop for at least 15 minutes.

- B. Domestic Water Piping: All new, altered, extended or replaced interior water piping installed shall be tested at 100 psig maintaining the pressure for four hours with not more than 1% drop in pressure. The system shall be filled with water which shall remain in the system until the water and the piping are the same temperature. If water pipe testing is under the jurisdiction of the local inspector, his requirements shall be used; however, they shall be not less than specified herein. The tests shall be performed in the presence of the representative of the Architect/Engineer and to his satisfaction.
- C. Natural Gas Piping:
1. All new, altered, extended or replaced interior natural gas piping installed shall be tested in accordance with the requirements of the National Fire Protection Association, latest edition of the IFGC, Section 107, and the requirements of the local Utility Company as applicable. In the absence of a specific test required by the Authorities, or if such requirements are less stringent than the test hereinafter specified, then the interior gas piping shall be tested as follows in the presence of the representative of the Architect.
 2. Before appliances are connected, piping shall be filled with air or nitrogen, to a pressure of 10 psi and proved tight with no drop in pressure for the length of time required to inspect the joints, but in no case less than 30 minutes. The source of pressure shall be isolated before the pressure tests are performed. Pressure shall be measured with a mercury manometer, or slope gauge or equivalent device so calibrated as to be read in increments of not greater than one-tenth pound. All piping which will be concealed shall be tested, prior to being closed in by construction.
- D. Compressed Air Piping: Compressed air piping shall be tested at 125 psi. The pressure shall be maintained on the system a minimum of 30 minutes without any loss in pressure. If a loss in pressure occurs, leakage shall be corrected and piping retested.

3.3 EXTERIOR PIPING

A. Gas Service:

1. All new exterior distribution piping, installed by this Contractor, for natural gas systems shall be tested in accordance with the requirements of the National Fire Protection Association, latest edition of the IFGC, Section 107, and the requirements of the local Utility Company. In the absence of a specific test required by the Authorities, or if such requirements are less stringent than the test hereinafter specified, then the exterior piping shall be tested as follows, before pressure regulating valves are installed, or connection made to interior piping.
2. Piping shall be filled with air or nitrogen, to a pressure of 100 psi, and proved tight with no drop in pressure for the length of time required to inspect the joints, but in no case less than one hour. The source of pressure shall be isolated before the pressure tests are performed. Pressure shall be measured with a gauge so calibrated as to be read in increments of not greater than one pound.

3.4 STERILIZATION

- A.** After final testing for leaks, all new potable water piping installed including water service piping, shall be flushed to remove foreign material.
- B.** Before placing domestic water systems in service, a qualified service organization shall be engaged, to sterilize the entire building including the exterior water service piping in accordance with the following procedure:

1. Contractor shall provide a 3/4" hose connection somewhere in the main entering the building, or in the Mechanical Room and/or in the meter pit, pump in sufficient sodium hypochlorite to produce a free available chlorine residual of not less than 100 PPM.
2. Proceed upstream from the point of chlorine application opening all faucets and taps until chlorine is detected. Close faucets and taps when chlorine is evident. Consult with the local code department for additional concentrations and durations.
3. When chlorinated water has been brought to every faucet and tap with a minimum concentration of 200 PPM chlorine, retain this water in the system for at least three hours.
4. At the end of the retention period, no less than 100 PPM of chlorine shall be present at the extreme end of the system.
5. Proceed to open all faucets and taps and thoroughly flush all new lines until the chlorine residual in the water is less than 1.0 PPM.
6. Obtain representative water samples from the system for analysis by a recognized Bacteriological Laboratory.
7. If all samples tested for impurities and organisms are negative, a letter and laboratory reports shall be submitted by the service organization to the contractor, certifying successful completion of the sterilization.
8. If any samples tested indicate the presence of harmful impurities and organisms, the entire sterilization procedure shall be repeated.

9. Plumbing Contractor shall provide plumbing connections and power for pumping chlorine solution into the system.

Warning: PVC and CPVC Pipe: Do not use a dry granular calcium hypochlorite as a disinfecting material for water purification in potable water piping systems. The introduction of granules or pellets of calcium hypochlorite with solvent cements and primers (including their vapors), may result in violent chemical reactions.

- C. Available Service Organizations: Subject to compliance with requirements, provide the sterilization service of one of the following:

Water Chem

Arc Company, Inc.

Nova Consultants

Artesian Water Co.

END OF SECTION 22 01 90

SECTION 23 02 00 – GENERAL PROVISIONS – HVAC

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to work of this Section.
- B. All Mechanical Systems shall be part of and included in all of the following: 230200 thru 230950.

1.2 WORK INCLUDED

- A. Provide labor, materials, equipment and supervision necessary to install complete operating HVAC Systems, including all work at the site and within the proposed construction areas to accomplish the required work.
- B. Wherever the term "provide" is used, it shall be understood to mean both "furnish" and "install".

1.3 REGULATIONS, CODES AND STANDARDS

- A. Work shall be performed in accordance with latest adopted codes, regulations and ordinances by authorities having jurisdiction. Observe all safety regulations.
- B. Obtain all permits and inspection certificates and pay all charges.
- C. Latest editions of any referenced standards shall govern.

1.4 RELATED WORK

- A. Refer to equipment shown or specified in sections of Division 1 thru 14 and 26 that will require Mechanical services and provide such service.
- B. Refer to work related to HVAC as shown on the following contract drawings:

Architectural & Structural

Plumbing

Electrical

1.5 COORDINATION

- A. The Mechanical, Plumbing and Electrical Contractors are responsible to coordinate all manufacturer's recommended circuit breakers, starters, disconnects and fuse sizes for all equipment. Submission of a shop drawing will certify that this has been completed. Any necessary changes required will be included as part of this contract.
- B. Mechanical Contractor shall coordinate scheduling, submittals and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of independent work elements, with provisions to accommodate items that may be installed at a later time.

- C. Mechanical Contractor shall verify utility requirements and all characteristics of operating equipment are compatible with the building utilities. Coordinate the work of all sections related and required for installing, connection and placing in service of all equipment.
- D. Mechanical Contractor shall coordinate all space requirements, supports and installation of all mechanical, electrical work, which are indicated diagrammatically on the Drawings. Verify routing of all pipes, ducts, conduits and equipment connections. Maximize accessibility for other work, and service requirements for maintenance and repairs.
- E. Obtain written confirmation from all related trade Contractors and the Owner or his representative that requirements, conflicts and coordination issues have been discussed and resolved.
- F. Submit coordination drawings to verify access and clearances.

1.6 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations..
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installation within unheated shelters.

1.7 SUBMITTALS

- A. Shop Drawings:
 - 1. Shop drawings shall be submitted in accordance with Division 1 of these specifications except where herein modified.

NOTE: Submittals will only be reviewed once and resubmittals will be reviewed once. Any other submittals will be billed to the Contractor at the Engineer's standard rates.

- 2. Shop drawings comprising complete catalog cuts, performance test data for HVAC equipment as required by other sections of Division 23, shall be submitted for review checking. The Contractor shall review these shop drawings for conformance to contract documents prior to submission and affix contractor's signature to each submittal certifying that this review has been done. By approving and submitting shop drawings, product data, samples and similar materials, the Contractor represents that the Contractor has determined and verified materials, field measurements and field construction data that relates to the work, and has checked and coordinated this information with all of the requirements contained in the contract documents for the work of all trades.

- a. The Contractor and equipment manufacturer shall clearly indentify in all submittals and shop drawings any and all applications standards which require additional work to accommodate this equipment and provide a complete and operational system as described in the contract documents.
 - b. The Contractor shall be completely responsible for any and all additional costs associated with the changes required by this and all other trades.
3. Submit a 1/4" scale layout of all mechanical equipment rooms. All equipment and pads shall be to scale of equipment being furnished. Obtain size information of any and all equipment from other trades and indicate on drawings. The drawings shall be fully coordinated with all trades prior to submission. Indicate coil pull areas, filter pull areas, maintenance clearances, and access as applicable.
4. Submit a 1/4" scale layout of all mechanical piping. Indicate pipe size, all valving, elevation change, expansion devices, and fluid type. The drawing shall be fully coordinated with all trades prior to submission.
5. All shop drawing submittals shall have the following identification data, as applicable, contained therein or permanently adhered thereto.
 - a. Project name.
 - b. Project number.
 - c. Sub-contractor's, vendor's and/or manufacturer's name and address.
 - d. Product identification.
 - e. Identification of deviation from contract documents.
 - f. Applicable contract drawings and specification section number.
 - g. Shop drawing title, drawing number, revision number, and date of drawing and revision.
6. Resubmit revised or additional shop drawings as requested.
7. Wherever shop drawings or vendor's standard data sheets indicate work to be done "by others", it shall be the responsibility of the contractor making the submission to identify by name, the contractor who is to do this work. If the contractor named is other than the contractor making the submission, the shop drawing submission must be reviewed by the named contractor and bear his mark of approval, prior to submission to the Architect/Engineer.
8. Where equipment proposed differs from that shown on the drawings or specified, he shall submit for approval drawings showing the manner in which the layout is affected by the substitution.
9. The Contractor shall keep a copy of approved shop drawings at the job site.
10. No equipment, ductwork or piping, shall be ordered, fabricated, etc., before approval of shop drawings.

- B. Contractor is responsible for the shop drawing coordination and interface with the work of other contracts and adjacent work. The relationship of Contractor's work shall be verified as it relates to adjacent and critical features of the work of this and all contracts and materials.
- C. The Contractor shall submit a complete schedule of all shop drawings required for the scope of work covering all materials and equipment listed in all sections of Division 23, Mechanical, including all documents required for contract closeout, Owner instructions and training, and all turnover items at the completion of the work. This schedule shall be submitted for review and approval within thirty days of contract award and before any subsequent materials are provided for review.

1.8 SITE INSPECTION

- A. The Contractor shall visit site, inspect, and become aware of all conditions which may effect the work during the estimation phase of his work prior to bid openings. Investigate utilities, protection requirements for adjacent facilities, storage locations, and access to the construction area.
- B. Submission of a bid will be deemed evidence of having complied with this requirement.

1.9 SUBSTITUTIONS

- A. Whenever a material, article, piece of equipment or system is identified in the following specification or indicated on the drawings by reference to manufacturers' or vendors' names, trade names, catalog numbers or the like, it is so identified for the purpose of establishing the basis of the Bid.
- B. Substitution approval must be obtained and included as an addendum item prior to the submission of the bid. An approved substitution shall not be considered as an approval for the Contractor or an equipment vendor to deviate from the written portion of the specifications unless so stated in the addendum.
- C. The drawings illustrate the space allocated for equipment and the Contractor shall install the equipment accordingly. If changes are required in the building or arrangement due to substitution of equipment, the Contractor making the substitution must pay for the necessary modifications.
- D. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements on all contract documents. This shall include, but not be limited to all: space requirements, code clearances, type-horsepower-capacities-number and size of services required from other trades including all auxiliary items provided by this Contractor and all other trades, and all manufacturer's specific equipment applications standards and requirements, for approved equipment including that which is basis of design or a substitution. The bidding related contractor and equipment manufacturers shall clearly identify in all submittals and shop drawings any and all applications standards which require additional work to accommodate this equipment and provide a complete and operational system as described in the contract documents. If the bidding contractor or manufacturer does not comply with these requirements then they shall be completely responsible for any and all additional costs associated with the changes required by this and all other trades.

1.10 LUBRICATION

- A. Provide and maintain all required lubrication of any equipment operated prior to acceptance by the Owner. Lubrication shall be as recommended by the equipment manufacturer.
- B. Provide one year's supply of lubricants to Owner at date of acceptance.

- C. Verify that required lubrication has taken place prior to any equipment start-up.

1.11 EQUIPMENT START-UP

- A. Verify proper installation by manufacturer or his representative.
- B. Advise General Contractor 2 days prior to actual start-up.
- C. Verify proper operation. Obtain signed statement by manufacturer or his representative that equipment is operating within warranty requirements. Submit statement to General Contractor.
- D. Perform field mechanical balancing in accordance with Section 230950: TESTING AND BALANCING OF MECHANICAL SYSTEMS.
- E. The Mechanical Contractor shall own as part of his work, the following:

Provide one (1) additional drive set, if necessary, to obtain final design balancing requirements. The Mechanical Contractor shall coordinate with Balancing Firm and equipment manufacturer for drive selection, including belts and pulleys.

1.12 OPERATION & MAINTENANCE INSTRUCTIONS

- A. Properly and fully instruct Owner's personnel in the operation and maintenance of all systems and equipment.
 - 1. Provide two (2) 4-hour sessions of training to School District Maintenance Staff.
- B. Insure that the Owner's personnel are familiar with all operations to carry on required activities.
- C. Such instruction shall be for each item of equipment and each system as a whole.
- D. Provide written confirmation that instruction has taken place. Include in the report the equipment and/or systems instructed, date, contractor, Owner's personnel, vendor, and that a complete operating and maintenance manual has been reviewed.
- E. Manual shall include all instructions on operation, maintenance, repair parts list, lubrication requirements, brochures, catalogue cuts, complete schedule of air filters for each unit type in Excel spreadsheet format, wiring diagrams, piping diagrams, control sequences, service requirements, names and addresses of vendors, suppliers and emergency contacts.
- F. Submit electronically for review a complete set of operating and maintenance manuals prior to operating instruction period. If required by Owner, provide three (3) hard copies of manuals, suitably bound.
- G. Provide to the Owner any special tools necessary for operation and routine maintenance of any of the equipment.
- H. Upon completion of the project, the Mechanical Contractor shall provide a complete set of legible as-built drawings for the Owner.
- I. Furnish three (3) copies of a professionally taped video and three (3) copies of professionally prepared drawings demonstrating the following:

- Locations of main shut-off valves.
- Procedures for equipment start-up and seasonal shut-downs.
- Procedures for maintenance.
- Provide written version of all procedures included in video.

The above should cover all equipment/systems including, but not limited to, the following:

- Hot water distribution system.
- Chilled water distribution system.
- Fans
- Pumps
- Boilers
- Chillers
- Cooling tower

1.13 TOOLS

- A. All equipment furnished by the Mechanical Contractor which requires special tools or devices other than those normally available to the maintenance or operating staff shall be furnished in duplicate to the Owner, sufficiently marked, packed or boxed for staff usage. The tools provided shall be listed by the Mechanical Contractor identified as to their use or the equipment applicable in a written transmittal to the Owner.

1.14 CLEANING AND FINISHING

- A. After equipment start-up and all operating tests have been made and the system pronounced satisfactory, each respective Contractor shall go over the entire project, clean all equipment, etc., installed by him and leave in a clean and working condition. Any surfaces found marred after this final cleaning shall be refinished or replaced by each Contractor at no cost to the Owner.
- B. Provide for the safety and good condition of all materials and equipment until final acceptance by the Owner. Protect all materials and equipment from damage. Provide adequate and proper storage facilities during the progress of the work. Special care shall be taken to provide protection for bearings, open connections, pipe coils, pumps, compressors and similar equipment.
- C. All fixtures, piping, finished surfaces and equipment shall have all grease, adhesive labels and foreign materials removed.
- D. All piping shall be drained and flushed to remove grease and foreign matter. Pressure regulating assemblies, traps, and similar items shall be thoroughly cleaned. Remove and thoroughly clean and reinstall all liquid strainer screens after the system has been in operation ten (10) days.

- E. When connections are made to existing systems, the Mechanical Contractor shall do all cleaning and purging of the existing systems required to restore them to the condition existing prior to the start of work.
- F. Clean-up: Remove from the premises, all unused material and debris resulting from the performance of work under this section.

PART 2 – PRODUCTS

2.1 GENERAL

- A. All material and equipment shall be new and of present day manufacture, and shall conform to accepted standards of the trade where such a standard has been established for the particular type of equipment or material.
- B. Whenever equipment or material is referred to in the singular, such as "the fan", it shall be deemed to apply to as many such items as necessary to complete the work.

2.2 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. During loading, transporting and unloading exercise care to prevent damage to material.
- B. Store all materials in dry enclosures or under protective coverings out of way of work progress.
- C. Material shall not be allowed to be stored directly on ground.
- D. Deliver in manufacturer's original cartons or on skids.
- E. Handle and protect so as to prevent damage to product or any surrounding material.

2.3 CONCRETE

- A. Concrete shall be in accordance with Section 03300.

2.4 WARRANTY

- A. Wherever in the specification sections of this division, reference is made to a specific warranty period, this warranty shall be in addition to and not a limitation of other rights the Owner may have against the Mechanical Contractor under the contract documents.

PART 3 – EXECUTION

3.1 PROTECTION

- A. Plug or cap open ends of piping systems, conduit and ductwork.
- B. Stored materials shall be covered to prevent damage by inclement weather, sun, dust or moisture.
- C. Protect all installed work until accepted in place by the Owner.
- D. Protect all work from operations which may cause damage such as hauling, welding, soldering, painting, insulating and covering.

3.2 WORKMANSHIP

- A. Install all work neat, trim and plumb with building lines.
- B. Install work in spaces allocated.
- C. Cutting and patching shall be performed by skilled tradesmen normally employed for the work involved.
- D. This Contractor shall provide a complete weathertight seal to all new systems in the building including the necessary caulking, weather-stripping and insulation.

3.3 EQUIPMENT SETTING

- A. Provide as a minimum, a 4-inch concrete pad beneath all floor-mounted equipment. Install anchor bolts in pour.
- B. Provide as a minimum, spring vibration isolation under any equipment 10 HP and over and rubber in shear vibration isolation on any equipment up to 10 HP. For further specifications and additional requirements, refer to other sections.
- C. Concrete shall be 3,000 psi, 28 day compressive strength in accordance with ACI-613. Reinforce with No. 4 rod 12" on centers both ways or as otherwise detailed.

3.4 FASTENERS, HANGERS AND SUPPORTS

- A. Provide all hangers and supports required to suspend, mount, or hang the work. Drilling into the roof deck is not permitted.
- B. Provide all miscellaneous steel angles, channels, beams, clips, brackets and anchors necessary to hang or support the work. Provide submissions for review.
- C. Install concrete inserts before concrete is poured.
- D. Drilled inserts shall not be loaded more than 1/4 rated capacity.
- E. Power-driven fasteners shall not be allowed for piping larger than 2 inch, or equipment. When used they shall not be loaded more than 1/8 rated capacity or 200 pounds.
- F. All hangers, miscellaneous steel, braces and supports shall be galvanized, cadmium plated, or primed steel. Copper tubing shall be supported with copper hangers.
- G. Piping shall be supported from adjustable clevis type hangers with insulation pipe saddles or pipe shields in accordance with piping support spacing table on the drawings. Where hangers are 18" or longer provide lateral bracing at every fourth hanger.
- H. Any lintels required for openings for this work if not indicated on Architectural or Structural drawings shall be provided under this Section.

3.5 OFFSETS, TRANSITIONS, MODIFICATIONS

- A. Provide all offsets necessary to install the work and to provide clearance for other trades.

- B. Maintain adequate headroom and clearance.
- C. Incidental modifications necessary to the installation of the systems shall be made as necessary and as approved by the Architect.

3.6 LABELING

- A. All HVAC equipment such as pumps, fans, air handling units, and devices requiring identification for operating procedures shall be provided with permanent black laminated micarta white core labels with 3/8 inch letters.
- B. This shall also apply to all controllers, remote start/stop pushbuttons and equipment cabinets.
- C. Refrigeration Machinery Rooms shall be identified with a permanent placard of red-white-red laminated, commercial grade, plastic construction. Letters shall be minimum one inch high for the header to read in capital letters: WARNING – REFRIGERATION EQUIPMENT ROOM – LIMITED ACCESS. The following information shall be posted in a similar fashion, minimum half-inch high capital letters, indicating:

1. The name and address of the installer.
2. The refrigerant number and amount of refrigerant in pounds.
3. The lubricant identity and amount in pounds or ounces as appropriate.
4. The field test pressure applied to the equipment in psig.

Placard shall be centered on each door leading into the refrigeration equipment room at five feet above the floor and attached at each corner with brass screws.

3.7 FLASHING AND COUNTERFLASHING

- A. Roof curbs, etc., shall have counterflashing fittings. General Contractor shall provide flashing.
- B. Piping and conduit thru the roof shall be flashed by the General Contractor. Provide counterflashing.
- C. Provide curbs with base features required to match roof materials, finishes and configuration; e.g., flat, sloped, raised seam, etc.

3.8 ACCESS

- A. Locate all equipment, valves, devices and controllers which may need service in accessible places.
- B. Maintain access clearances for tube or fan removal, coil pulls, and filter removal.

3.9 WIRING AND MOTOR CONTROLS

- A. Packaged equipment shall be furnished with disconnect switches, starters, overloads, factory furnished and wired by the unit manufacturer.
- B. Roof-mounted exhaust fans, except utility sets, rated less than 1/2 HP at 115 volts, single phase, shall be furnished with disconnect switches, factory furnished and wired by unit manufacturer.

- C. This Contractor shall furnish all information and assistance required for the Electrical Contractor to purchase all motor starters that are not specified to be part of the mechanical equipment.
- D. Control wiring shall be provided under this Division of the work.
- E. All wiring shall be in accordance with the National Electrical Code and as recommended by the equipment manufacturer.

3.10 UTILITIES

- A. Do not interrupt any utility or service to the Owner without adequate previous notice and schedule.

3.11 OPENINGS – CUTTING, REPAIRING

- A. This Contractor shall cooperate with the work to be done under other sections in providing information as to openings required for all piping, ductwork and equipment, including sleeves where required.
- B. Any drilling or cutting required for the performance of work under this Section, shall be the responsibility of this Contractor and the cost thereof shall be borne by him.
- C. It shall be the responsibility of this Contractor to ascertain that all chases and openings are properly located.
- D. Fire-Rated Sealing Method:
 - 1. Sleeves, openings, and sealants shall comply with applicable codes, recommended practices and standards, and manufacturer's instructions. Fire sealants shall have ability to prevent spread of flame, smoke, or water throughout the penetration and shall pass 3-hour test, UL test ASTM E814 and UL 1479.
 - 2. Products: Chase Corporation CTC PR-855, O.Z. Gedney CRS/CAFS, 3M Electco-Products Division Putty 303 or Caulk CP25 penetration sealing kits, General Electric Company sealants type RTV-850, 6428 or 7403, Hilti FS-one, Thunderline Corporation "Link-Seal Pyro-Pak". Installation and type of sealant to be used as recommended by the manufacturer.

3.12 PAINTING

- A. The General Contractor shall be responsible for painting.

3.13 GUARANTEE

- A. All work shall be guaranteed to be free from defects for a period of two year of operation from date of acceptance by the Owner.
- B. Guarantee shall be extended on an equal time basis for all non-operational periods due to failure within the guarantee period.
- C. All materials and equipment provided and/or installed under this section of the specifications shall be guaranteed for a period of two years from date of acceptance of the work by the Owner unless otherwise specified in Division 1. Should any trouble develop during this period due to defective materials or faulty workmanship, the Mechanical Contractor shall furnish necessary labor and

materials to correct the trouble without any cost to the Owner. Any defective materials or inferior workmanship noticed at time of installation and/or during the guarantee period shall be corrected immediately to the entire satisfaction of the Owner.

- D. In the event of occupancy by the Owner prior to final acceptance of the project, the guarantee date for equipment placed in operation shall be mutually agreed to by the Mechanical Contractor and the Owner's representative.

3.14 DRAWINGS

- A. The Mechanical Systems are indicated on the Contract Drawings. Certain pertinent information and details required by the Mechanical Work appear on the Architectural, Structural and Electrical Drawings; become familiar with all drawings, and incorporate all pertinent requirements.
- B. Drawings are diagrammatic and indicate the general arrangement of systems and requirements of the work. Do not scale drawings. Exact locations of fixtures and equipment, not specifically shown, shall be obtained before starting work.

3.15 TESTING AND BALANCING OF MECHANICAL EQUIPMENT

- A. Perform field mechanical balancing in accordance with Section 230950: TESTING AND BALANCING OF MECHANICAL SYSTEMS.
- B. The Mechanical Contractor shall own as part of his work, the following:

Provide one (1) additional drive set, if necessary, to obtain final design balancing requirements. The Mechanical Contractor shall coordinate with Balancing Firm and equipment manufacturer for drive selection, including belts and pulleys.

END OF SECTION 23 02 00

SECTION 23 02 10 – BASIC MATERIALS AND METHODS – HVAC

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other conditions, if any) and Division 1 as appropriate, apply to the work specified in this section.
- B. Refer to Section 230200 for HVAC General Provisions.
- C. Refer to other sections in Division 23 for materials and methods not specified herein.

1.2 DESCRIPTION OF WORK

- A. Included in this Section are the following:
 - 1. Steel Pipe and Fittings
 - 2. Copper Tubing & Fittings
 - 3. Polyvinyl Chloride (PVC) Pipe and Fittings
 - 5. Grooved End Pipe (Gruvlok) or (Victaulic)
 - 6. Strainers
 - 7. Thermometers
 - 8. Gauges
 - 9. Test Stations - Pressure/Temperature
 - 10. Isolating Fittings
 - 15. Unions
 - 16. Motors

1.3 REFERENCE STANDARDS

- A. Refer to Section 230200 for a general description of requirements applying to this section.
- B. Install work to meet the requirements of the following:
 - 1. New Castle County Dept. of License and Inspections
 - 2. International Mechanical Code
 - 3. Gas Utility Company

4. NFPA
5. OSHA
6. ASHRAE
7. Manufacturer's Standardization Society (MSS) of the valve and Fittings Industry, Inc.:

 SP-58 Pipe Hangers and Supports Materials, Design and Manufacture.

 SP-69 Pipe Hangers and Supports Selection and Application

- C. Appliances and materials governed by UL requirements shall meet such requirements and bear the label.

1.4 QUALITY ASSURANCE

- A. Provide adequate supervision of labor force to assure that all aspects of the specifications are being fulfilled.
- B. Verify that all work and equipment is installed in accordance with manufacturer's warranty requirements.

1.5 SUBMITTALS

- A. Submit piping layout shop drawings in accordance with Section 230200.

PART 2 – PRODUCTS

2.1 STEEL PIPE AND FITTINGS

- A. Water Piping:
 1. ASTM A53, Schedule 40.
 2. Fittings up to 2 inch shall be 150 lb. malleable iron, screwed pattern ASME B16.3. Butt weld , ASME B16.9, same thickness as pipe.
 3. Fittings 2-1/2" and larger shall be butt weld ASME B16.9, same thickness as pipe.
 4. Weld-O-Lets and Thread-O-Lets shall be maximum of two sizes smaller than main size; i.e., maximum of a 2-inch Weld-O-Let on a 3-inch pipe.
 5. Thread tape shall be teflon tape, 3 mils minimum thickness.

2.2 COPPER TUBING & FITTINGS

- A. Water Piping:
 1. Tubing: Hard drawn seamless ASTM B-88 Type "L" aboveground.
 2. Joint Material: Brazed joints, low temperature silver-bearing solder.

- a. Flux shall be non-toxic type and non-corrosive.
- 3. Fittings: ASME B16.15, B16.18, B16.22, or B16.26.
- B. Condensate Drain Piping:
 - 1. Pipe: Copper tubing Type DWV.
 - 2. Fittings: Wrought copper solder type drainage fittings, ASME B16.23 or B16.29.
- 2.3 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS
 - A. Pipe:
 - 1. ASTM D-1785 Schedule 40, Type 1, Grade 1.
 - 2. ASTM D-2665 (DWV) drain, waste and vent.
 - B. Fittings:
 - 1. ASTM D-2466 Schedule 40
 - 2. ASTM D-2665 DWV.
 - C. Solvent Cement: ASTM D-2564 Schedule 40 and DWV.
 - D. Uniformity: To insure installation uniformity, all piping components shall be of one manufacturer.
 - E. Flux shall be non-toxic type and non-corrosive.
- 2.4 GROOVED END PIPE (VICTAULIC)
 - A. All pipe shall be prepared in accordance with (ANSI/AWWA C-606). (CSA B242-M1980). (MIL-P-11087C Grooved End Pipe), or Victaulic (manufacturer's) published specifications as appropriate according to pipe materials, wall thickness, size and method of joining, as further detailed in Paragraph G: Pipe Preparation. In the event of conflict, Victaulic data shall prevail.
 - 1. Iron Pipe Size: Pipe shall conform in size (outside diameter) to ANSI B-36.10 (API-5L) and/or to Victaulic (Manufacturer's) published outside diameter tolerances.
 - a. Steel Pipe (CSI-15061): Steel pipe shall be black, conforming to ASTM A-53, Grade B, 3/4 - 1-1/2" (20-40 mm) Type F and 2 - 24" (50-600mm) Type E or S or hot-dip galvanized.
 - B. Couplings shall consist of two ductile iron cast housings, a synthetic rubber gasket of a central cavity pressure-responsive design, with nuts, bolts, locking toggle or lugs to secure unit together.
 - 1. Coupling Housings: Shall be cast of ductile iron conforming to ASTM A-536 (Grade 65-45-12) enamel coated, hot dip galvanized to ASTM A-153 or zinc electroplated to ASTM B-633, as manufactured by Victaulic Company of America. Refer to Victaulic product specifications for other materials.

- a. Coatings: Shall consist of an enamel paint or hot dip galvanizing to ASTM A-153, or zinc electroplating to ASTM B-633 as specified.
2. Couplings for End Steel Pipe: Shall be Victaulic couplings for grooved and steel pipe prepared under "Grooved End Pipe". Couplings shall comply with ASTM F1476 Standard Specification for the Performance of Gasketed Mechanical Couplings for Use In Piping Applications.
 - a. Sizes 2" through 12": Coupling housings cast with offsetting, angle pattern bolt pads shall be used to provide system rigidity and support and hanging in accordance with ANSI B31.1 and B31.9.
 - (1) Victaulic Style 107V, Installation-Ready, for direct stab installation without field disassembly, with grade EHP gasket, suitable for water service to +250 deg F.
 - b. Flexible Type: For use in locations where vibration attenuation and stress relief are required, thermal expansion and contraction, in riser piping and for elimination of flexible connectors. Victaulic Installation-Ready Style 177N or Style 77.
 - c. 14" and Larger: AGS Series, with lead-in chamfer on housing key and wide width FlushSeal gasket. Victaulic Style W07 (rigid) with Coupling housing key designed to fill the wedge shaped AGS groove and provide system rigidity, and Style W77 (flexible).
 - d. Reducing Joints: Shall be Victaulic Style 750 Reducing couplings for pipe to pipe joints or to create reducing fittings using straight fitting configurations.
 - e. Outlets: All joints designed Outlet Couplings or where feasible to replace reducing outlet tees, shall be Victaulic Style 72 Outlet couplings male threaded outlet.
 - f. Flanged Connections: Shall be Victaulic Style 741 /W741 (2 - 24") Vic-Flange adapters, engaging directly into grooved pipe and bolting directly to ANSI Class 125 cast iron or Class 150 steel flanged components.
- C. Couplings for Grooved End Ductile Iron Pipe: Shall be Victaulic couplings for radius cut grooved ductile iron pipe preparation.
 1. Line and Fittings Joints: Shall be Victaulic Style 31 couplings.
 2. Flanged Connections: Shall be Victaulic Style 341 (4-24") (100-600mm) Vic-Flange adapters, engaging directly into grooved end pipe and bolting directly to ANSI Class 125 cast iron or Class 150 steel flanged components. Installer to supply standard flange bolts.
 3. For direct connection to IPS steel pipe sizes, couplings shall be Victaulic Style 307 transition couplings.
- D. Coupling Components:
 1. Gaskets shall be molded of synthetic rubber in a central cavity, pressure-responsive configuration conforming to the pipe outside diameter and couplings housing, of elastomers having properties as designated in ASTM D-2000. Reference always shall be made to the latest published selection guide for Victaulic gaskets for proper gasket selection for the intended service.

- a. Water Service: Gasket supplied for water services from -30 deg. F to +230 deg F (-34 deg. C to +110 deg. C) shall be a Grade "E" EPDM compound, with green color code, molded of materials conforming to ASTM D-2000, designation 2CA615A25B24F172, recommended for hot water service within the specified temperature range, plus a variety of dilute acids, oil-free air, and many chemical services. Not recommended for petroleum services.
2. Bolts and Nuts shall be heat treated carbon steel, track head, conforming to physical properties of ASTM A-449 and A-183 minimum tensile 110,000 psi, zinc electroplated to ASTM B-633, as supplied or specified.
 - a. Other Fasteners: Fasteners to certain products may vary from the specification as noted with each product.
- E. Fittings: Shall be Victaulic full flow cast fittings, steel fittings or segmentally welded fittings with grooves or shoulders designed to accept Victaulic grooved end couplings and AGS couplings 14" through 24".
 1. Standard Fittings: Shall be cast of ductile iron conforming to ASTM A-536 (Grade 65-45-12) painted with enamel or hot dip galvanized to ASTM A-153 or zinc electroplated to ASTM B-633 as required.
 2. Standard Steel Fittings: Including large size elbows (16-24"/400-600mm) shall be forged steel conforming to ASTM A-234 Grade WPB (0.375" wall), painted with enamel or hot-dip galvanized to ASTM A-153.
 3. Standard Segmentally Welded Fittings: Shall be factory-fabricated of Schedule 40 carbon steel pipe as follows: 3/4 - 1-1/2" (20-40mm) conforming to ASTM A-53 Type F, 2 - 10" (50 - 250mm) Schedule 40 conforming to ASTM A-53, Type E or S, Grade B, 12 - 24" (300 - 600mm) 0.375" wall conforming to ASTM A-53, Type E or S, Grade B, painted with enamel or hot-dip galvanized to ASTM A-153.
- F. Branch outlets for hole cut steel pipe: Shall be Victaulic hole cut products, cast of materials as in Paragraph 4a, with gasket as detailed in Paragraph 3c, on pipe preparation in Paragraph G.
- G. Gauge, Meter Outlets for Hole Cut Steel Pipe: Shall be Victaulic strapless mechanical outlet products Style 923 Vic-Let, or 924 Vic-O-Well and shall provide a pipe outlet without a need for a strap or lower housing to wrap around the pipe.
- H. Pipe Preparation: Shall be prepared in accordance with the latest published Victaulic specifications, ANSI/AWWA C-606, CSA B-242, UL, FM, NFPA or other standards as applicable. Pressure ratings and end loads for cut grooved pipe are based upon tests on pipe prepared in accordance with Victaulic specifications.
- I. Steel Pipe: Shall be steel pipe conforming to ASTM A-53 Grade "B", 1-1/2" (25-40 mm) Type F, 2-14" (50 - 600 mm) Type E or S.
 1. Grooved End Pipe: Shall be grooved in accordance with Victaulic Standard Specifications.
 - a. Standard Weight Pipe shall be roll grooved or square cut grooved.
- J. Assembly: Couplings, fittings, valves and pipe shall be assembled in accordance with latest published instructions from Victaulic Company of America for the particular product installed.

1. Pipe: Shall be checked to be certain it is sufficiently free of indentations, projections, grooves, weld seams, or roll marks on the exterior of the pipe over the entire gasket seating area to assure a leak-tight seat for the gasket, that pipe ends are square cut and that preparation is in accordance with Victaulic pipe preparation standards.
2. Gasket: All gaskets shall be of the central cavity pressure-responsive design. Gasket style and elastomeric material (grade) shall be checked to be certain gasket supplied is suited for the intended service.
3. Lubrication shall always be used for proper coupling/fitting assembly as follows:
 - a. Thorough lubrication of the gasket exterior including the lips and/or pipe ends and housing interiors, is essential to prevent pinching the gasket. Lubrication assists proper gasket seating and alignment during installation.
 - b. Use Victaulic Lubricant for installation. Other compatible materials such as silicone and others may be used; however, petroleum based lubricants must not be used on Grade "E" or "M" gaskets.
 - c. A thin coat of Victaulic lubricant shall be applied by brush or by hand by: 1) brushing on the gasket lips (ID) and the entire exterior of the gasket; 2) brushing lubricant on the pipe ends around the entire pipe circumference and inside the coupling housing.
 - d. The coupling manufacturer's factory trained representative shall provide on-site training for the contractor's field personnel in the use of grooving tools and installation of product. The representative shall periodically visit the job site to ensure best practices in grooved product installation are being followed. (A distributor's representative is not considered qualified to conduct the training.)

K. Support:

1. The requirements of MSS-SP-69 "Pipe Hangers and Supports"- Selection and Application: shall, in general, govern the installation of hangers and supports, in accordance with the following recommendations:
 - a. Piping joined with grooved type couplings, like all other piping systems, requires support to carry the weight of pipes and equipment. Like all other methods of jointing pipes, the support or hanging method must be such as to eliminate undue stresses on joints, piping and other components. Additionally, the method of support must be such as to allow movement of pipes where required and to provide for other special requirements such as drainage, etc., as may be required by the designer. The support system for mechanical grooved type pipe couplings must consider some of the special requirements of these couplings.

OR

2.4 GROOVED END PIPE

- A. Couplings, fittings, valves and other grooved components may be used as a proprietary piping method, or listed as an option to welding, threaded or flanged piping methods.
- B. Grooved Piping products shall comply with ISO 9001 Certified standards. Grooved piping installation shall meet ANSI B-31.1 – ANSI B-31.9 standards for horizontal and vertical pipe support

design criteria. Grooved products shall meet national and local piping and/or building codes. Grooved products shall conform to ASTM, ANSI Standards, and other applicable Product Piping standard. All mechanical commercial and industrial piping products shall have a minimum 300 psi working pressure with 3 to 1 or greater safety working pressure.

- C. Couplings and grooved flange adapters shall conform to ASTM A-536 Ductile Grade 65-45-12 or to ASTM A-47 malleable grade 32510. Coupling track head bolts shall conform to ASTM A-183 Grade 2. Hex nuts shall conform to ASTM A-563 Grade A. Bolts and nuts are zinc electroplated. Fittings shall conform to cast ductile ASTM A-536 or cast malleable ASTM A-47. Forged steel fittings shall conform to ASTM A-234 or A-106 Gr B. Segmental welded fittings shall conform to ASTM A-53. Coatings shall be standard (orange) Alkyd-enamel rust inhibiting lead-free paint. Hot dipped galvanized fittings shall conform to ASTM A-153. Standard coupling gaskets for building services shall be Grade “E” EPDM conforming to ASTM D-2000 with operating temperature range from -30°F to +230°F.
- D. Coupling gaskets shall be lubricated with approved lubricant as provided by the piping system manufacturer. “Extreme Temperature Lubricant” shall be used for all systems below minus 20°F, and above 180°F and systems subject to continuous cycle temperature.
- E. Black steel pipe conforming to ASTM A-53, Grade A or B, Standard Schedule 40 may be roll or cut grooved. Grooving must conform to Manufacturer’s Standards.
 - 1. Manufacturer’s Standard (rigid) couplings shall be used including flange adapters. Manufacturer’s Standard (flexible) couplings may be used for vibration attenuation and noise suppression at equipment locations.
 - a. Optional: Combination rigid, flexible and outlet couplings may be used for complete systems to aid in providing vibration, noise suppression and seismic tremor. Clamp type couplings may be used for branch outlets. Grade “E” EPDM gaskets. Flexible or other style couplings designed for axial motion or other movements must be engineered and supported in strict accordance with factory recommendations.
 - 2. Transition flange adapter from flange to groove shall conform to ANSI class 125 or 150 lb. bolt pattern. Sizes 2” – 20” 300 psig. Sizes 24” 250 psig. Style 7013 2” – 12” available for ANSI Class 250/or 300 lb. bolt pattern. 750 psig. Flanges are designed with internal anti-rotation “tang” designated as a rigid connection 2” – 12”. Series 7012 flange adapters require sealing rings when used with certain flanged products.
 - 3. Fittings shall be cast ductile, malleable, forged steel, and/or segmentally welded steel fittings. Cast ductile conforms to ASTM A-536 or ASTM A-47. Forged steel conforms to ASTM A-234. Segmentally welded conforms to ASTM A-53. Fittings shall be coated with an Alkyd-enamel non-toxic paint. Zinc electroplated fittings conform to ASTM B-633. Hot dip galvanized fittings conform to ASTM A-153. Standard Fittings are Schedule 40 or standard wall. Other fittings are schedule 80 or lightwall as specified.
 - 4. Grooved x grooved or grooved x thread insulating nipples. Inhibits the formation of a galvanic cell between dissimilar metals. Housing: Steel Tube to ASTM A513. Liner: Polypropylene to ASTM D4140. Operating temperature -40°F to +230°F. Size range is 2” – 6” diameter.
 - 5. Branch outlets shall be Clamp T Branch and Clamp T Cross with grooved or threaded outlets. Sizes 2” – 8”. Branch outlets from ½” – 4” diameter. Designated as a bolted-on positive pipe

engagement branch outlet. Working pressure to 500 psi.

6. Outlet couplings shall have grooved or threaded outlets. Run sizes 1-1/2" – 6". Branch outlets from 1/2" – 2" diameter. Working pressure to 500 psig.
 7. Plain end couplings and fittings shall be Manufacturer Standard coupling and plain-end fittings to match. Size range is 2" – 8" diameter. Materials conform to ASTM A-536 and A-47. Fittings are cast or forged steel. Intended for working pressures 300 – 750 psig with factory recommended torque requirement on plain-end standard wall pipe. Fittings match coupling working pressure.
 8. Plain end method shall be Manufacturer's Standard fitting. Size range is 1" – 2" diameter. Material conforms to ASTM A-126 Class A cast iron. Working pressures from 175-300 psi UL/ULC listed FM approved.
- F. Gaskets shall be Grade "E" EPDM pressure responsive design for all water and non-oily air service. EPDM gaskets are color-coded green. Material conformance to grooved industrial standards ASTM D-2000, designation 2CA615A25B24F17Z. Temperature operating range minus 30° to +230°F. Non-toxic lubricant must be used to insure non-pinching of gaskets during product installation. "Extreme Temperature Lubricant" must be used for all system installations, below -20°F, installations above 180°F and installations that are subject to temperature cycles.
- G. Standard products shall be furnished with alkyd enamel, rust inhibiting non-toxic paint. Galvanized material conforms to ASTM A-153. Bolts and nuts are zinc electroplated to ASTM A-164.
- H. Couplings shall be furnished with heat treated, oval neck track head bolts conforming to ASTM A-183 Grade 2. Bolts meet minimum tensile strength of 110,000 psi. Hex nuts are carbon steel conforming to ASTM A1-563 Grade A. Bolts and nuts are electroplated.
- I. Assembly: Couplings, fittings, valves and pipe shall be assembled in accordance with latest published instructions from the piping system manufacturer for the particular product installed.
1. Pipe: Shall be checked to be certain it is sufficiently free of indentations, projections, grooves, weld seams, or roll marks on the exterior of the pipe over the entire gasket seating area to assure a leak-tight seat for the gasket, that pipe ends are square cut and that preparation is in accordance with pipe manufacturer's preparation standards.
 2. Gasket: All gaskets shall be of the central cavity pressure responsive design. Gasket style and elastomeric material (grade) shall be checked to be certain gasket supplied is suited for the intended service.
 3. Lubrication shall always be used for proper coupling/fitting assembly as follows:
 - a. Thorough lubrication of the gasket exterior including the lips and/or pipe ends and housing interiors, is essential to prevent pinching the gasket. Lubrication assists proper gasket seating and alignment during installation.
 - b. Use manufacturer's lubricant for installation. Other compatible materials such as silicone and others may be used; however, petroleum based lubricants must not be used on Grade "E" or "M" gaskets.

- c. A thin coat of lubricant shall be applied by brush or by hand by: 1) brushing on the gasket lips (ID) and the entire exterior of the gasket; 2) brushing lubricant on the pipe ends around the entire pipe circumference and inside the coupling housing.

J. Support:

1. The requirements of MSS-SP-69 "Pipe Hangers and Supports"- Selection and Application: shall, in general, govern the installation of hangers and supports, in accordance with the following recommendations:
 - a. Piping joined with grooved type couplings, like all other piping systems, requires support to carry the weight of pipes and equipment. Like all other methods of jointing pipes, the support or hanging method must be such as to eliminate undue stresses on joints, piping and other components. Additionally, the method of support must be such as to allow movement of pipes where required and to provide for other special requirements such as drainage, etc., as may be required by the designer. The support system for mechanical grooved type pipe couplings must consider some of the special requirements of these couplings.

K. Manufacturers: Anvil Golvok or Tyco Grinnell.

2.5 STRAINERS (WATER)

- A. Perforations: .033" pipe size to 2", .057" pipe size 2-1/2" to 4", 1/8" pipe size 6" and up.
- B. Self-cleaning "Y" type screwed end up to 2 inch with machined seats with blow-off outlet, stainless steel screen, iron body.
- C. Self-cleaning "Y" type flanged 2-1/2 inch and up, with bolted cover flange, blow-off outlet, 125 psi ANSI, brass screen.
- D. Manufacturer: Muesco, Sarco, Hoffman Specialties, Metraflex, Armstrong, Watson McDaniel.

2.6 THERMOMETERS

- A. Separable socket, inserted into fluid flow, adjustable, hermetically sealed, red or blue indicating fluid, non-toxic, die-cast, baked enamel finish, double strength glass lens, white scale and black graduations.
- B. Scale: Heating Water - 30 deg. to 240 deg. F
Chilled Water - 0 deg. to 100 deg. F
Condenser Water-30 deg. to 150 deg. F
- C. Manufacturer: U.S. Gauge, H.O. Trerice, Moeller, Duro, Miljoco Corp., Winter Instruments.

2.7 GAUGES

- A. Phosphor bronze bourdon tube, polypropylene case, gasketed glass crystal, aluminum dial, black graduations 4-1/2 inch diameter.
- B. Range: 0 to 60 psi, 5 pound intervals, 1/2 pound graduations.

- C. Install with bronze gauge cock.
- D. Manufacturers: Danton, U.S. Gauge, H.O. Trerice, Moeller, Miljoco Corp., Winter Instruments, Weksler Instruments.

2.8 TEST STATIONS – PRESSURE/TEMPERATURE

- A. Provide a SISCO 1/4" or 1/2" NPT fitting (Test Plug) of solid brass at desired indicated locations. Test plug shall be capable of receiving either a pressure or temperature probe 1/8" o.d. Dual seal core shall be neoprene for temperature to 200 degrees F. Nordel to 350 degrees F and shall be rated zero leakage from vacuum to 1000 psig. P/T plug to have grooved cap and chain.
- B. P/T plugs shall be provided with extensions as required by insulation.
- C. Mechanical Contractor shall also provide the following: pressure gauge adapters with 1/8" o.d. probe, 5" stem pocket testing thermometers for 25° to 125° F (tower and chilled water) for 0° to 220° F (hot water) for 50° - 500° F (temperatures above 220° F).
- D. One (1) Master Test Kit shall be furnished to the Owners. Kit shall contain one (1) 2-1/2" test gauge of suitable range, one (1) Gauge Adapter 1/8" o.d. probe, and 5" stem pocket testing thermometers - one (1) 0° - 220° F and one (1) 50° - 550° F.
- E. Manufacturer: Sisco P/T Plugs.

2.9 ISOLATING FITTINGS

- A. Provide isolating fittings between all sections of dissimilar piping materials or piping and equipment where one material is ferrous and the other is non-ferrous.
- B. Manufacturer: Epco Sales, Inc., or insulated unions by Central Plastic Co.

2.10 UNIONS

- A. Up to and including 2-inch pipe size: Screwed pattern, bronze-to- bronze seat.
- B. Above 2-inch pipe size: Flanged pattern, A.S.A. forged steel, with gaskets, bolts and nuts.
- C. Copper tubing unions shall have sweated type ends. Flanged unions on copper tubing may be soldered connections.
- D. Materials and pressure ratings shall be the same as specified for the respective pipe and fitting system unless otherwise specified.

2.11 MOTORS

- A. All single phase and polyphase motors shall be manufactured to incorporate the latest NEMA standards.
- B. All single phase and polyphase motors shall have steel frames with ball bearings and copper windings. All motors to have a Class "F" insulation system with a service factor of 1.15.

- C. All motors shall be 1725 RPM, 4 pole design, unless otherwise noted on the drawings, or in the equipment specifications.
- D. Motors installed indoors and not exposed to moisture shall be open, dripproof, Class B temperature rise based on 40 deg. C maximum ambient temperature.
- E. Motors installed outdoors and exposed to moisture shall be totally enclosed, fan cooled, Class B temperature rise based on 40 deg. C maximum ambient temperature.
- F. Based on NEMA Standards, motors shall comply with the following minimum nominal efficiencies at full load.

Nominal Efficiencies for “NEMA Premium”™ Induction Motors Rated 600 Volts or Less (Random Wound)						
	Open Drip-Proof			Totally Enclosed Fan-Cooled		
HP	3500 RPM	1800 RPM	1200 RPM	3500 RPM	1800 RPM	1200 RPM
1	82.5	85.5	77.0	82.5	85.5	77.0
1.5	86.5	86.5	84.0	87.5	86.5	84.0
2	87.5	86.5	85.5	88.5	86.5	85.5
3	88.5	89.5	85.5	89.5	89.5	86.5
5	89.5	89.5	86.5	89.5	89.5	88.5
7.5	90.2	91.0	88.5	91.0	91.7	89.5
10	91.7	91.7	89.5	91.0	91.7	90.2
15	91.7	93.0	90.2	91.7	92.4	91.0
20	92.4	93.0	91.0	91.7	93.0	91.0
25	93.0	93.6	91.7	93.0	93.6	91.7

- G. Motor Characteristics: Refer to Equipment Schedules for specific data.

 120/208 Volt System: Motors 1/2HP & Larger - 208V, 3 Phase, 3 Wire
 Motors Less than 1/2HP- 120V, 1 Phase, 2 Wire

 277/480 Volt System: Motors 1/2HP & Larger - 480V, 3 Phase, 3 Wire
 Motors Less than 1/2HP-120/277V, 1 Phase, 2 Wire.
- H. All motors rated less than 1/2HP shall have thermal protection of the auto-reset type as an integral part of the motor.
- I. All motors rated 1/2HP and larger shall have thermal protection provided by an external device.
- J. Whenever a variable frequency PWM drive is installed to control an AC motor, a maintenance-free, circumferential, conductive micro fiber shaft grounding ring shall be installed on the AC motor drive end to discharge shaft currents to ground. Recommended part: AEGIS SGR™ Bearing Protection Ring, as made by Electro Static Technology. Install in accordance with the manufacturer’s written instructions.

PART 3 – EXECUTION

3.1 PIPING SYSTEMS

- A. All piping to drain to low points. Low points shall be provided with drain valves with hose thread.
- B. All piping shall be arranged to have air vents at high points.
 - 1. Air vents shall be automatic in operation when located in Boiler Rooms, and Mechanical Equipment Rooms. All air vents shall be provided with a PVC drain line which shall be routed to the nearest floor drain. Several air vents may be tied together.
- C. Do not install trapped lines where water cannot be drained or air can accumulate without being vented.
- D. Piping shall run square with building lines.
- E. Piping shall not be insulated or covered until tested.
- F. Necessary drains, off-sets, vents and drips shall be provided for coordination of the work as part of the contract.
- G. Running or close nipples are not permitted.
- H. Piping shall not be installed over electrical transformers, panels, switchgear, substations, and control panels.
- I. Allow clearance for expansion and contraction.
- J. Install eccentric piping fittings where change in sizes occurs in piping systems. Tops of pipes shall remain level for hydronic systems.
- K. Install isolating fittings between sections of ferrous and non-ferrous pipe or connected equipment.
- L. Do not support piping from other piping, conduits or equipment.
- M. Support piping from building structure with expansion bolts, rods, steel angles, or channels installed to meet existing or new building conditions.
- N. Drilling into the roof deck is not permitted.
- O. Strainers shall be installed on suction of all pumps, inlets of control valves, and where indicated on drawings.
- P. Thermometers and gauges shall be installed where indicated on the drawings, required by equipment specifications and where indicated elsewhere in the specifications.
- Q. Flexible connectors shall be provided on suction and discharge piping of all base mounted pumps.
- R. Unions shall be provided adjacent to all valves, at equipment connections, and where necessary to facilitate dismantling of the piping system.
- S. Material Requirements for Systems:

1. Heating Hot Water Supply & Return Piping:
 - a. Schedule 40 black steel.
 - b. Type L hard copper.
 - c. Grooved End black steel.
2. Chilled Water Supply & Return Piping:
 - a. Schedule 40 black steel.
 - b. Type L hard copper.
 - c. Grooved End black steel.
3. Condenser Water Supply & Return Piping:
 - a. Schedule 40 black steel.
 - b. Grooved End black steel.
4. Make-up Water: Type L hard copper.
5. AC Condensate Drain (including pumped condensate):
 - a. Type DWV copper.
 - b. Schedule 40 PVC.

3.2 TAGS, CHARTS AND IDENTIFICATION

- A. See Paragraph "Labeling" in GENERAL PROVISIONS for equipment labeling.
- B. Identify each valve in all systems with black, numbered and stamped 1- 1/2" brass or aluminum tags fastened to valve by brass chain and S-hook.
- C. Provide 1/8" scale diagrams showing location, number and service or function of each tagged item.
 1. Provide Owner with one (1) electronic copy of diagram.
 - a. Include one (1) additional copy in the Operation and Maintenance Manuals.
- D. Piping Identification: Identify piping with Seton "Setmark" or Brimar, semi-rigid plastic, wraparound pipe markers with flow arrows and conforming to ANSI A13.1. Locate marker at each valve, changes in direction, where pipes pass thru barriers and every 25' of horizontal runs. Lettering on background shall be in accordance with the following colors:

Legend		Background	Lettering
1.	Chilled Water Supply	- Green	- White
2.	Chilled Water Return	- Green	- White
3.	Cooling Tower Water Supply	- Green	- White
4.	Cooling Tower Water Return	- Green	- White

Legend		Background	Lettering
5.	Gas	- Yellow	- Black
6.	Heating Water Supply	- Yellow	- Black
7.	Heating Water Return	- Yellow	- Black
8.	Boiler Blow Down	- Yellow	- Black
9.	Boiler Feedwater	- Yellow	- Black
10.	Cold Water Make-up	- Green	- White
11.	Vent	- Yellow	- Black

- E. Manufacturers: Seton “Setmark”, Brimar, B-Line MSI.

3.3 WELDING

- A. All concealed and inaccessible black steel piping shall be welded.
- B. All black steel piping larger than 1-1/4 inch may be fusion welded.
- C. All elbows, tees and branch connections shall be made with welding fittings ANSI B16.9.
- D. Welding shall be in accordance with the ASME Boiler and Pressure Vessel Code Section IX.
- E. Furnish welder test certificate for review. Certificates of successful qualification by the following organizations shall be acceptable.
 - 1. ASME Boiler and Pressure Vessel Code
 - 2. ANSI Code for Pressure Piping
 - 3. National Certified Pipe Welding Bureau
 - 4. Military Specification MIL-STD-248

3.4 SOLDERING/BRAZING

- A. Connections between copper tubing and copper fittings shall be made with the appropriate filler metal. Flux shall be non-corrosive type as recommended by the manufacturer of the filler metal, and conforming to AWS A5.8.
- B. Tubing shall be cut square and then reamed and deburred. End of tubing and inside of fitting cup shall be cleaned with steel wool and the flux shall be applied to the clean surface before joining. After joining, the excess filler metal shall be wiped off while still plastic.
- C. Silver brazing alloy shall be equal to Easy-Flo by Handy and Harmon or Sta-Brite silver solder and shall be used for joints in:
 - 1. Hot water heating piping
 - 2. Chilled water piping
 - 3. Air conditioning condensate drain piping
 - 4. Cold water fill and make-up piping

- 5. Condenser water piping
- D. Where the silver brazing is performed in a confined non-ventilated space, a non-toxic, cadmium-free brazing alloy such as braze 560 by Handy & Harman shall be used.

END OF SECTION 23 02 10

SECTION 23 02 15 – VALVES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other conditions, if any) and Division 1 as appropriate, apply to the work specified in this section.
- B. Refer to Section 230200 for HVAC General Provisions.
- C. Refer to other sections in Division 23 for materials and methods not specified herein.

1.2 DESCRIPTION OF WORK

- A. This Section includes the following:
 - 1. General
 - 2. Condenser Water and Chilled Water Systems
 - 3. Hot Water Heating System
 - 4. Grooved End Specialties

1.3 QUALITY ASSURANCE

- A. Provide adequate supervision of labor force to assure that all aspects of the specifications are being fulfilled.
- B. Verify that all work and equipment is installed in accordance with manufacturer's warranty requirements.

PART 2 – PRODUCTS

2.1 GENERAL

- A. All gate and globe valves shall be designed for repacking under pressure when fully opened, and shall be equipped with packing suitable for the intended service. When the valve is fully opened, the back seat shall protect the packing and the stem threads from the fluid. All gate and globe valves shall have a gland follower. The pressure- temperature rating of valves shall be not less than the design criteria applicable to all components of the system.
- B. Insofar as possible, all valves of the same type shall be of the same manufacturer.
- C. Valves installed above 7 ft. in Mechanical Rooms shall have chain operators.
- D. All valves shall be provided with stem extensions. Valve handle shall be clear of insulation jacket.

E. Manufacturers:

Stockham

Milwaukee

Hammond

Apollo

Watts

Walworth

Nibco

Jamesbury

2.2 CONDENSER WATER AND CHILLED WATER SYSTEMS

A. Gate Valves - 2" and smaller:

Valves 2" and smaller shall be of Class 125, body and bonnet shall be of ASTM-B-62 cast bronze composition, threaded or solder ends, solid disc, copper-silicon alloy stem, brass packing gland, Teflon- impregnated packing and malleable handwheel.

Recommended Valves:

Threaded:

Solder:

Stockham B-100 (RS)

Stockham B-108 (RS)

or

or

Stockham B-103 (NRS)

Stockham B-104 (NRS)

RS NRS

RS NRS

Hammond IB690 IB609 Nibco

S111 S113

Milwaukee 148 105 Hammond

IB691 IB613

B. Gate Valves - 2-1/2" and Larger:

Valves 2-1/2" and larger shall be Class 125 iron body, bronze mounted, with body and bonnet conforming to ASTM A-126 Class B cast iron, flanged ends with Teflon-impregnated packing and two-piece packing gland assembly.

Recommended valves:

Stockham G-623 OS&Y RS

Stockham G-612 NRS

	OS&Y	NRS
Hammond	IR1140	---
Nibco	F617-0	F639-31

C. Ball Valves - 3" and Smaller:

Valves 3" and smaller shall be 600 psi CWP, have cast brass bodies, replaceable reinforced Teflon seats, conventional port, blowout proof stems, chrome plated brass ball, and threaded or solder ends. Provide extended valve handle to accommodate up to 2" of insulation with non-thermal conductive material, insulation plug, cap and protective sleeve.

Recommended valves:

Threaded:	Solder:
Stockham S-216-BR-RT	Stockham S-216-BR-RS
NIBCO T-580-70EL	NIBCO S-580-70EL
Jamesbury II 1100TT	----
Apollo 70-100	Apollo 70-200
Inline 334	----

Alternative is Stockham S-217-BR-RT (threaded).

Drain valves, ½" or ¾" shall be 600 psi CWP, with stainless steel trim, cast bronze body, 2-piece with cap and chain, full port stainless steel ball and stem, RTFE ball seat, threaded or soldered inlet connection, cap rated for 150 psi.

Recommended valve:

Stockham S-285-BR-R-66-HC.

D. Globe Valves - 2" and Smaller:

Valves 2" and smaller shall be of Class 125, body and bonnet of ASTM B-62 cast bronze composition, threaded or soldered ends, copper silicon alloy stem, brass packing gland, Teflon-impregnated packing, and malleable handwheel.

Recommended valves:

Threaded:	Solder:
Stockham B-13T	Stockham B-14T
(Teflon Disc)	(Teflon Disc)

Stockham B-16	Stockham B-17
(Bronze Disc)	(Bronze Disc)
Nibco T211B	Jenkins 1200
Hammond IB440	Nibco S211Y

E. Globe Valves - 2-1/2" and Larger:

Valves 2-1/2" and larger shall be Class 125 iron body, bronze mounted with body and bonnet conforming to ASTM A-126 Class B cast iron, flanged ends, with Teflon-impregnated packing and two-piece packing gland assembly.

Recommended valves:

Stockham G-512 (Bronze disc)

Stockham G-514T (Teflon disc)

Bronze Disc:	Comp. Disc.:

Hammond IR116	---

Nibco F718B	---

F. Butterfly Valves - 2-1/2" and Larger: (Chilled Water)

Valves 2-1/2" and larger shall be high performance, bubble-tight, wafer type body or grooved-end, 200 psi CWP, conforming to ASTM A-126 Class B cast iron, field replaceable EPDM sleeve, with ductile nickel-plated disc, 410 stainless steel stem, and EPDM O-ring stem seals. Sizes 2 - 6" shall be lever operated and 8 - 24" shall have gear operators.

Recommended valves:

Stockham LG-512-DS3-B Lever operated

Stockham LG-522-DS3-B Gear operated

Victaulic 300 Masterseal and AGS VIC300-Grooved-end

Lever:	Gear:

Demco NE-150-1215351	NE-150-1215359-2097

Norris R1010-13SS-1F	R1010-13SS-2K

Keystone Fig. 239	239

Center Line Series A	Series A

Nibco WD3110-3	WD3110-5

Milwaukee F2974

Victaulic 716, 779, or W715 – Grooved end

2.3 HOT WATER HEATING SYSTEM

A. Gate Valves - 2" and smaller:

Valves 2" and smaller shall be of Class 150 with body and union bonnet of ASTM B-62 cast bronze composition, threaded or solder ends, solid disc, copper-silicon stem, brass packing gland, Teflon- impregnated packing, and malleable handwheel.

Recommended valves:

Threaded:	Solder:
Stockham B-120 (RS)	Stockham B-124
Stockham B-130 (RS)	----
Hammond IB629	IB648
Nibco T134	S134

B. Ball Valves - 3" and smaller:

Valves 3" and smaller shall be 600 psi CWP, have cast brass bodies, replaceable reinforced Teflon seats, conventional port, blowout proof stems, chrome plated brass ball, and threaded or solder ends with extended solder cups. Provide extended valve handle to accommodate up to 2" of insulation with non-thermal conductive material, insulation plug, cap and protective sleeve.

Recommended valves:

Threaded:	Solder:
Stockham S-216-BR-RT	Stockham S-216-BR-RS
Worcester 4112 RT	---
Jamesbury II 1100TT	----
Apollo 70-100	Apollo 70-200
Nibco T580-70EL	S580-70EL
Inline 334	----

Drain valves, ½" or ¾", shall be 600 psi CWP, with stainless steel trim, cast bronze body, 2-piece with cap and chain, full port stainless steel ball and stem, RTFE ball seat, threaded or soldered inlet connection, cap rated for 150 psi.

Recommended valve:

Stockham S-285-BR-R-66-HC

C. Gate Valves - 2-1/2" and larger:

Valves 2-1/2" and larger shall be Class 125 iron body, bronze mounted, with body and bonnet conforming to ASTM A-126 Class B cast iron, flanged ends, with Teflon-impregnated packing and two-piece packing gland assembly.

Recommended valves:

Stockham G-623 (OS&Y) RS

Stockham G-612 (NRS)

	OS&Y	NRS
Nibco	F617-0	F639-31

Hammond IR1140

D. Globe Valves - 2" and smaller:

Valves 2" and smaller shall be of Class 150 with body and union bonnet of ASTM B-62 bronze, copper-silicon alloy stem, brass packing gland, Teflon-impregnated packing and malleable handwheel.

Recommended valves:

Threaded:	Solder:

Stockham B-22 (Teflon Disc)	Stockham B-24 (Teflon Disc)

Stockham B-29 (Stainless trim) ----

Comp. Disc.:	S.S. Trim:

Nibco T-235-Y	Milwaukee 591A

E. Globe Valves - 2-1/2" and Larger:

Valves 2-1/2" and larger shall be Class 125 body, bronze mounted, with body and bonnet conforming to ASTM A-126 Class B cast iron, flanged ends, with Teflon - impregnated packing and two-piece packing gland assembly.

Recommended valves:

Stockham G-512 (bronze disc)

Stockham G-514 (Teflon disc)

Hammond IR 116

Nibco F7181B

F. Butterfly Valves - 2-1/2" and Larger:

Valves 2-1/2" and larger shall be high performance, bubble-tight, wafer type body or grooved-end, 200 psi CWP, conforming to ASTM A-126 Class B cast iron, replaceable EPDM sleeve, with ductile nickel-plated disc, 410 stainless steel stem, and EPDM O-ring stem seals. Sizes 2 - 6" shall have lever operators and 8 - 24" shall have gear operators.

Recommended valves:

Stockham LG-512-DS3-B Lever operated

Stockham LG-522-DS3-B Gear operated

Victaulic 300 Masterseal and AGS VIC300 – Grooved end

Lever:

Gear:

Demco NE 150-1215351

NE-150-121359-2097

Norris R1010-13SS-1F

R1010-13SS-2K

Keystone Fig. 239

239

Center Line Series A

Series A

Nibco WD 3110-3

WD 3110-5

Note: In Treated Systems, valves with aluminum bronze disc (ASTM B-148 Alloy 954) and EPT or EPDM sleeve may be preferred.

Recommended valves:

Stockham LG-512-BS3-E Lever operated

Stockham LG-522-BS3-E Gear operated

Victaulic 300 Masterseal and AGS VIC300 – Grooved end

G. Check Valves - 2" and smaller:

Valves 2" and smaller shall be Class 150 with bodies and caps of ASTM B-62 bronze composition and threaded ends. Class 150 valves shall have lift-type Buna-N-disc and union caps, and are to be used in lines with globe valves.

Recommended valves:

Stockham B-322-B

Hammond IB948

Milwaukee 510

For backflow prevention in lines with gate valves, Y-pattern valves with swing-type disc are recommended.

For Class 150 Service, threaded ends:

Stockham B-321

H. Check Valves - 2-1/2" and Larger:

Valves 2" and larger shall be iron body, bronze mounted, with body and cap conforming to ASTM A-126 Class B cast iron, flanged or grooved ends, and swing-type disc.

Recommended valves:

Stockham G-931

Hammond IR1124

Nibco F918-B

Victaulic 716, 779, or W715 – Grooved end

2.8 GROOVED-END SPECIALTIES

A. Strainers

1. T-Type Strainer: 2" and larger sizes, 300 PSI (2065 kPa) T-Type Strainer shall consist of ductile iron (ASTM A-536, Grade 65-45-12) or carbon steel (ASTM A-53) body, Type 304 stainless steel frame and mesh removable basket with No. 12 mesh, 2"-3" strainer sizes, or No. 6 mesh, 4"-16" strainer sizes, 57% free open area. Victaulic Style 730. For 14" through 24", use T-Type W730 AGS with stainless steel removable basket.
2. Y-Type Strainer: 2" through 12" sizes, 300 PSI (2065 kPa) Y-Type Strainer shall consist of ductile iron body, ASTM A-536, Grade 65-45-12, Type 304 stainless steel perforated metal removable baskets with 1/16" (1.6mm) diameter perforations and 41% open area 2"-3" strainer sizes or 1/8" (3.2mm) strainer sizes diameter perforations and 40% open area 4"-12" strainer sizes. Victaulic Style 732.

- B. Suction Diffuser – Grooved/Flanged End. Rated to 300 psi (2065kPa). Ductile iron (ASTM A-536) body. 304 stainless steel frame and perforated sheet diffuser with 5/32" (4.0mm) diameter holes 3"-12" inlet sizes or 3/16" (4.8mm) diameter holes 14" and 16" inlet sizes. Removable 20 mesh 304 stainless steel start-up prefilter, outlets for pressure/temperature drain connections, and base supports boss. Victaulic Series 731-G. For sizes 14" through 24", use W731G AGS.

PART 3 – EXECUTION

3.1 PIPING SYSTEMS

- A. All piping to drain to low points. Low points shall be provided with drain valves with hose thread.
- B. Valve body construction shall match piping system material.
- C. Install isolating fittings between sections of ferrous and non-ferrous pipe or connected equipment.
- D. Valves shall be installed with stems above horizontal.
- E. Valves shall be installed on all sides of equipment and control valves to allow isolation for repair.
- F. Unions shall be provided adjacent to all valves, at equipment connections, and where necessary to facilitate dismantling of the piping system.

3.2 TAGS, CHARTS AND IDENTIFICATION

- A. Identify each valve in all systems in accordance with requirements of Section 230210.

END OF SECTION 23 02 15

SECTION 23 02 30 – INSULATION & COVERING – HVAC

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. The general provisions of the contract, including the conditions of the contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this section.
- B. Refer to Section 230200 for HVAC General Provisions
- C. Refer to Section 230210 for HVAC Basic Materials & Methods.

1.2 DESCRIPTION OF WORK

- A. Included in this section are the following:
 - 1. Pipe Insulation Material
 - 2. Reusable Valve Covers
 - 3. Insulated Pipe Saddles
- B. This Section includes insulation and covering provided on the following piping and equipment:
 - 1. Cold Water Make-Up Piping
 - 2. Hot Water Heating Piping
 - 3. Chilled Water Piping
 - 4. Condensate Drain Lines
 - 5. Cold Equipment Surface
 - 6. Hot equipment surfaces.
 - 7. Exterior Piping
 - 8. Reusable Valve Covers
 - 9. Insulated Pipe Saddles

1.3 REFERENCE STANDARDS

- A. Refer to Section 230200 for a general description of requirements applying to this section.

1.4 QUALITY ASSURANCE

- A. Refer to Section 230210 for a general description of requirements applying to this section.

- B. Install insulation in accordance with manufacturer's recommendations.
- C. Provide adequate supervision of labor force to assure that all aspects of the specifications are being fulfilled.

1.5 SUBMITTALS

- A. Submit shop drawings, installation instructions, and manufacturer's literature of all materials specified in accordance with Section 230200.
- B. Submit fabrication instructions for pipe fitting and valve insulation.
- C. Submit manufacturer's joining recommendations for butt joints and longitudinal seams.

1.6 WARRANTY/GUARANTEE

- A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, General Requirements.

PART 2 – PRODUCTS

2.1 PIPE INSULATION MATERIAL

A. Fiberglass:

1. Material: Preformed fiberglass bonded with resin to form circular pipe sleeves with factory applied, white all service jacket bonded to reinforced foil vapor barrier jacketing. The jacket shall have factory applied double pressure-sensitive, self-sealing, adhesive closure and vapor sealing of longitudinal joints. Thermal conductivity: 0.24 Btu/Hr./SF/inch at 100 degrees F. Flame spread of 25 and developed smoke of 50 or less.
2. All Valves and Fittings:
 - a. Glass fiber insert and pre-molded PVC cover, Proto Corp., Johns Manville Corp. "Zeston" and "Hi-Lo Temp Inserts" for fittings. Glass fiber or prefabricated elastomeric foam fittings must fill the entire space within the cover completely.
 - b. Factory molded fibrous glass fitting covering for fittings. Coat ends with Fosters 30-36 lagfast adhesive
 - c. Mitered sections of pipe covering for valves.

3. Manufacturers: Johns Manville Corp., Certain-Teed, Owens- Corning, Knauf.

B. Closed Cell:

1. Material: Black flexible elastomeric foamed closed cell structure insulation 25/50 rated with a flame spread rating of 25 or less and a smoke developed rating of 50 or less with both a moisture seal and a reinforced elastic foam lap seal closure system.
2. Flexible pipe insulation shall be a foamed elastomeric closed cell structure material, with a thermal conductivity of not more than 0.27 Btu/Hr./Sq. Ft./Inch at a mean temperature of 75

degrees F. The insulation shall have an average density of at least 2 pounds per cubic foot, shall be self-extinguishing, and shall have a water vapor transmission rating of not more than 0.1 perms. Between temperature limits of -40 degrees F and plus 220 degrees F, the insulation shall not indicate any deviation from its original state.

3. Specification Compliance:

ASTM-E-84

ASTM-C-534 Type I – Tubular, Type II – Sheet.

ASTM-D-1056, 2B1 – Tubular, Sheet.

MIL-C-3133B (MIL STD 670B) Grade SBE-3

MIL-P-15S280J, Form T, Form S.

4. Manufacturers: Armacell, Nomaco, K-Flex, Aeroflex USA, Inc.

C. Covering of Pipe Insulation Outdoors:

1. Wrapping: Wrap insulation with embossed 0.016" aluminum jacket.
2. Fastenings: Cover shall be held in place with soft aluminum bands on 12" centers.
3. Valves and Fittings: Weatherproof all valves and fittings.

D. Manufacturers: Johns Manville Corp., Certain-Teed, Owens- Corning, Knauf.

2.2 REUSABLE VALVE COVERS

- A. All valves, strainers, combination valves, etc. in chilled water and heating hot water systems shall be insulated with a factory fabricated removable and reusable cover. (This product shall not be used for pipe and fittings.)
- B. Insulation shall be either fiberglass blanket or flexible elastomeric thermal insulation as listed in Paragraph 3.2 of this specification, or prefabricated fitting from the supplier. Flame and smoke spread shall be 25/50 per ASTM 84.
- C. Outer jacket shall be made of material equal to Tychem QC, overlap and completely cover the insulation, with seams joined by tabs made from Velcro or fabric straps per manufacturer's standards.
- D. Outer jacket shall overlap adjoining sections of pipe insulation, and shall be non-combustible, impermeable to water, and prevent mold, mildew and condensation.
- E. Installation shall not require the use of any special hand tools.
- F. Manufacturers: Corick Valve Covers, NoSweat Valve Wraps.

2.3 INSULATED PIPE SADDLES

- A. Insulation and facing shall each meet 25/50 flame and smoke ratings per ASTM E-84 on a component basis.
- B. A section of rigid insulation shall be used at all cold pipe hangers or support locations and shall consist of:
 - 1. A rigid 3.75 PCF phenolic foam pipe insulation designed to support pipe sizes up to and including 6” iron pipe size.
 - 2. A rigid 5 PCF phenolic foam pipe insulation designed to support pipe sizes from 8” to 30” iron pipe size.
 - 3. For all hot pipe hanger or support locations, the insert material shall be either rigid calcium silicate per ASTM C303 or perlite silicate per ASTM C303 with all service jacket and laminated to a steel support saddle.
- C. The insulation jacket shall contain a vapor retarding material to provide low moisture vapor permeability and resistance to mold, mildew and fungus growth.
- D. The insulation shall be free of any CFC or HCFC materials.
- E. The insulation shall have a minimum K-factor of 0.13 at 75 deg. F mean temperature, and self-sealing lap joint with high performance acrylic pressure sensitive adhesive tape.
- F. Integral insulation saddle shall be made of G-90 carbon steel, with full 180 deg. Coverage, flared edges to protect the vapor barrier jacket and insulation, and short rib surface to center the saddle inside the hanger and prevent movement.
- G. Preformed insulation shall extend beyond the saddle by a minimum of 1-1/2” to accommodate a tape joint seal at the butt edges of adjoining insulation sections.
- H. Minimum product dimensions shall be as follows:

Nominal pipe size (inches)	Insulation density (PCF)	Insulation length (inches)	Saddle length (inches)	Saddle gauge
½ - 3-1/2	3.75	9	6	20
4 – 6	3.75	12	9	18
8 – 18	5.0	18	12	16
20 – 30	5.0	24	18	14

- I. Manufacturer: Tru-Balance insulated saddles as made by Buckaroos, Inc., Aerofix-U as made by Aeroflex USA, Inc.

PART 3 – EXECUTION

3.1 INSTALLATION – GENERAL

- A. Do not install until systems have been tested and meet requirements.

- B. Heavy work which may damage insulation shall have been completed in the vicinity of the insulation work.
- C. Provide non-compressible insulation saddles at all piping hanger locations, and at all piping hanger locations where piping is insulated with flexible closed cell insulation.

Option: Provide insulation coupling system as made by Klo-Shure Co.
- D. All installations shall be made by skilled craftsmen regularly engaged in this type of work.
- E. Insulation shall be continuous thru-wall, ceiling and floors.
- F. Metal shields, 16 gauge galvanized, shall be installed between hangers and pipe insulation.
- G. Pipe, ductwork and equipment shall be clean and dry prior to insulating.
- H. Install all insulation per manufacturer's instructions.
- I. To avoid undue compression of insulation, provide solid core inserts at all supports as recommended by the insulation manufacturer. Provide insulation shields between the insulation jacket and the hanger.
- J. Apply vapor proof mastic as recommended by the insulation manufacturer on all longitudinal and butt joints of sectional pipe insulation. Apply similar mastic to the end of every third length of sectional pipe insulation on all chilled water and dual temperature pipe insulation to prevent the migration of condensation that might occur.
- K. Provide insulation on all piping, equipment, and fixtures that are part of a factory assembly package not otherwise insulated by the manufacture of such packaged equipment. Insulation type and thickness shall comply with all of the requirements of this section.

3.2 PIPE INSULATION – TYPES & THICKNESSES

- A. Provide fiberglass insulation of thickness specified on:
 - 1. Cold Water Make-Up:

1/2" for piping less than 1-1/2".

1" for piping 1-1/2" and over
 - 2. Heating Hot Water: (141°F to 200°F)

1-1/2" for piping less than 1-1/2"

2" for pipes 1-1/2" and over.
 - 3. Chilled Water:

1" for piping less than 1-1/2".

1" for piping 1-1/2" and over

B. Provide flexible closed cell insulation of thickness specified on:

1. Cold surfaces of refrigeration equipment, air separators for chilled and heating hot water, and chilled water pumps. 3/4" thickness
2. Hot and chilled water expansion tanks. 3/4" thickness
3. 1/2" thickness for condensate drain lines.

3.3 PIPE COVERING (FOAMED PLASTIC TYPE)

A. All joints and seams shall be sealed with a compatible adhesive. Approved adhesives are as follows:

Armstrong World Industries No. 520

Benjamin Foster Company No. 85-75 up to 200 degrees F.

Contractor may use Armstrong Self-Seal Armaflex 2000 insulation in lieu of the above wherever 1/2" is specified.

B. Fitting covers shall be fabricated from the foamed plastic pipe insulation or from sheet insulation of the identical material. The fabrication shall be in accordance with manufacturer's instructions, and all seams mitered joints shall be joined using the adhesives described hereinbefore.

C. Pipe insulation in concealed spaces shall require no finish coatings.

D. Pipe insulation in all other areas shall receive two coats of finish of color selected by Architect. Approved finishes are as follows:

Armstrong World Industries WB Armaflex Finish

3.4 EXTERIOR PIPE COVERING

A. Wrapping: Wrap insulation with embossed 0.016" aluminum jacket, orient seam down.

B. Fastenings: Cover shall be held in place with soft aluminum bands on 12" centers.

C. Valves and Fittings:

1. Weatherproof all valves and fittings.
2. Finish: Apply two coats of vapor resistant mastic reinforced with glass fabric over wrapping.

3.5 INTERIOR PIPE COVERING

A. Provide premolded PVC cover on all interior insulated piping exposed in finished spaces. Orient seams up in overhead piping and toward the wall in vertical runs.

B. Provide factory molded fitting covering for fittings and accessories, sealed and held in place by manufacturer's recommended sealing system.

C. Provide mitered sections of covering for valves.

3.6 INSULATED PIPE SADDLES

- A. Insulated pipe saddles shall be installed at all hangers, rollers or supports in accordance with manufacturer's written instructions.
- B. All piping shall be clean and free of oil, rust and moisture prior to and during support installation.
- C. All insulated saddles and accessories shall be stored in a dry area protected from weather before and during installation
- D. Seal adjoining butt edges of pipe insulation with approved mastic and tape to insure continuity of the insulation jacket and vapor barrier, especially on cold piping system installations.

END OF SECTION 23 02 30

SECTION 23 03 00 – VIBRATION AND SOUND ISOLATION – HVAC

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. The general provisions of the contract, including the conditions of the contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this section.
- B. Refer to Section 230200 for HVAC General Provisions
- C. Refer to Section 230210 for HVAC Basic Materials & Methods.

1.2 DESCRIPTION OF WORK

- A. This Section includes providing the following vibration and sound isolation material on items furnished and installed under HVAC work:
 - 1. Pump-mounted inertia pads
 - 2. Piping
 - 3. Cooling towers

1.3 REFERENCE STANDARDS

- A. Refer to Section 230200 for a general description of requirements applying to this section.

1.4 QUALITY ASSURANCE

- A. Refer to Section 230210 for a general description of requirements applying to this section.

1.5 SUBMITTALS

- A. Submit shop drawings, installation instructions, and manufacturer's literature of all materials specified in accordance with Section 230200.
- B. Submit the following:
 - 1. Shop drawings
 - 2. Product data

1.6 WARRANTY/GUARANTEE

- A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, General Requirements.

PART 2 – PRODUCTS

2.1 GENERAL

- A. All vibration control apparatus shall be furnished by a single recognized manufacturer. The manufacturer shall submit to the Architect/Engineer evidence affirming that he has been a supplier of vibration control devices of the type required for the past five years.
- B. The vibration control apparatus manufacturer shall supervise, inspect, measure, and approve the installation and shall submit a report to the Architect/Engineer substantiating that all the equipment has been adequately isolated.
- C. Any requests for changes in the specifications must be submitted in writing in time for review and approval through a written addendum to the specifications prior to bid closing.
- D. Unless otherwise indicated or specified, all equipment mounted on vibration isolator bases shall have a minimum operating clearance of 1 inch between the base and the floor or housekeeping and beneath. Clearance space shall be checked to insure that no scrap, rubbish, hardware, etc., has been left to possibly short circuit isolated base.
- E. In connecting isolated HVAC equipment to rest of system, care must be exercised to insure proper installation.
 - 1. Equipment connected to water piping shall be erected on isolators or isolated foundations to correct operating height prior to making piping connections to avoid misalignment problems. To facilitate this, equipment shall be blocked-up with temporary shims to final operating height. When full load is assembled and water is in system, isolators shall then be adjusted to take up load just enough to allow removal of shims.
- F. Vibration isolator sizes and location shall be determined by the vibration control products manufacturer or as specified herein.
- G. Model numbers of Amber/Booth Co., are given for identification. Products of specified manufacturers will be acceptable, provided they comply with all of the requirements of this specification.

2.2 ISOLATOR TYPES

- A. Pump Mounted Inertia Pads:
 - 1. Frame to be structural steel with built-in height saving bracket for recessing into a CPF concrete inertia block for side access.
 - 2. Spring to be adjustable, free-standing, open-spring mounting with combination leveling bolt and equipment fastening bolt. The spring shall be rigidly attached to the spring mounting baseplate and compression plate. The isolator shall be designed for a minimum Kx/Ky (Horizontal-to-Vertical spring rate) of 1.0. A neoprene pad having a minimum thickness of 1/4" shall be bonded to the baseplate. Amber/Booth Type CPF with RSW-1.
- B. Piping in Mechanical Room:
 - 1. Type PBSR: for first two hangers in horizontal piping adjacent to isolated equipment and for

all hangers on 8" and larger pipe, except the first two hanger points adjacent to riser shall be Type BS.

2. Type BSR for remaining hangers in horizontal piping.
3. Type SW for pipe risers. Isolator base plates shall be provided with holes for bolting and isolation grommets.
4. Type SW for floor supports except Type CT for first floor support adjacent to equipment isolated on CT isolators.

C. Cooling Towers:

1. Provide hot dip galvanized (if outdoor installation) adjustable, open-spring isolators having coil springs attached to the top compression plate and baseplate. An elastomeric pad having a minimum thickness of 1/4" shall be bonded to the baseplate. Nuts, adjusting bolts, and washers shall be zinc-electroplated.
2. The spring assembly shall be removable and shall fit within a welded steel enclosure consisting of a top plate and rigid lower housing. Isolated restraining bolts shall connect the top plate and lower housing to prevent the equipment from rising when drained of water. Amber/Booth Type CT/CTC.
3. Provide a hot dipped galvanized structural steel base for increasing rigidity of equipment. The steel members shall have a minimum depth of 1/12 of the longest span, but not less than 6" deep.
4. Junior beams and junior channels shall not be used. Cross members shall be provided where necessary to support the equipment or to prevent twisting of the main members.

D. Manufacturers: Amber/Booth, Kinetics Noise Control, Mason Industries, Vibration Mounting & Controls, Vibration Eliminator, Inc., Vibro-Acoustics.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's specifications and instructions.

1. No metal-to-metal contact will be permitted between fixed and floating parts.
2. Connections to Equipment: Allow for deflections equal to or greater than equipment deflections. Electrical, drain, piping connections, and other items made to rotating or reciprocating equipment (pumps, compressors, etc.) which rests on vibration isolators, shall be isolated from building structure for first three hangers or supports.
3. Common Foundation: Mount each electric motor on same foundation as driven machine. Hold driving motor and driven machine in positive rigid alignment with provision for adjusting motor alignment and belt tension. Bases shall be level throughout length and width. Provide shims to facilitate pipe connections, leveling and bolting.
4. Provide heat shields where elastomers are subject to high temperatures.

5. Extend bases for pipe elbow supports at discharge and suction connections at pumps. Pipe elbow supports shall not short circuit pump vibration to structure.
- B. Inspection and Adjustments: Check for vibration and noise transmission through connections, piping, ductwork, foundations, and walls. Adjust, repair or replace isolators as required to reduce vibration and noise transmissions to specified levels.

END OF SECTION 23 03 00

SECTION 23 04 00 – HEATING GENERATION EQUIPMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this section.
- B. Refer to Section 230200 for HVAC General Provisions.
- C. Refer to Section 230210 for HVAC Basic Materials and Methods.
- D. Refer to Section 230230 for Insulation and Covering – HVAC

1.2 DESCRIPTION OF WORK

- A. This Section includes labor, material, and equipment necessary to provide a complete boiler system as specified herein and shown on the drawings:
 - 1. Boilers - General
 - 2. Boiler - Flexible Steel Watertube
- B. Refer to other Division 23 sections for related work.

1.3 REFERENCE STANDARDS

- A. Refer to Section 230200 for a general description of requirements applying to this Section.
- B. See specifications in this Section for specific compliance with I=B=R, NFPA, UL, ASME, etc.
- C. Underwriters Laboratories:
 - 1. UL 795 – Commercial-Industrial Gas Heating Equipment
- D. American Society of mechanical Engineers:
 - 1. ASME Section IV – Boiler and Pressure Vessel Code – Heating Boilers.
- E. Hydronics Institute Boiler Testing Standards:
 - 1. BTS-2000 – Method to Determine Efficiency of Commercial Space Heating Boilers.

1.4 QUALITY ASSURANCE

- A. Refer to Section 230210 for a general description of requirements applying to this section.
- B. Quality Assurance:

1. Manufacturers: Firms regularly engaged in manufacture of boilers, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
2. Regulatory Requirements:
 - a. I=B=R Compliance: Provide boilers that have been tested and rated in accordance with Institute of Boiler and Radiator Manufacturers (I=B=R) "Testing and Rating Standard for Cast Iron and Steel Heating Boilers", and bear I=B=R emblem on nameplate affixed to boiler.
 - b. NFPA Compliance: Install boilers in accordance with National Fire Protection Association (NFPA) Code 54 "National Fuel Gas Code".
 - c. NFPA 211 Compliance: Heating equipment burning gas, solid or liquid fuels, Section 60.
 - d. Underwriter's Laboratories, Inc., (U.L.) file MA 7991 for storage of flammable liquids.
 - e. ASME, CSD-1

1.5 SUBMITTALS

- A. Submit shop drawings and product data in accordance with Section 230200.
- B. Submit the following:
 1. Shop Drawings
 2. Product Data
 3. Evidence of specified code or other compliance.

1.6 SUBSTITUTIONS

- A. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements on all contract documents. This shall include, but not be limited to, space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades, including all required ancillary items furnished and installed by other trades. If the manufacturer or related bidding contractor does not comply with these requirements, this Contractor shall be responsible for any and all additional costs associated with the changes required by other trades.

1.7 WARRANTY/GUARANTEE

- A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, GENERAL REQUIREMENTS. In addition, the following special guarantee applies:
 1. Start-up and two years of factory service on boilers.

PART 2 – PRODUCTS

2.1 BOILERS - GENERAL

- A. Provide factory packaged type boiler, burner units for hot water heating units arranged for automatic firing with natural gas. Each unit shall include an internal, header type boiler, insulated metal jacket, pre-engineered combustion system consisting of a special horizontal gas/oil burner with forced draft wind box, refractory type combustion chamber and precut block insulation, factory wired NEMA 1 control panel for combustion programming and flame failure protection, integral draft inducer and all operating and limit controls in accordance with CSD-1. Each unit shall be provided with all castings, fittings, accessories and appurtenances necessary for assembly, connection and operation, including safety/relief valves, water column type pump control and lower water cutoff with precut piping and necessary fittings, prefabricated return yoke together with gauges and instruments as hereinafter described. Boiler/Burner package shall be a standard product of the manufacturer.

2.2 BOILER – FLEXIBLE STEEL WATERTUBE

- A. Furnish and install two (2) steel flexible water tube hot water heating boilers, suitable for firing with natural gas as scheduled and hereinafter specified.
- B. Boiler shall be manufactured in strict accordance with the appropriate ASME boiler code for a maximum operating pressure of 160 psi and a maximum operating temperature of 240 degrees. Boiler shell shall be constructed of welded steel boiler plate and tubing. Boiler shell shall be constructed with adequately sized upper drums, water legs, and tube headers, providing proper internal water circulation. Water tubes shall be 1-1/2" O.D., .095 steel, six pass, flexible serpentine bend design and shall be easily replaceable without requiring welding or rolling. The boiler is to have no more than two tube configurations for ease of repair and parts stock for the owner. Boilers design shall include "reverse construction" allowing for side-by-side installation if so indicated on the Contract drawings.
- C. Boiler shell shall be constructed and assembled as a completely packaged unit. Boiler shall be test-fired at the factory and test data shall be forwarded to the Architect by the Contractor.
- D. Boiler shell shall be furnished with an adequate number of tappings and inspection openings to facilitate boiler inspection and cleaning. The entire tube area shall be easily accessible for cleaning through cleanout openings. Access openings shall be arranged for visual access to combustion chamber and burner head. The boiler shall have no less than five (5) square feet of heating surface per boiler horsepower (no exceptions) and shall be constructed and assembled as a completely packaged unit.
- E. Furnace/Combustion Chamber Construction
 - 1. Access to the furnace/combustion chamber is gained by a hinged access door(s) with an opening of no less than 26" wide x 62" high maximum to allow for inspection of the interior chamber and the burner head. All remaining panels shall be individually removable.
 - 2. All access panels shall be affixed to the pressure vessel frame and insulated with 2" mineral fiber mono block and 2" high temperature ceramic blanket insulation and be fully gasketed for pressurized firing.
 - 3. The furnace/combustion chamber shall be primarily of water-wall design with one side of removable panels.

4. The stationary interior wall shall be lined with 2” ceramic blanket insulation.
 5. The front and rear walls are insulated with 5” mineral fiber mono block and 2” ceramic blanket insulation.
 6. The floor beneath the tubes shall be lined with 2” mineral wool insulation, 1” mineral fiber mono block insulation and 2” ceramic blanket insulation.
- F. Boiler shall be complete with an insulated metal jacket, consisting of not less than 1-1/2" thickness fiberglass insulation and a 16-gauge rust-resistant, zinc-coated steel casing, painted with a suitable heat-resisting primer and lacquer. Complete jacket and insulation shall be readily removable and reinstalled if necessary.
- G. Standard controls for boiler shall be mounted in an enclosed control panel on boiler front to include indicating light and fused on-off switch. The electronic programming relay, fused disconnect switch and starter shall be mounted in the control panel. Fuses shall be of the Class R rejection type Fusetrons. Magnetic starter shall be provided with overload elements in all phase legs.
- H. Boilers shall be Model RV500-W-FDG as manufactured by the Bryan Steam Corporation of Peru, (Basis of Design) or equal. Boilers shall be ASME stamped and approved. Should an alternate manufacturer be pre-approved, an addendum will be issued listing the manufacturer and model.
- I. The gas burner shall be a Webster JB2G-30-LMV37-M.25-UL/CSD-1.. Burner Control Panel shall have four (4) signal lights, Power on – Fuel on – Call for Heat and Alarm. Burner shall be provided with linkageless controls and 4:1 minimum turndown.
- J. Boiler shall be complete with all accessories, fittings, trim and controls for gas firing only. Boiler shall also include a combination thermometer and pressure gauge, ASME rated relief valves as required, McDonnell-Miller No. 901 probe type low water cutoff, Honeywell L4006-A high limit temperature control, ASCO Integrated UL/CSD-1 gas train with Auxiliary motorized gas valve, gas pressure regulator, pilot line and safety controls, manual gas shutoff valve, 100% safety gas controls, air safety switch, low water alarm bell installed on boiler panel, flue brush, and all other safety and operating accessories and auxiliary equipment to meet all applicable local, State and Federal codes and regulations. Controls for natural gas firing shall be mounted in an enclosed control panel furnished with each boiler. The unit shall be completely factory assembled and tested. A tube extractor and driver set shall be furnished with each boiler. The gas pressure regulator and gas train shall be sized by the boiler manufacturer in accordance with the gas pressure available in the Boiler Room. Boilers shall have a “low fire start sequence”.
- K. A separate high limit controller shall be furnished as herein specified and installed by the Installation Contractor in the piping at each boiler.
- L. High temperature limit switch installed in the piping system for each boiler shall operate only on emergency conditions and shall be coordinated for operation with the boiler controls.
- M. Boiler shall be mounted on concrete pads constructed under this Contract.
- N. This Contractor shall extend gas vent line from the UL/CSD-1 gas train of each boiler. Vent piping from gas train shall be extended to the exterior of the building in accordance with AGA and Gas Company requirements by this Contractor.

- O. The boiler manufacturer shall furnish an agent or engineer to provide complete and detailed instructions for the operating personnel in the proper operation, care and maintenance of all equipment. All required service and maintenance for the first complete heating season shall be provided by the Installation Contractor. The boiler manufacturer's representative shall also provide all necessary supervision to the Installation Contractor, for the installation and operation of the boilers. Burners shall be placed in operation and adjusted for maximum burning efficiency by this boiler representative. In the process of effecting these adjustments, a combustion efficiency test shall be conducted with the use of carbon dioxide analyzer. This test shall be conducted under full load conditions and shall extend over a period of not less than one hour. Stack temperature, draft and carbon dioxide shall be recorded at intervals. A written report of the combustion test shall be rendered in duplicate to the Architect. Three (3) sets of operating and maintenance manuals shall be delivered to the Owner.
- P. The boiler manufacturer shall be capable of providing factory service in the immediate vicinity and within a reasonable amount of time on a 24 hour a day emergency basis.
- Q. All power wiring to the boilers will be furnished and installed by the Electrical Contractor. All control wiring, including wiring from the separate-mounted low water cutoff switch, high limit switch and all associated safeties shall be furnished and installed under this Contract.
- R. Gas piping will be extended to the boiler from the existing natural gas line by the Plumbing Contractor.
- S. A control panel on the boiler door shall be interlocked with the outdoor air damper end switch and the draft assist system by the Installation Contractor. The damper must be open and the draft assist fan operating before the boiler burner will start. The boiler shall also be interlocked with the building control system to start the boiler when outside air falls to a preset temperature.
- T. The boiler manufacturer's representative shall provide as part of the boiler equipment package a Boiler Control Panel. Refer to the "Boiler Control Panel" specification section.
- U. Boiler shall be capable of operating at zero minimum flow of water through the boiler at any time, without the threat of damage to the boiler. The boiler manufacturer shall provide certified pressure drop curves as part of the submittals to verify the zero minimum flow requirement, without the assistance of a preheater or flow proving switch.
- V. Warranty: 10-year parts and labor.
- W. The boiler supplier shall be responsible for supplying to the HVAC Contractor a comprehensive, interconnecting wiring diagram, which shall indicate all terminal connections for items such as the boiler(s), Emergency Shutdown Switch, combustion air damper, and any other electronically-powered devices directly related to the operation of the boiler(s).
- X. Boiler Manufacturers: Bryan, Cleaver Brooks, UNILUX Boilers.
- Y. Burner Manufacturers: Webster, Power Flame, Industrial Combustion.
 - 1. Any listed equivalent manufacturer and the Mechanical Contractor shall be completely responsible to comply with all requirements on the contract documents. This shall include, but not be limited to, space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades.

PART 3 – EXECUTION

3.1 BOILER-BURNERS

A. Install per Manufacturer’s Written Instructions:

1. Properly level.
2. Set bottom of framework on concrete pad. The Contractor shall construct level concrete pad and foundations according to the manufacturer’s erecting instructions. Mount boilers on 4” high concrete pads. Provide pads, with beveled edges.
3. Pipe all relief valves, blowoffs and drains to the floor drains. Pipe size shall not be less than tapping on boiler, low water cutoff, etc.
4. Adequately protect boiler-burner unit during construction.
5. Pipe all gas vents to exterior in accordance with CSD-1 and utility company requirements. Terminate with screened vent head.
6. Insulate all factory installed piping for hot water, steam and condensate as applicable.

B. Start-up, Contractor shall:

1. Employ the services of approved water treatment consultant who shall:
 - a. Test water before filling boiler and prescribe proper water treatment to prevent corrosion or deterioration due to oxygen, acid or scaling.
 - b. Immediately after internal inspection and refilling of boiler, check water conditions at that time and prescribe proper water treatment again.
2. Be responsible for:
 - a. Supplying and using prescribed ingredients. (initial water treatment)
 - b. Maintain proper water conditions until acceptance of boiler. After acceptance of boiler, water treatment will be provided by the Owner.
 - c. Cleaning systems as specified.
 - d. Not filling boiler until firing equipment is operable.
3. As soon as boiler is filled, ready for testing, or final acceptance.

C. Testing and Cleaning:

1. Bring water up to 210°F and circulate for two hours to drive off air.
2. Demonstrate all safety devices in presence of Owner’s Representative and Engineers before final acceptance.

3. Set maximum firing rate of boiler.
 4. Skim off impurities until boiler water is clear.
- D. Services of Factory mechanic:
1. Arrange to have services of a factory representative trained field mechanic on site to start up the boiler(s).
 2. Mechanic shall check out entire installation, including all pumps and feed apparatus and controls, shall start the units into operation and shall make all necessary tests and adjustments to have said equipment operate to his and to the Engineer's satisfaction.
 3. Manufacturer shall issue a letter stating that the installation has been checked and adjusted and is ready to turn over to the Owner following the completion of this work.
 4. Manufacturer is to forward three (3) copies of the starting reports to the Owner.
 5. Factory mechanic shall be at the job for the initial start-up for not less than two (2) consecutive calendar days.
 6. Factory mechanic shall conduct demonstration and combustion tests in the presence of the Owner for each boiler for gas firing and oil fire and shall submit written report to the Owner.
 7. The same factory mechanic shall make two more trips to the job within the succeeding eight months from the date of the above-mentioned letter for the purpose of further adjusting and checking and shall be immediately available in the event of operating failure of the units within a period of one year from the date of the letter.
- E. Tools and spare Parts for Each Boiler: Furnish and obtain receipt for complete set of gaskets, flue brush and scraper with light weight handles and all special tools that may be required.

END OF SECTION 23 04 00

SECTION 23 04 10 – HEATING GENERATION AUXILIARY EQUIPMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this section.
- B. Refer to Section 230200 for HVAC General Provisions.
- C. Refer to Section 230210 for HVAC Basic Materials and Methods.
- D. Refer to Section 230400 for Heating Generation Equipment.

1.2 DESCRIPTION OF WORK

- A. This Section includes labor, material, and equipment necessary for a complete boiler system as specified and shown on the drawings:
 - 1. Boiler Stack and Breeching
- B. Provision for boiler stack and breeching, or vent and combustion air piping.
- C. Refer to other Division 23 sections for related work.

1.3 REFERENCE STANDARDS

- A. Refer to Section 230200 for a general description of requirements applying to this section.

1.4 QUALITY ASSURANCE

- A. Refer to Section 230210 for a general description of requirements applying to this section.
- B. Quality Assurance:
 - 1. Manufacturers: Firms regularly engaged in manufacture of equipment types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
 - 2. Regulatory Requirements:
 - a. NFPA Compliance: Install gas-fired cast-iron boilers in accordance with National Fire Protection Association (NFPA) Code 54 "National Fuel Gas Code".
 - b. NFPA 211 Compliance: Heating equipment burning gas, solid or liquid fuels, Section 60.
 - c. Underwriter's Laboratories, Inc., (U.L.) file MA 7991 for storage of flammable liquids.
 - d. NFPA 30 and 31 compliance for storage of flammable liquids.
 - e. Licensed and certified installer for underground fuel oil piping and aboveground tanks.

1.5 SUBMITTALS

- A. Submit shop drawings and product data in accordance with Section 230200.
- B. Submit the following:
 - 1. Shop Drawings
 - 2. Product Data
 - 3. Evidence of specified code or other compliance.

1.6 SUBSTITUTIONS

- A. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements on all contract documents. This shall include, but not be limited to, space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades, including all required ancillary items furnished and installed by other trades. If the manufacturer or related bidding contractor does not comply with these requirements, this Contractor shall be responsible for any and all additional costs associated with the changes required by other trades.

1.7 WARRANTY/GUARANTEE

- A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, GENERAL REQUIREMENTS

PART 2 – PRODUCTS

2.1 BOILER STACK AND BREECHING

- A. Provide factory-built modular connector, manifold/breeching and vertical stack system that is tested and listed by the Underwriters' Laboratories, Inc. (UL 103 positive pressure chimney) for use with building heating equipment and appliances, which produce exhaust flue gases at a temperature not exceeding 1000°F (positive or negative pressures) under continuous operating conditions, and not exceeding 1400°F under intermittent operating conditions when burning gaseous, liquid, or solid fuels as described in NFPA-211. Not to be used for heating appliances that produce condensing flue gases at the appliance outlet (category II or IV appliance designation).
- B. The double wall chimney and breeching shall have a 304 stainless steel inner liner (20-gauge min) and an aluminized steel outer jacket (24-gauge min). The materials and construction of the modular sections and accessories shall be as specified by the terms of the product's U.L. listing.
- C. Aluminized steel surfaces exposed to the elements shall be field-painted by a minimum of one base coat of primer and one finish coat of corrosion resistant paint suitable for outer jacket skin temperatures of the given application as published by the flue pipe manufacture. All exposed chimney shall have an outer jacket constructed of 304 or 316 stainless steel (24-gauge min).
- D. This vent system shall be designed and installed to prevent leakage of combustion products into a building.

- E. Common pipe sections & fittings (ie lengths/elbows/tees) shall have a self-centering sleeve to ensure proper alignment at the inner wall joint connection.
- F. Inner pipe joints shall be securely connected and sealed with factory supplied overlapping V-bands and appropriate sealant as specified in the manufacturer's installation instructions. Double Wall outer joints, exposed to weather, shall also be caulked per the installation instructions.
- G. The vent system shall be designed and supports to compensate for all flue gas induced thermal expansion.
- H. The prefabricated breeching system shall be warranted against functional failure due to defects in material and manufacturer's workmanship for a period of 15 years from date of installation.
- I. Manufacturer: AMPCO Model 'VSI', Selkirk Metalbestos, Heat Fab, Inc., Metal-Fab, Inc.

PART 3 – EXECUTION

3.1 BOILER BREECHING (FIELD FABRICATED)

- A. Boiler breeching shall be installed in accordance with the latest International Mechanical Code.

3.2 CHIMNEY STACK AND BREECHING (PRE-ENGINEERED)

- A. The chimney stack and breeching manufacturer shall warrant the complete system against functional failure due to defects in material and workmanship for 15 years from date of delivery. The system manufacturer shall be responsible for checking the sizing, design, and installation of the system. If any component fails to perform its intended function of exhausting combustion by-products from the boiler equipment, for any reason, within 15 years of shipment, the system supplier shall, at no expense to the Owner, provide a replacement part or parts FOB jobsite.

3.3 ELECTRICAL

- A. All electrical power, conduit, etc., including final connections shall be coordinated with the Electrical Contractor.
- B. All control wiring, conduit, etc., including final connections shall be by this Contractor.
- C. The Contractor shall coordinate all his electrical requirements and data with the equipment manufacturer's installation diagrams.
- D. All control wiring beyond that point shall be in conduit. Interior wiring shall be in EMT conduit minimum size 3/4" and exterior wiring shall be in PVC conduit minimum size 3/4".
- E. All wiring shall comply with NEC, NFPA 70.

END OF SECTION 23 04 10

SECTION 23 04 50 – REFRIGERATION EQUIPMENT – HVAC

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. The general provisions of the contract, including the conditions of the contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this section.
- B. Refer to Section 230200 for HVAC General Provisions
- C. Refer to Section 230210 for HVAC Basic Materials & Methods.

1.2 DESCRIPTION OF WORK

- A. This Section includes labor, material, equipment and supervision to for the following:
 - 1. Cooling Tower (Cross Flow – Induced Draft)
 - 2. Modular Water Chiller
- B. Provide complete refrigeration system including chillers, cooling towers, underground pre-insulated pre-fabricated piping, aboveground piping and all required accessories.

1.3 REFERENCE STANDARDS

- A. Refer to Section 230200 for a general description of requirements applying to this section.
- B. Comply with applicable provisions of:
 - 1. International Mechanical Code
 - 2. ASME Boiler & Pressure Vessel Code
 - 3. A.R.I. Capacity Ratings
 - 4. NFPA Pamphlets
 - 5. ASHRAE Standard 15 – 2019 Safety Standards for Refrigeration Systems
 - 6. ASHRAE Standard 90.1 – 2019 Energy Standards
 - 7. UL 1995 Standard for Safety
 - 8. AHRI Standard 550/590-2011 Performance Rating of Water-Chilling and Heat Pump Water-Heating Packages Using the Vapor Compression Cycle.

1.4 QUALITY ASSURANCE

- A. Refer to Section 230210 for a general description of requirements applying to this Section.

- B. Whenever a variable frequency PWM drive is installed to control an AC motor, a maintenance-free, circumferential, conductive micro fiber shaft grounding ring shall be installed on the AC motor drive end to discharge shaft currents to ground. Recommended part: AEGIS SGR™ Bearing Protection Ring, as made by Electro Static Technology. Install in accordance with the manufacturer's written instructions.

1.5 SUBMITTALS

- A. Submit shop drawings and product data in accordance with Section 230200.
- B. Submit the following:
 - 1. Shop drawings and product data for all equipment in this section.
 - 2. 1/4" = 1'-0" scale layout of all equipment in Mechanical Room.

1.6 SUBSTITUTIONS

- A. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements on all contract documents. This shall include, but not be limited to, space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades, including all required ancillary items furnished and installed by other trades. If the manufacturer or related bidding contractor does not comply with these requirements, this Contractor shall be responsible for any and all additional costs associated with the changes required by other trades.

1.7 WARRANTY/GUARANTEE

- A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, General Requirements. In addition, the following special guarantee applies:
 - 1. Manufacturer shall guarantee all refrigeration equipment including parts and labor, for five (5) years from start-up.

PART 2 – PRODUCTS

2.1 COOLING TOWER (CROSS-FLOW INDUCED DRAFT)

- A. Cooling tower shall be induced draft crossflow type as manufactured by Mesan, BAC, Evapco or Marley. Tower shall be a variable water flow rate design.
 - 1. Any listed equivalent manufacturer and the Mechanical Contractor shall be completely responsible to comply with all requirements on the contract documents. This shall include, but not be limited to, space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades.
- B. Casing shall be constructed of fiberglass-reinforced polyester (FRP), the cold water basin shall be 304 stainless-steel.

- C. Pan shall include overflow, drain, and make-up water connections. Strainer shall be 304 stainless steel with anti-vortex baffle to prevent air entrainment. Make-up water valve shall be stainless steel with an unsinkable, polystyrene-filled 304 stainless steel ball.
- D. Fan shall be heavy duty, extruded aluminum, airfoil blade type. Motor shall be a IE3 high efficiency TEAO fan motor, ball bearing type with VFD. Provide a heavy gauge, hot dip galvanized steel fan guard. V-belt type speed reducer fitted with NSK brand bearings, permanently lubricated and isolated from the airstream.
- E. Hot water distribution basin shall be open gravity type constructed of FRP and hot-dip galvanized steel. Provide distribution orifices to assure even distribution of water over the infill. Fill shall be a thermo-formed PVC, rated for up to 122 deg. F.
- F. Vibration switch shall be 110V/60Hz., and used to protect the fan and drivetrain assembly from damage caused by abnormal or excess vibration.
- G. An internal walkway shall provide easy access to the fan, belt, motor, sheave, bearings, and complete water distribution system.
- H. A vertical access ladder with a safety cage shall extend from the tower base to the top platform.
- I. Mesan Control System, intelligent cooling tower control panel, variable speed type, rated for 1x15 HP (460/3/60) includes:
 - VFD 3-contactor bypass
 - NEMA-3R enclosure
 - 3%, 480V, line reactor, 15HP
 - Temperature controller (120V)
 - Immersion temperature sensor
 - 120V drive run pilot light (green standard)
 - 120V drive fault pilot light (red standard)
 - 120V drive bypass pilot light (amber standard)
 - BACnet interface

2.2 MODULAR WATER CHILLERS

A. PRODUCT DESCRIPTION

1. Chiller module shall be 4-pipe system with a dual refrigerant circuit, one dual-circuited brazed plate evaporator and one dual-circuited shell & tube condenser. Each refrigerant circuit shall consist of a single on/off scroll compressor, along with expansion valves, liquid line filter driers, and interconnecting refrigerant copper pipes, and interconnecting refrigerant copper pipes.
2. Each circuit shall be equipped with an active freeze protection solenoid valve. This active freeze

protection solenoid shall be located on a bypass line that extends from a compressor discharge line to a port that is between the expansion valve and the brazed plate heat exchanger. The active freeze protection solenoid valve will open the active freeze protection solenoid if the suction pressure falls to approximately 101 psig (32°F). The solenoid closes when the pressure climbs to approximately 105 psig (34°F) and the freezing potential no longer exists.

3. Chiller arrays consisting of multiple chiller modules shall form a fully functional single high-capacity multistage water-cooled package chiller
4. Chiller modules shall be capable of being combined in modular arrays. Each array shall have two 20-mesh wye strainers (evaporator and condenser), one flow switch (evaporator), and a set of 6-inch water headers. Modules shall be placed alongside other modules along the long dimension.
5. Each chiller module must have a removable header pipe section with chilled and condenser water pipe, suitable for connecting the chiller modules together with parallel flow to form the chiller array. The header pipes shall be 6-inch pipes with grooved end connections. Flexible groove type couplings are required to connect adjacent chiller modules. An array controller package must be provided from the factory
6. The chiller array shall be controlled by a controller capable of maintaining the chiller array leaving chilled water temperature set-point within a control zone by staging individual Chiller Module compressors.
7. Chiller array must continue to cool entering chilled water if a single chiller module in the array fails.
8. Each chiller module must have manual chilled water balancing and isolation valve capable of isolating a chiller module from the header pipe section so that a chiller module can be valved in and removed from the header pipe section without disturbing the chilled water flow, or operation, of the other chiller modules.
9. Each chiller module must have manual condenser water balancing and isolation valve capable of isolating a chiller module from the header pipe section so that a chiller module can be valved in and removed from the header pipe section without disturbing the condenser water flow, or operation, of the other chiller modules.
10. Dual circuited modules shall have each compressor electrically and mechanically isolated so that if a compressor fails or needs service, it can be serviced or removed from the chiller without disabling the other compressors or the chiller. The chiller module shall be able to operate with the remaining compressor with the other compressor removed.

B. CABINET

1. Each chiller module shall have a single heavy gauge cabinet containing electrical power distribution components, control components and the chiller module unit controller.
2. The base of the chiller shall consist of galvanized-steel material, extending along the perimeter of the unit. This base shall securely accommodate the frame, compressors, and evaporator, ensuring a unified structure.

3. The frame of the chiller shall be constructed of rigid galvanized-steel material, firmly fastened to the base. This frame shall be engineered to provide support for the cabinet, condenser, control panel, and any other chiller components not directly upheld by the base.
4. Sound-reduction package designed to reduce sound level without affecting performance and consisting of the following:
 - a. Chillers shall have neoprene isolator pads for all load bearing points for vibration control. Each isolator pad shall be rated for the operating weight and dynamic load of each chiller module.
5. Unit shall be painted in accordance with the manufacturer's standard procedures and practices suitable for the operating environment and as a minimum have a top coat of two-part epoxy

C. REFRIGERATION SYSTEM

1. Compressor: Each circuit of the chiller shall feature a single hermetic ON/OFF scroll-type compressor mounted on vibration isolators for quiet operation.
 - a. Each compressor shall utilize R-454B refrigerant and be equipped with a crankcase heater for safeguarding against liquid flood-back conditions and preventing oil foaming during startup.
 - b. Total steps of capacity for one module shall be two (50%-100%). Compressor Options:
 - (1) Each compressor shall be equipped with sound blankets constructed from materials resistant to UV degradation, moisture, and extreme temperatures, designed specifically for noise reduction, ensuring durability and longevity.
 - (2) Hot gas bypass on all circuits
 - (3) Each compressor shall be equipped with compressor liquid and discharge service isolation valves and replaceable core filter driers.
 - c. Chiller shall include manual reset high refrigerant discharge pressure and low refrigerant suction pressure safety controls.
 - d. A liquid line sight glass and moisture indicator are required on each refrigerant circuit.
 - e. Refrigerant circuit must provide refrigerant charging ports including one port between expansion device and evaporator inlet.
 - (1) Chiller shall include manual reset high refrigerant discharge pressure and low refrigerant suction pressure safety controls. Reset through Unit Controller is acceptable.
 - (2) A liquid line sight glass and moisture indicator are required on each refrigerant circuit.
 - (3) Refrigerant circuit must provide refrigerant charging ports including one port between expansion device and evaporator inlet.
2. Evaporator

- a. Evaporator shall be brazed plate heat exchanger type constructed of 316 stainless steel, and shall be designed and tested in accordance with the UL 1995 Safety Standard bearing the UL Listing mark for US and Canada. Maximum refrigerant side design / abnormal pressure rating shall be no less than 650 psig, and water side design / abnormal pressure rating shall be no less than 330 psig.
 - b. Brazed plate evaporator shall have a waterside flush connection to permit back-flushing or cleaning of the evaporator without removal.
 - c. The brazed plate evaporator must be protected from freezing from an internal core temperature sensor. This temperature must be read by the unit controller.
 - d. The brazed plate evaporator shall have a factory installed air vent.
 - e. Chilled water wye strainer with 20-mesh straining element or finer is required and must be field installed in the evaporator inlet piping of the Chiller array
 - f. Evaporator shall have flexible groove type couplings on water inlet and outlet for easy, unobstructed removal.
 - g. Evaporator shall be insulated with a minimum of 0.5 inch (12.7 mm) thick closed-cell flexible insulation with a K value of 0.26 BTU / (hr.-ft.- degF).
 - h. Evaporator Options:
 - (1) Chiller shall include a high-capacity brazed plate evaporator to allow leaving chilled water temperatures as low as 40°F [4.4°C] without the need for glycol.
 - (2) Manual balancing valves, factory-installed in array headers, facilitate proper hydronic balance in constant flow systems and serve to isolate individual modules within arrays for maintenance or cleaning purposes, with constant flow pumping systems incorporating staged cooling and heating (heat recovery) and continuous water pumping, avoiding module isolation during part load while ensuring a minimum load requirement of 25% of full load in constant flow applications (Array - Constant Flow)
3. Condenser
- a. Condenser shall be dual circuited shell and tube condenser shall have two refrigerant circuits and interconnecting refrigerant copper pipe and be used in place of brazed plate condenser.
 - (1) Shell and tube condensers shall be mechanically cleanable shell-and-tube type with enhanced copper tube geometry with 0.025" wall thickness and removable head to facilitate cleaning
 - (2) Shell side (refrigerant) working pressure is 600 psig and bears the ASME stamp. The tube side (water) working pressure is 180 psig
 - (3) Corrosion resistant shell and tube condenser with internal tubes finned with Cu/Ni 90/10.
4. Expansion Valves
- a. The refrigeration circuits will be outfitted with a mechanical expansion valve.

D. WATER SYSTEM

1. All water side components must be pressure rated for 150 psi.
2. One evaporator flow-proving device must be provided per Chiller Array. A paddle style liquid flow switch is available with a NEMA Type 4X enclosure for field-installation.
3. Modular chillers are set alongside other Chillers along the long dimension. A common 6-inch header is connected between chillers on the short dimension. An array controller package must be provided from the factory.
4. Include factory provided header connection extension for adding 6 inches of space between chiller module.
 - a. Water strainer options: Include two 20-mesh wye strainer kit that includes pipe adaptors, differential pressure ports and a blowdown valve. One kit for chilled water and the other for condenser water.
5. Evaporators shall have factory installed manual balancing valves for balancing the water flow to the evaporator and isolating the evaporator for service.
6. Each chiller module shall have an integral factory installed motorized condenser water regulating valve controlled by the chiller modules unit controller for refrigerant discharge pressure control. This control valve shall also be suitable for isolating the chiller module from the condenser water circuit for removal or service of the condenser. This valve is required for N+1 redundancy operation or variable condenser water flow. (Variable Flow Condenser– Single Unit)

E. SERVICEABILITY

1. All heat exchangers must be accessible from the front of the chiller module for cleaning and service. Heat exchangers contained within chiller's water piping shall not be acceptable.
2. Access for service for all refrigeration components such as sight glasses, moisture indicators, filter driers, expansion valves and solenoid valves must be from the front of the chiller module.
3. Chiller modules must be designed and installed in such a manner that compressors, evaporators, condensers, refrigerant specialties, and water pipe components can be easily serviced or removed from the chiller module without disturbing the chilled or condenser water flow, or operation of the other modules in the chiller array.
4. The chiller unit compressors shall be designed for mechanical and electrical isolation to facilitate service and removal.
5. Low voltage control power switches should be provided for the unit and each refrigerant circuit. The low voltage unit switch can act as an emergency stop or to cut power from low voltage side of control panel. Individual refrigerant circuits switches are for maintenance of a compressor or preventing a circuit from being enabled while trying to charge the other circuit.

F. POWER CONNECTIONS

1. Each module will have its own power connection at the voltage, phase, and hertz indicated on the equipment schedule.

2. Each chiller module is supplied with a terminal block with a SCCR rating of 5 kA.
3. Options
 - a. Chiller will have a SCCR rating of 100 kA.
 - b. Power monitor for each chiller that includes notification for low voltage, phase rotation reversal, loss of phase and phase imbalance
 - c. Include a factory installed non-fused disconnect switch.
 - d. Single point power connection for the entire array so that each module does not have separate power feed from the building service panel. The single point power connection for the array will be in a separate panel box and contain breakers for each chiller module. Power will be routed to each module from this power panel box. Power can be turned off for any module without affecting the operation of the other chiller modules in the array.

G. CONTROLS

1. General
 - a. The chiller array shall be controlled by a microprocessor-based controller capable of operating the chiller array as a single high-capacity multistage water-cooled package chiller, while maintaining array leaving chilled water temperature set-point within the control zone.
 - b. The controller shall also have the capability of being accessed from a remote computer such as a laptop using RS232 or Ethernet port having all functions that are available through the local interface with the additional ability to download and view fault history graphically.
 - c. The controller shall be capable of capacity modulation and equalizing the run time on all chiller modules. Capacity modulation shall be accomplished by staging individual compressors in each Chiller Module using lag/lead logic while performing all operational, annunciation, data retention, and communication functions.
 - d. The controller shall monitor entering and leaving chilled water temperatures and stage individual compressors, within the Chiller Modules, to maintain leaving chilled water set-point temperature within the control zone using proportional, integral, derivative (PID) logic.
 - e. Chiller Array shall be controlled by a microprocessor-based Controller capable of operating the Chiller Array as a single high-capacity multistage water-cooled package chiller, while maintaining Array leaving chilled water temperature set-point within the control zone.
 - f. The local operator must be capable of displaying all unit set points, faults, alarm and fault history, and operating conditions in a clear language format for easy interpretation by user/operator.
 - g. The Controller shall have multiple, progressive levels of security.
 - h. Controller inputs must include Remote Off/Auto (dry contact closure from a remote device); Flow Proving Device (dry contact closure from a remote device - input); Remote Start/Stop (input from BMS); customer demand limit reset signal (input from BMS); and customer chilled water reset signal.

- i. Controller outputs must include the following items that can be only reviewed from the building management system (BMS); array run indication signal; customer alarm relay; array entering chilled water temperature; array leaving chilled water temperature; remote chilled water flow switch input; array condenser pump relay; array chilled water pump relay;
 - j. The controller must provide the following dry contact closures for a remote device: remote alarm; remote chilled water enable for a maximum of two (2) chilled water pumps; condenser water pump enable for one (1) condenser water pump; array on/off status.
 - k. At a minimum, the controller should maintain a fault history with date and time of day of each fault up to the last 99 occurrences. The faults should include low chilled water flow, low leaving chilled water temperature, and chiller module fault code.
 - l. The controller shall store a minimum of 1,008 packets of information for graphical presentation on a remote computer. The controller shall be capable of having data taken for graphical display based on a set time interval. The time interval shall be factory set at 15 seconds, but shall be adjustable from 1 second to 12 hours. The Controller shall also allow up to 99 fault conditions to be stored.
 - m. The Controller shall also have RS485 and Ethernet communications ports for a Building Management System (BMS). Display and Keypad
2. Supervisory Controller
- a. The Supervisory Controller will supervise and coordinate up to ten chiller modules in an array. It will control the chiller modules to meet the chilled water or hot water (heat recovery) setpoints. It will provide the chiller module lead-lag functionality to balance runtime among the controllers.
 - b. With the Supervisory Controller, each individual chiller module will also have its own controller. Should communication with the Supervisory Controller be lost, the individual chiller modules can operate independently.
 - c. The Supervisory Controller shall be contained in a separate control panel. The control panel containing the Supervisory Controller will include a display (exterior of control cabinet door), 120 VAC circuit breaker for input power to the panel and field connection terminal strip.
 - d. The Supervisory Controller shall have the capability of executing N+1 Logic when each Chiller module in the Chiller array is equipped with a chilled or hot water (heat recovery) motorized On-Off valve, and when a standby Chiller module is installed in the Chiller array.
3. Control Option
- a. Provide NEMA4 color touchscreen on unit exterior with a 15.4” diagonal, 1280x800 resolution, color touchscreen capable of displaying all unit control set points, fault and alarm conditions with history, operating conditions, schedules, run history, Chiller IOMs, and field wiring diagrams.
 - b. Communication between the controller and a building management system (BMS) shall be accomplished using the BACnet MS/TP protocol.

H. WARRANTY

1. Standard Warranty: Provide a complete unit parts warranty (excluding refrigerant) for one (1) year from startup or 18 months from shipment, whichever occurs first. (standard warranty)
2. Extended Parts Only Warranty Includes:
 - a. Additional compressor parts only warranty covering compressor(s) through sixty (60) months from date of shipment.
3. The Extended Labor Warranty provided shall be applicable when the start-up of the system is conducted by the factory authorized personnel:

Pre-startup unit inspection, startup, and immediate part repair/replacement at the time of startup (if needed) by Service Technicians. Parts and labor warranty period is twenty-four (24) months from date of startup or thirty (30) months from date of original shipment, whichever may occur first.

4. Maintenance of equipment while the product is under warranty is mandatory and is the responsibility of the equipment owner.

- I. Manufacturers: Jetson by Modine, Multistack, or approved equal.

PART 3 – EXECUTION

3.1 REFRIGERATION EQUIPMENT

- A. All equipment to be installed in accordance with manufacturer's recommendations.

3.2 COOLING TOWERS

- A. Examine proposed route of moving cooling towers into place and verify that it is free of interferences.
- B. Examine elements and surfaces to support cooling tower.
- C. Verify piping and wiring roughing-in locations.
- D. Verify suitability of branch-circuit wiring.
- E. Install cooling towers according to manufacturer's written instructions.
- F. Install cooling towers level and plumb, and fasten to supporting structure with vibration isolators and seismic restraints.
- G. Maintain recommended clearances for service and maintenance.
- H. Electrical Wiring: Install electrical devices furnished by cooling tower manufacturer that are not factory mounted.
- I. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including piping and electrical connections. Report results in writing.

END OF SECTION 23 04 50

SECTION 23 05 00 – PIPING SYSTEMS & ACCESSORIES – HVAC

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. The general provisions of the contract, including the conditions of the contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this section.
- B. Refer to Section 230200 for HVAC General Provisions
- C. Refer to Section 230210 for HVAC Basic Materials & Methods.

1.2 DESCRIPTION OF WORK

- A. This Section includes the following equipment:

- 2. Base-Mounted End Suction Pumps
- 3. Suction Diffusers
- 9. Relief Valve (Water Systems)
- 10. Balancing Valves
- 11. Combination Valve Package for Pumps
- 13. Flexible Pump Connectors

1.3 REFERENCE STANDARDS

- A. Refer to Section 230200 for a general description of requirements applying to this section.

1.4 QUALITY ASSURANCE

- A. Refer to Section 230210 for a general description of requirements applying to this Section.
- B. Whenever a variable frequency PWM drive is installed to control an AC motor, a maintenance-free, circumferential, conductive micro fiber shaft grounding ring shall be installed on the AC motor drive end to discharge shaft currents to ground. Recommended part: AEGIS SGR™ Bearing Protection Ring, as made by Electro Static Technology. Install in accordance with the manufacturer's written instructions.

1.5 SUBMITTALS

- A. Submit shop drawings and product data in accordance with Section 230200.
- B. Submit the following:
 - 1. Shop Drawings

- 2. Manufacturers Product Data
- 3. Test Reports on Piping System Tests

1.6 SUBSTITUTIONS

- A. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements on all contract documents. This shall include, but not be limited to, space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades, including all required ancillary items furnished and installed by other trades. If the manufacturer or related bidding contractor does not comply with these requirements, this Contractor shall be responsible for any and all additional costs associated with the changes required by other trades.

1.7 WARRANTY/GUARANTEE

- A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, General Requirements.

PART 2 – PRODUCTS

2.1 BASE-MOUNTED END SUCTION PUMPS

- A. Provide frame-mounted end suction pumps where indicated, and of capacities and having characteristics as scheduled.
- B. Horizontal mount, single stage, flexible coupling, base-mounted, designed for 175 psi working pressure.
- C. Cast iron casing 125 psi ANSI flanges, tappings for gauge and drain connections.
- D. Steel shaft with replaceable shaft sleeve, regreasable ball bearings and mechanical seals with carbon seal ring and ceramic seat.
- E. Non-overloading motor at any point on pump curve, open, drip-proof, ball bearings, 15,000 hours bearing life, with lifting lug on top of motor.
- F. Provide open drip-proof motor with regreasable ball bearings.
- G. Enclosed type impeller hydraulically and dynamically balanced, keyed to shaft and secured with locking screw.
- H. Structural steel baseplate with welded cross members, and open grouting area.
- I. Flexible coupling capable of absorbing torsional vibration, equipped with coupling guard.
- J. Manufacturers: Subject to compliance with requirements, provide pumps of one of the following:
 - Armstrong Pumps
 - Bell & Gossett

Peerless

Patterson

Taco

2.2 SUCTION DIFFUSERS

- A. Provide at each base-mounted pump, a suction diffuser of size required for pump connection. Units shall consist of angle type body with straightening vanes and combination diffuser-strainer-orifice cylinder with 3/16" diameter openings for pump protection. A permanent magnet shall be located within the flow stream and shall be removable for cleaning. The orifice cylinder shall be equipped with a disposable fine mesh strainer which shall be removed after system start-up. Orifice cylinder shall be designed to withstand pressure differential equal to pump shutoff head and shall have a free area equal to five times cross section area of pump suction opening. Straightening vanes shall extend the full length of the orifice cylinder and shall be replaceable. Unit shall be provided with adjustable support foot to carry weight of suction piping.
- B. Manufacturers: by pump manufacturer.

2.3 RELIEF VALVE (WATER SYSTEMS)

- A. Each water circulating system of the closed type shall be provided with a pressure relief valve selected to suit the system heat generation capacity and set at 75 psig. Valves shall have casts bronze or cast steel body suitable for 250 PSIG and 450°F, stainless steel bushing, ring pin, and nickel alloy compression screw.
- B. This discharge from the relief valves shall be piped to a drain.
- C. Relief valves shall be manufactured by McDonnell and Miller, Bell and Gossett, A.W. Cash Company.

2.4 BALANCING VALVES

- A. Balancing valves shall be installed where indicated.
- B. Provide, as shown on the plans, balancing valves with provision for connecting a portable differential (Ft. of Head) pressure meter. Each meter connection shall have pressure/temperature readout ports.
- C. The balancing valves shall be either a bronze body/brass ball valve, or a Y-pattern globe valve style design and all metal parts of non-ferrous, pressure die-cast, nonporous Ametal copper alloy. Each valve can be installed in any direction without affecting flow measurement and shall provide four (4) functions:
 - 1. Precise flow measurement
 - 2. Precision flow balancing
 - 3. Positive shut-off with no drop seat and teflon disc
 - 4. Drain port suitable for hose bib fitting.

- D. The valves shall have four (4) 360 deg. adjustment turns of handwheel for maximum setting with hidden memory feature to program the valve with precision tamperproof balancing setting.
- E. Design Pressure/Temperature:
 - 1/2" - 3" NPT connections 300 psig at 250 deg. F.
 - 1/2" and 3/4" sweat connections 200 psig at 250 deg. F.
 - 2" – 4" flanged or grooved connections 250 psig at 250 deg. F
 - 4" flanged connections 175 psig at 250 deg. F.
- F. Flow sensor: For installation in piping 5" and larger, a precision wafer type orifice insert installed between standard 125 psi at 250 deg. F ANSI flanges to monitor system flow; cast iron body with integral brass EPT check valves to accommodate a differential pressure meter; furnish with calibrated nameplate with flow range through a range of differential head pressures; provide globe valve at each sensor to adjust flow to design conditions.
- G. Manufacturers: Tour & Andersson, Armstrong, Bell & Gossett, Nexus Valve, Taco, Victaulic, Wheatley.

2.5 COMBINATION VALVE PACKAGE FOR PUMPS

- A. Each centrifugal pump shall be provided with the following valve assemblies:
 - 1. Combination silent check valve, balancing valve and shut-off valve on pump discharge.
- B. The combination units shall be flanged assemblies of 125 lb. ASA Class, 175 psi. W.O.G. @ 300 degrees F. The combination units shall be suitable for vertical or horizontal installation with the stem pointing up.
- C. The body and bonnet shall be cast semi-steel; and the stem, seat and disc shall be bronze. The valve shall be designed for repacking under pressure.
- D. The unit shall be provided with a calibrated stem indicator, and the check valve shall have a stainless steel spring and be provided with disc designed for quiet operation at low flow rates.
- E. Manufacturers: by Pump Manufacturer.

2.6 FLEXIBLE PUMP CONNECTORS

- A. Flexible hose connectors shall be provided on suction and discharge piping of all base-mounted pumps. The flexible connectors shall be spring steel wire reinforced rubber compound in accordance with the following descriptions.
- B. Construction: The flexible connectors of reinforced rubber compound shall be a compression molded elastomer material with wire and rayon cord reinforcing and designed for a service temperature of 240 degrees F and a minimum pressure of 150 psi. Screwed end type shall have metal screwed connections molded into the elastomer material. Flanged units shall be one-piece construction whereby the elastomer material is molded to form the flanges.

- C. The flexible connections shall have approximate length in accordance with the following tabulation:

Pipe Size	Live-Length
1 inch	6-1/4 inches
1-1/4 inches	6-1/4 inches
1-1/2 inches	6-1/2 inches
2 inches	8-1/4 inches
2-1/2 inches	10-3/8 inches
3 inches	12-3/8 inches
4 inches	16-1/2 inches
5 inches	17-5/8 inches
6 inches	18-3/5 inches

- D. Manufacturers: Mason Industries, Moyno-RKL, Amber Booth, Metraflex, Patterson, Proco Products, Inc., Twin City Hose, Inc.

PART 3 – EXECUTION

3.1 CIRCULATING PUMPS

- A. Pump shall be installed in accordance with recommendations of the Hydraulic Institute.
- B. Suction reducers shall be eccentric and located at the pump suction. Discharge increasers shall be concentric and located at the pump discharge.
- C. Suction and discharge piping shall be adequately supported without imposing any load on the pump casing.
- D. Pressure gauges shall be installed at the suction and discharge of each pump.
- E. Vibration isolation equipment shall be provided where noted.
- F. Impeller diameter used shall be approximately 85% of the maximum impeller diameter capable of being supplied for each pump.
- G. The motor nameplate horsepower shall not be exceeded under any conditions of pump operation.
- H. Prior to shipment, each pump shall be tested to insure its capability to produce the required capacity at the design head, and when requested written verification of this test shall be supplied.
- I. Before grouting and piping the pump, the Contractor shall check to insure pump alignment is satisfactory, and where required, realign the pump. Fill baseplate with non-shrink grout to the top of the base rail.

- J. Start-up service shall be provided by the pump manufacturer or his representative. This service shall include the following:
1. Check alignment
 2. Check absence of pipe strain
 3. Check lubrication
 4. Check rotation
 5. Take suction and discharge pressure gauge readings and compare with pump nameplate for operating head.
 6. Take voltage and current readings and compare with motor nameplate.
 7. Insure proper maintenance manuals are available if required.

3.2 PIPING SYSTEM DRAINS

- A. All piping shall be graded or pitched toward drain locations which shall be provided with gate valve unless otherwise indicated on drawings or specified. Individual risers may be drained through removable plugs or caps.
- B. Drain valves shall be provided at all major components in systems including boilers, pumps, heat exchangers, cooling towers, and similar equipment.

3.3 ECCENTRIC PIPE FITTINGS

- A. Eccentric pipe fittings shall be furnished and installed in all piping and circulated water piping where a change in pipe size occurs in a horizontal run. In water systems the top of the adjacent pipe sections shall be maintained level.

3.4 CHEMICAL CLEANING

- A. New boilers shall be boiled out with an alkaline type boiling out compound to remove grease, oil, mil scale and other foreign matter. The compound should be used at the rate of 1-1/2 pounds per 20 boiler horsepower. After the boiling out period, the boiler shall be completely drained, flushed and refilled with fresh water.
- B. Closed re-circulating systems shall be filled and sufficient detergent and dispersant added to remove all dirt, oil and grease. System shall be circulated for at least 48 hours after which a drain valve at the lowest point shall be opened and allowed to bleed while the system continues to circulate. The automatic make-up valve shall be checked to be sure it is operating. Bleeding shall continue until water runs clear and all detergent is removed. A sample of water shall be tested and if pH exceeds 8.0, draining should be resumed.
- C. Drain all detergent solution from system piping and equipment to nearest floor drain or indirect waste point connected to the building's sanitary system.

END OF SECTION 23 05 00

SECTION 23 05 10 – WATER TREATMENT (HVAC)

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. The general provision of the contract, including the conditions of the contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this section.
- B. Refer to Section 230200 for HVAC General Provisions.
- C. Refer to Section 230210 for HVAC Basic Materials & Methods.

1.2 DESCRIPTION OF WORK

- A. This Section includes labor, material, equipment and supervision to provide a complete water treatment system for the following:
 - 1. Cleaning and treatment of circulating HVAC chilled water system and hot water system.
 - a. Cleaning Compounds.
 - b. Chemical Treatment for Closed Loop Systems.
 - c. Chemical Cleaning of New Systems

1.3 REFERENCE STANDARDS

- A. Refer to Section 230200 for a general description of requirements applying to this section.
- B. Requirements established within the portions of the Project Manual titled Division 1, General Requirements, are collectively applicable to the work of this section.
- C. Technical Services: Provide the services of an experienced water treatment chemical engineer or technical representative to direct flushing, cleaning, pre-treatment, training, debugging, and acceptance testing operations; direct and perform chemical limit control during construction period and monitor systems for a period of 12 months after acceptance, including not less than four service calls and written status reports. Minimum service during construction/start-up shall be 8 hours.
- D. Field Quality Control and Certified Laboratory Reports: During the one year guarantee period, the water treatment laboratory shall provide not less than 12 reports based on on-site periodic visits, sample taking and testing, and review with Owner, of water treatment control for the previous period. In addition to field tests, the water treatment laboratory shall provide certified laboratory test reports. These monitoring reports shall assess chemical treatment accuracy, scale formation, fouling and corrosion control, and shall contain instructions for the correction of any out-of-control condition.
- E. Log Forms: Provide one year supply of preprinted water treatment test log forms.

1.4 SUBMITTALS

In accordance with Section 230200 provide the following:

- A. Manufacturer's Literature and Data:
 - 1. Cleaning compounds and procedures.
 - 2. Chemical treatment for closed systems.
- B. Water analysis verification.
- C. Materials Safety Data Sheet for all proposed chemical compounds.
- D. Maintenance and operating instructions.

PART 2 – PRODUCTS

2.1 CLEANING COMPOUNDS:

- A. Alkaline phosphate or non-phosphate detergent/surfactant/specifically to remove organic soil, hydrocarbons, flux, pipe mill varnish, pipe compounds, iron oxide, and like deleterious substances, with or without inhibitor, suitable for system wetted metals without deleterious effects.
- B. Refer to Section, PIPING SYSTEMS & ACCESSORIES - HVAC, PART 3, for flushing and cleaning procedures.

2.2 CHEMICAL TREATMENT FOR CLOSED LOOP SYSTEMS:

- A. Inhibitor: Provide sodium silicate, sodium nitrite/borate, or other approved proprietary compound suitable for make-up quality and make-up rate and which will cause or enhance bacteria/corrosion problems or mechanical seal failure due to excessive total dissolved solids. Shot feed manually. Maintain inhibitor residual as determined by water treatment laboratory, taking into consideration residual and temperature effect on pump mechanical seals.
- B. pH Control: Inhibitor formulation shall include adequate buffer to maintain pH range of 8.0 to 10.0.
- C. Performance: Protect various wetted, coupled, materials of construction including ferrous, and red and yellow metals. Maintain system essentially free of scale, corrosion, and fouling. Corrosion rate of following metals shall not exceed specified mills per year penetration; ferrous, 0.5; brass, 0.2; copper, 0.15. Inhibitor shall be stable at equipment skin surface temperatures and bulk water temperatures of, respectively, not less than 250 and 125 degrees Fahrenheit. Heat exchanger fouling and capacity reduction shall not exceed that allowed by fouling factor 0.0005.
- D. Pot Feeder: By-pass type for chemical treatment schedule 10 gauge heads, 3/4-inch system connections and large neck opening for chemical addition. Feeder shall be bypass filter feeder, minimum five gallon, installed per detail on the drawings, for chilled water system, and for hot water system.
- E. Water Analysis: Confirm raw water analysis or provide analysis if none is furnished.

Description	Year (Avg.)
Silica (SiO ₂)	_____
Insoluble	_____

Iron & Aluminum	_____
Calcium (Ca)	_____
Magnesium (Mg)	_____
Sodium & Potassium (Na & K)	_____
Carbonate (CO ₃)	_____
Bicarbonate (HCO ₃)	_____
Sulfate (SO ₄)	_____
Chloride (Cl)	_____
Nitrate (NO ₃)	_____
Turbidity	_____
pH	_____
Residual Chlorine	_____
Total Alkalinity	_____
Non Carbonate Hardness	_____
Total Hardness	_____
Dissolved Solids	_____
Fluorine	_____

F. Conduct performance test to prove capacity and performance of treatment system.

Raw water total hardness, ppm.

Concentration cycles.

Raw water, pH.

System water, pH.

Chemical solution used.

Acid solution used, obe.

Quantity or chemical solution injected into system per cycle.

Quantity of acid injected into system per cycle.

Make up water required.

Waste to drain requirement.

G. Recommended Conditions

1. Buffered Nitrite:

- a. For temperatures 140°F to 180°F - 1000 ppm as sodium nitrite.

2. Molybdate:

- a. 50 - 100 ppm as molybdate (chilled water).

3. pH - 7.0 to 10.0

2.3 CHEMICAL CLEANING OF NEW SYSTEMS

- A. Boil out boilers with an alkaline type boiling out compound to remove grease, oil, mill scale and other foreign matter. Compound should be used at the rate of 1-1/2 lbs. per 20 boiler HP. After boiling out period, completely drain, flush and refill boiler with fresh water.
- B. Fill closed recirculating systems and add sufficient detergent and dispersant to remove all dirt, oil and grease. Circulate system for at least 24 hours, after which open a drain valve at lowest point, open the make-up water valve and allow to bleed while system continues to circulate. Check the automatic make-up valve to be sure it is operating. Bleeding shall continue until water runs clear and all detergent is removed. Test sample of water and if pH exceeds the pH of the makeup water, flushing shall be resumed.
- C. Drain all detergent solution from system piping and equipment to nearest floor drain or indirect waste point connected to the building's sanitary system.

PART 3 – EXECUTION

3.1 INSTALLATION:

- A. Delivery and Storage: Deliver all chemicals in manufacturer's sealed shipping containers. Store in designated space and protect from deleterious exposure and hazardous spills.
- B. Install equipment furnished by the chemical treatment supplier and charge systems according to the manufacturer's instructions and as directed by the Technical Representative.
- C. Perform tests and report results.
- D. Instruct owner personnel in system maintenance and operation.

3.2 INSPECTIONS AND MAINTENANCE:

- A. Furnish complete inspection and maintenance service on water treatment equipment for a period of one year after completion and acceptance of the water treatment equipment installation. This maintenance service shall begin concurrently with the guarantee. Maintenance work shall be performed by skilled personnel directly employed and supervised by the same company that provided the water treatment equipment specified herein.

- B. The maintenance service shall include the following:
1. Monthly systematic examination of equipment.
 2. Cleaning, lubricating, adjusting, repairing and replacing of all parts as necessary to keep the equipment in first-class condition and proper working order.
 3. Furnishing all lubricant, cleaning materials and parts required.
 4. The operational system shall be maintained to the manufacturer's standards specified including any changes and/or adjustments required to meet varying conditions.
 5. Provide 24 hour emergency call-back service which shall consist of promptly responding to calls within two hours for emergency service should a shutdown or emergency trouble develop between regular examinations. Overtime emergency call-back shall be limited to minor adjustments and repairs required to protect the immediate safety of the equipment.
 6. Service personnel shall report to the owner or his authorized representative upon arrival and again upon completion of the required work. A copy of the work ticket containing a complete description of the work performed shall be given to the owner.
 7. The Contractor shall maintain a log in the boiler room and chiller room. The log shall list the date and time of all monthly examinations and all trouble calls. Each trouble call shall be fully described including the nature of the call, necessary correction performed and/or parts replaced.

END OF SECTION 23 05 10

SECTION 23 06 00 – AIR DISTRIBUTION & ACCESSORIES – HVAC

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. The general provisions of the contract, including the conditions of the contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this section.
- B. Refer to Section 230200 for HVAC General Provisions
- C. Refer to Section 230210 for HVAC Basic Materials & Methods.
- D. This Contractor shall coordinate with the work of Division 26 and the Fire Alarm System vendor for locations and mounting of all duct smoke detectors. These devices are shown on the Mechanical Drawings for reference only to show the intent of the work. All locations shall be determined based on approved shop drawings from the Fire Alarm System vendor and the Contractor for the work of Division 26, Electrical. Mount smoke detectors in the supply and return air stream at each unit in accordance with NFPA 72.

1.2 DESCRIPTION OF WORK

- A. This Section includes labor, material, equipment and supervision to provide a complete air distribution system as specified herein and as shown on drawings.
 - 1. Ductwork – Single Wall, Square and Rectangular
 - 2. Dampers
 - 3. Prefabricated Roof Curbs, Equipment Supports, and Pipe Curb Assembly

1.3 REFERENCE STANDARDS

- A. Refer to Section 230200 for a general description of requirements applying to this section.
- B. Requirements established within the portions of the Project Manual titled Division 1, General Requirements, are collectively applicable to the work of this section.
- C. IMC (International Mechanical Code).
- D. SMACNA (Sheet Metal and Air Conditioning Contractors National Association, Inc.)
- E. American Society of Heating, Refrigerating and Air Conditioning Engineers' recommendations in ASHRAE Guide shall apply to this work.
- F. ARI Standard 885 - Standard for Estimating Occupied Sound Levels in the Applications of Air Terminals and Air Outlets.
- G. UL (Underwriter's Laboratories, Inc.)
- H. State Fire Prevention Regulations.

1.4 QUALITY ASSURANCE

- A. Refer to Section 230210 for a general description of requirements applying to this Section.

1.5 SUBMITTALS

- A. Submit shop drawings and product data in accordance with Section 230200.
- B. Submit the following:
 - 1. Shop drawings of all sheet metal. Indicate all steel, piping, conduit, and Architectural/Structural features to demonstrate complete coordination. Scale shall not be less than 1/4".
 - a. Shop drawings shall indicate the sizes and lengths of each section of ductwork as well as all system components such as coils, VAV boxes, access doors, dampers, diffusers and register locations. Also indicate the type of joints used and where internal acoustic lining or insulation, if required, will be utilized.
 - b. The location of the duct runs and the air outlets shall be closely coordinated with all other trades by the sheet metal contractor to avoid interference. The shop drawings shall show the contact surfaces adjacent to the ducts or air outlets and the space assigned for concealment. The drawings shall indicate principal items of equipment, adjacent piping and conduit, etc., the location of which shall be secured from the contractors of other trades.
 - c. Sheet Metal Contractor to include resubmissions of the shop drawings to the Engineer. The resubmissions are to include all corrections to previous submissions.
 - 2. Manufacturer's literature and performance data of all equipment and devices.
 - 3. Samples: Furnish color samples, etc., at request of the Architect.

1.6 SUBSTITUTIONS

- A. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements on all contract documents. This shall include, but shall not be limited to space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades, including all required ancillary items furnished and installed by other trades. If the manufacturer or related bidding contractor does not comply with these requirements, they shall be responsible for any and all additional costs associated with the changes required by other trades.

1.7 WARRANTY GUARANTEE

- A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, General Requirements.

PART 2 – PRODUCTS

2.1 DUCTWORK (SINGLE WALL, SQUARE AND RECTANGULAR)

- A. All ductwork shall be fabricated in accordance with SMACNA "HVAC Duct Construction Standards - Metal and Flexible" latest Edition except as described below. The minimum thickness of metal ductwork is 26 gauge. Fabrication requirements shall be based on ductwork subjected to positive or negative pressures of 3" W.G. Ductwork systems shall be sealed to SMACNA "Seal Class "A" Standards. Alternatively, "Ductmate" System 45 can be used in accordance with manufacturer's specifications. Drive slip joints are not permitted.

Exception: For ductwork smaller than 12" x 8", Contractor may provide slip and drive joints with all joints sealed with Hardcast tape and mastic system.

- B. Rectangular ducts for 3" W.G. or less, positive or negative pressure shall be per SMACNA Table 1-6. Longitudinal seams shall be Pittsburgh Lock Type L-1 per SMACNA Figure 1-5. Transverse joints shall be standing seam type T -15 per Figure 1-4.

1. In the event that material size is not compatible with duct size and segmenting must be utilized to fabricate duct, use SMACNA Figure 1-5, seam L-4 (Standing Seam).

- C. Joints:

1. Per SMACNA Transverse Joint Reinforcement Table 1-12, only joints T -22, T -25a, T -25b and Proprietary slip on flanges will be acceptable.
2. Joints T -25a and T -25b that have stress fractures from bending will not be accepted.
3. All joints will have butyl gasket 3/16" thick by 5/8" wide installed per manufacturers installation instructions.

- D. Ductwork systems for this standard shall be galvanized sheet steel, commercial quality of lock - forming grade, conforming to ASTM coating standards A-525 or A-527 with coating of designation G-60. For corrosive or moist conditions, use coating designation G-90.

- E. The size and configuration of each duct shall be indicated on design drawings. Where thicker sheets or different types of materials are required, they shall be specified on the design drawings or in the project specifications.

2.2 DAMPERS

- A. Provide where indicated and required to control flow of air and balance system.
- B. Rectangular and square dampers shall be opposed blade within 16 gauge galvanized steel channel frame with corner brace, 16 gauge galvanized steel blades; molded synthetic bearings and hex steel shafts, exposed or concealed linkage, adjustable quadrant and locking device. Damper 10" and below shall be single-blade. Dampers shall be Ruskin Model MD35.
- C. Approved Manufacturers: Ruskin, Arrow, Nailor-Hart, Pottorff, Lloyd Industries, Inc., Cesco Products, Louvers & Dampers, United Enertech.

2.3 PREFABRICATED ROOF CURBS, EQUIPMENT SUPPORTS, AND PIPE CURB ASSEMBLY

- A. Factory fabricated by the manufacturer of the respective roof-mounted equipment when available and capable of meeting the following requirements:
 - 1. Thermally and acoustically insulated, rubber isolating pads.
 - 2. Built to suit slope of roof and type of roofing; i.e. standing metal seam with integral cant strip and flashing extension.
 - 3. 12” height unless otherwise indicated.
 - 4. Support rails shall be aluminum, or sheet steel, with continuous wood nailer and removable counterflashing.
- B. Curbs shall be a product of a custom manufacture in the following cases:
 - 1. Curbs as specified are not available from the respective equipment manufacturer.
 - 2. Piping or ducts penetrating roof.
 - 3. Prefabricated equipment supports are required.
 - 4. Step flashing assembly, EPDM for normal use and silicone for pipe temperatures above 200°F stainless steel clamp, suitable for single or multiple pipes.
- C. Pipe supports shall be a product of a custom manufacture equal to Pipe Prop as made by JMB Industries, or Anvil International Haydon H-Block.
- D. Pipe curb assembly shall be a 12” high, 18-gauge sloped hood box with 1 ½” thick rigid fiberglass insulation and pressure treated wood nailer strip. Assembly shall be provided with an 8” high insulated roof curb. Curbs shall be similar to Pate ‘CPBA-1’.
- E. Manufacturers: Pate, Shipman, Custom Curb, Portals Plus, Lloyd Industries, Inc., PHP Systems/Design.

PART 3 – EXECUTION

3.1 DUCTWORK

- A. Dimensions on drawings are inside dimensions.
- B. Ducts shall be concealed unless otherwise indicated.
- C. Changes in direction shall be made with radius bends or turning vanes.
- D. Supports shall be galvanized steel for steel ductwork and aluminum for aluminum ductwork.
- E. Do not install ductwork directly above any electrical equipment.
- F. Ductwork shall be supported per SMACNA Standards including the following:

1. Rivet or screw to side and bottom of duct when using flat strap hangers. Rivet or screw to bottom of duct when using trapeze hangers.
2. Strap hangers shall pass under duct 1" minimum or shall loop around duct.
3. Hangers:
 - a. For ductwork less than 4 square feet in area, hangers shall be spaced not more than 8' on center.
 - b. For ductwork 4-10 square feet in area, hangers shall be spaced not more than 6' on center.
 - c. For ductwork greater than 10 square feet in area, hangers shall be spaced not more than 4' on center.
4. Wire/Cable hangers are not acceptable.
5. Support ductwork from building structure with expansion bolts, rods, steel angles or channels installed to meet existing or new building conditions.
6. Drilling into the roof deck is not permitted.
7. Driving nails into anchors is not permitted.

G. Air Flow Control:

1. Major take-offs: Install volume control dampers.
2. Branches: Install volume control dampers in all branches and at tap in branch take-off connections.
3. Elbows: Use unvaned elbows with throat radius equal to width of duct and full heel radius; provide turning vanes where full throat and heel radius are not possible.
4. Transitions: Make transitions in ducts as required by structural or architectural interferences.
 - a. Proportion airways to compensate for any obstructions within duct.
 - b. Avoid dead ends and abrupt angles.
 - c. Do not exceed 22-1/2 degrees slope on sides of transitions.

3.2 DUCT SYSTEM LEAK SEALING

- A. Joints in duct systems shall be sealed to prevent air leakage.
- B. All duct joints and seams in medium pressure and high-pressure duct systems shall be sealed to SMACNA Seal Class" A" Standards to prevent air leakage.
- C. In the event there is in excess of 5% air leakage indicated in low pressure duct systems, it shall be the Contractors responsibility to seal the duct system. The amount of sealing necessary shall be

that required to obtain the design air quantity at each terminal.

- D. Duct sealing shall be by means of high velocity duct sealants such as Hardcast and/or Neoprene gaskets. Type of sealant and method of application shall conform to recommendations in SMACNA high velocity duct construction standards.

END OF SECTION 23 06 00

SECTION 23 06 05 – FANS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. The general provisions of the contract, including the conditions of the contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this section.
- B. Refer to Section 230200 for HVAC General Provisions
- C. Refer to Section 230210 for HVAC Basic Materials & Methods.

1.2 DESCRIPTION OF WORK

- A. This Section includes labor, material, equipment and supervision to provide a complete air distribution system as specified herein and as shown on drawings.

1. Roof-Mounted Exhaust Fans

1.3 REFERENCE STANDARDS

- A. Refer to Section 230200 for a general description of requirements applying to this section.
- B. Requirements established within the portions of the Project Manual titled Division 1, General Requirements, are collectively applicable to the work of this section.
- C. IMC (International Mechanical Code)
- D. SMACNA (Sheet Metal and Air Conditioning Contractors National Association, Inc.)
- E. American Society of Heating, Refrigerating and Air Conditioning Engineers' recommendations in ASHRAE Guide shall apply to this work.
- F. UL (Underwriter's Laboratories, Inc.)
- G. State Fire Prevention Regulations.

1.4 QUALITY ASSURANCE

- A. Refer to Section 230210 for a general description of requirements applying to this Section.
- B. Whenever a variable frequency PWM drive is installed to control an AC motor, a maintenance-free, circumferential, conductive micro fiber shaft grounding ring shall be installed on the AC motor drive end to discharge shaft currents to ground. Recommended part: AEGIS SGR™ Bearing Protection Ring, as made by Electro Static Technology. Install in accordance with the manufacturer's written instructions.

1.5 SUBMITTALS

- A. Submit shop drawings and product data in accordance with Section 230200.

B. Submit the following:

1. Shop drawings of all sheet metal. Indicate all steel, piping, conduit, and Architectural/Structural features to demonstrate complete coordination. Scale shall not be less than 1/4" = 1'-0".
2. Manufacturer's literature and performance data of all equipment and devices.

1.6 SUBSTITUTIONS

- A. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements on all contract documents and as described within the specifications. This shall include, but shall not be limited to space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades, including all required ancillary items furnished and installed by other trades. If the manufacturer or related bidding contractor does not comply with these requirements, they shall be responsible for any and all additional costs associated with the changes required by other trades.

1.7 WARRANTY/GUARANTEE

- A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, General Requirements.

PART 2 – PRODUCTS

2.1 ROOF MOUNTED EXHAUST FAN – DIRECT DRIVE

- A. Fan shall be a spun aluminum, roof mounted, direct driven, down blast centrifugal exhaust fan.
- B. Fan shall be constructed of minimum 16 gauge marine alloy aluminum, bolted to a rigid aluminum support structure. The motor shall be enclosed in a weather-tight compartment, separated from the exhaust air stream.
- C. Unit shall have an engraved nameplate indicating fan number, CFM and static pressure at a minimum.
- D. Wheel shall be centrifugal, backwards inclined.
- E. Motor shall be NEMA design B with class B insulation rated for continuous duty.
- F. Motor shall be an electronically communicated motor rated for continuous duty and furnished with internally mounted potentiometer speed controller or with leads for connection to 0-10 VDC external controller.
- G. Accessories: Disconnect switch, insulated roof curb. Curb to match roof configuration (flat, sloped, raised -seam, etc.).
- H. Manufacturers: Penn Ventilator Co., Greenheck, Loren Cook, Captive-Aire.

PART 3 – EXECUTION

3.1 FANS, EQUIPMENT AND ACCESSORIES

- A. Install in accordance with manufacturer's details and instructions.

- B. Mount fan speed control at the fan to facilitate mechanical balancing. Power wiring shall be part of the work of Division 26.
- C. Perform field mechanical balancing in accordance with Section 230950: TESTING AND BALANCING OF MECHANICAL SYSTEMS.
- D. Install units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.
- E. Support: Install and secure roof curb structure, in accordance with National Roofing Contractor's Association (NRCA) installation recommendations and shop drawings. Install and secure units on curbs and coordinate roof penetrations and flashing.
- F. The Mechanical Contractor shall own as a part of his work, the following:

Provide one (1) additional drive set, if necessary, to obtain final design balancing requirements. The Mechanical Contractor shall coordinate with Balancing Firm and equipment manufacturer for drive selection, including belts and pulleys.

END OF SECTION 23 06 05

SECTION 23 09 00 – AUTOMATIC TEMPERATURE CONTROL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Section 230200 and drawings are hereby made a part of this section as fully as if repeated herein.

1.2 DESCRIPTION OF WORK

- A. Provide labor, material and supervision necessary to interface the new equipment into the existing building's direct digital control system.

1.3 SUBMITTALS

- A. Submit shop drawings and manufacturer's data sheets of all equipment.
- B. Submit manufacturer's certificates of conformance with applicable codes.
- C. Submit electronically, for review, all submittal data within thirty (30) days of contract award.
- D. Submittal shall consist of:
 - 1. System Architecture showing all digital actuated devices.
 - 2. Equipment lists of all proposed devices and equipment including data sheets of all products.
 - 3. Valve, damper and well and tap schedules showing size, configuration, capacity and location of all equipment.
 - 4. Data entry forms for initial parameters. Contractor shall provide English listing of all analog points with columnar blanks for high and low warning limits and high and low alarm limits, and a listing of all fan systems with columnar blanks for beginning and end of occupancy periods; and samples of proposed text for points and messages (for at least two systems of at least 15 points total) including sample 480-character alarm message. All text shall be approved prior to data entry.
 - 5. Wiring and piping interconnection diagrams including panel and device power and sources.
 - 6. Sketches of all graphics.

1.4 QUALITY ASSURANCE

- A. Insure that all work and equipment is installed in accordance with manufacturer's warranty requirements.
- B. Provide adequate supervision of labor force to assure that all aspects of specifications are being fulfilled.
- C. The system shall be engineered, programmed and installed by personnel trained and regularly employed by the control's manufacturer.

- D. Supplier shall have technical support to promptly respond within 24 hours or less to service calls to the site with technical staff, spare parts inventory and test and diagnostic equipment.
- E. Codes and Approvals:
 - 1. The complete system installation shall be in strict accordance with national and local electrical codes. All devices designed for or used in line voltage applications shall be UL listed.
 - a. All microprocessor based devices shall be UL916 listed.
 - b. All electrical environmental control and monitoring devices shall be UL429 and/or UL873 listed.
 - 2. All electronic equipment shall conform to the requirements of FCC regulation Class B, Part 15, Section 15 governing radio frequency electromagnetic interference and be so labeled.
 - 3. The complete system shall conform to ANSI/ASHRAE Standard 135-2020, BACNET.
- F. All system components shall be designed and built to be fault tolerant.
 - 1. Provide satisfactory operation without damage at 100% above and 85% below rated voltage and at +3 Hertz variation in line frequency.
 - 2. Provide static, transient, and short circuit protection on all inputs and outputs. Communication lines shall be protected against incorrect wiring, static transients and induced magnetic interference. Bus connected devices shall be A.C. coupled or equivalent so that any single device failure will not disrupt or halt bus communication.

1.5 ELECTRICAL WIRING

- A. All electrical wiring, components and accessories in connection with the Automatic Temperature Control System shall be furnished and installed by the control's contractor.
 - 1. Unless stated otherwise in the design documents, the ATC Contractor is responsible for providing control power to all valves, actuators, devices and components within the DDC System regardless of the selected voltage of those devices. This also includes all 120-volt power circuits required for devices, panels and control equipment.
- B. Control wiring shall include all wiring necessary to interface with new controls, such as relays and transducers, and shall also include electric and electronic devices such as freezestats, electronic sensors, relays, flow switches and controlled devices such as valve and damper operators, both electric/electronic actuated devices. Pilot devices such as ON/OFF switches and thermostats installed in series with line voltage circuits shall be considered to be control wiring.

1.6 AUTOMATIC TEMPERATURE CONTROL

- A. Interface/Expand the existing a DDC System manufactured by Schneider EcoStruxure, as installed by Tri-M Group, LLC. The system shall be complete in all respects including labor, materials, equipment and services necessary.
- B. All electrical wiring in connection with the installation of the automatic temperature control system shall be furnished and installed under the direct supervision of the control manufacturer.

PART 2 – PRODUCTS

2.1 TEMPERATURE SENSORS

- A. Solid state room sensors shall be of the wire wound resistance type element. Sensors shall be equipped with visual readout and adjustment. Sensors shall be of the completely solid state type with no moving contacts. Printed circuit board under thermostat cover shall contain a low mass resistance type setpoint dial and amplifier. Provide test points for measuring output voltage. Sensors shall be direct or reverse acting as required for the sequence of operation.
- B. Sensors shall provide the application for night setback override.
- C. Sensors shall be mounted at ADA height (48" above floor).

2.2 ACTUATORS

- A. Electronic actuators shall be sized to operate their appropriate dampers and valves with sufficient reserve power to provide smooth modulating action or two-position action as specified.
- B. Provide integral, auxiliary switches for direct coupled actuators to indicate when a desired position is reached or to interface additional controls for a specific sequence.
- C. Align actuator with drive shaft, provide permanent mark to identify closed position of end device.

2.3 SENSOR TRANSMITTERS

- A. Duct and immersion sensors shall have minimum spans as required to meet the temperature requirements. Duct sensors shall have sensing elements of sufficient length and accuracy to measure average duct temperature in each location.
- B. Sensors shall be of corrosion resistant construction, tamperproof, suitable for mounting on a vibrating surface. Exposed capillaries shall be temperature compensated, and armored or installed in protective tubing.
- C. All sensing elements for water pipe mounting shall be of the rod and tube type with linear output and shall be furnished complete with separable protecting wells filled with heat conductive compound. Sensors shall be factory calibrated and tamperproof. If easily adjustable sensors are provided, they shall be located inside metal enclosures with cylinder lock and key to prevent unauthorized setting.
- D. Safety Devices: Provide the following:
 - 1. Air and water duty flow switches: Differential pressure type for fan and pump status.
 - 2. Make-up Water Monitoring System (Typical for chilled water & hot water heating system): (Manufacturer's Rep. 888-397-5353)
 - a. Monitor data as received by flow meter on cold water make-up system. When flow exceeds 10 gal./1 min (adj.), ATC system to close normally open solenoid valve, alarm system (provide call out), shutdown boilers, pumps, chillers, etc., associated with respective system.
 - b. Flow sensor, consisting of a removable flow sensor mounted in cast bronze housing, available in ½" to 1-1/2" pipe size. Sensor shall be rated for a flow range of 0.5 to 15 feet

per second, 220°F max., 400 psig at 100°F max. pressure; Nylon impeller, Pennlon bearing, tungsten carbide shaft, PPS housing and EPDM seals. Manufacturer: Kele Model 250B, Data Industrial Series 250BR.

- c. Programmable analog flow transmitter shall be a loop-powered device that converts a flow sensor signal into a linear 4 – 20 mA signal. Electronic signal dampening, computer programmable, compact size in a metal enclosure. Power input, 9-35 VDC/0-1 kHz, 75 ohms at 24 VDC, accuracy of 0.1% of full scale. Manufacturer: Kele Model 310-02, Universal Flow Transmitter Model UFT-1.

2.4 CONTROL VALVES

- A. Valves shall be rated for a minimum of 150 percent (150%) of system operating pressure at the valve location but not less than 125 psig.
- B. 2" and Smaller: Valves shall be bronze body with screwed or flared connections.
- C. 2-1/2" and Larger: Valves shall be bronze or iron body, flanged.
- D. Flow characteristics:
 - 1. Three-way valves shall have a linear relation of flow vs. valve position.
 - 2. Two-way valve position vs. flow relation shall be equal percentage for water flow control.
- E. Maximum pressure drop through valve:
 - 1. Modulating water flow control: 1/2 the pressure drop through the apparatus with maximum of 10 feet of water. Two position water valves shall be line size.
 - 2. Two-position steam control: 20 percent (20%) of inlet gauge pressure.
 - 3. Modulating steam control: 67 percent (67%) of inlet gauge pressure but not to exceed 45 percent (45%) of inlet absolute pressure (acoustic velocity limitation).

2.5 CONTROL DAMPERS

- A. The ATC Sub-contractor shall furnish all the controlled dampers of the type and sizes indicated on the drawings for installation by the sheet metal Sub-contractor.
- B. All 2-position control dampers shall be parallel blade and sized for minimum pressure drop, at the specified duct size.
- C. All modulating dampers shall be opposed blade and sized for an effective linear air flow control characteristics within the angle of rotation and maximum pressure drops specified. Information shall be provided to the sheet metal Subcontractor for determining the proper duct reductions or baffles used.
- D. Damper frames shall not be less than 16-gauge galvanized steel, formed with corner braces for extra strength, with mounting holes for enclosed duct mounting.

- E. All damper blades shall be of not less than 16-gauge galvanized steel formed for strength and high velocity performance. Blades on all dampers must not be over 8" in width. Blades shall be secured to 1/2" diameter zinc plated axles by zinc plated bolts and nuts. All blade bearings shall be nylon or oilite. Blade side edges shall be sealed off against spring stainless steel seals. Teflon coated thrust bearings shall be provided at each end of every blade to minimize torque requirements and insure smooth operation. All blade leakage hardware shall be constructed of corrosion resistant, zinc plated steel and brass.
- F. Dampers shall be suitable for operation between -40 and 200 degrees. The control manufacturer shall submit leakage and flow characteristics plus a size schedule for all controlled dampers.
- G. All blade edges shall have inflatable seal edging that shall be rated for leakage less than 10 cubic feet per minute per square foot of damper area at a differential pressure of 4" of water when the damper is being held by a torque not to exceed 50 inert lbs. Leakage shall not exceed 1/2 of 1% of total flow.
- H. Provide permanent mark or scribe end of drive shaft to align damper with actuator in closed position.

2.6 CONTROL CABINETS

- A. Control cabinets shall be constructed of 18-gauge steel with locking hinged door. Unless otherwise specified, all controllers, electric relays, switches and other equipment furnished as part of the control system which are not required to be mounted on mechanical equipment, shall be cabinet mounted. The temperature indicators and switches shall be flush mounted on the door tagged with plastic labels. All electrical devices shall be wired to a numbered terminal strip and all devices shall be completely adjusted and checked for proper operation prior to shipment to job site. All wiring shall be numbered according to the control diagram.

2.7 SEQUENCE OF OPERATION

- A. Replacement equipment shall operate as per existing equipment sequencing including temperature settings, water settings, scheduling, etc.
- B. Refrigerant Monitoring System Control (provided by Tri-M Group):
 - 1. The system consists of a refrigerant monitor and sensors mounted in the Mechanical Room. Provide all functions and the following interlocks.
 - 2. Whenever the monitor goes into high-level alarm, shut down the gas-fired boilers and existing domestic water heaters. Close the normally open motor-operated gas valve in the supply pipe to the domestic water heaters.
 - 3. Activate alarm horn and strobe light in Mechanical Room and at each door into the Mechanical Room. Provide a horn reset switch at each door to allow the horn to be silenced, while strobe light continues to flash until the system is reset.
 - 4. Activate exhaust fan EF-4 after motor operated exhaust damper is open subject to damper limit switch. Open existing outside air motor operated damper at existing louver.
 - 5. Exhaust fan shall continue to run until the monitoring system resets. Once reset, the exhaust fan shall stop, dampers shall close, and the strobe lights shall turn off.

6. Provide alarm and system status at the OWS with remote alarm call out through the building Fire Alarm System.
7. Provide a control switch outside of the Mechanical Room doors to shut down the gas-fired boilers and existing domestic water heater. Provide a control switch (on a separate circuit) to activate EF-4.

C. Exhaust Fan EF-1 Control

1. Provide a motor operated damper and actuator for control of exhaust fan as shown on the drawings. The damper shall be installed by the Mechanical Contractor.
2. During the building's scheduled occupied mode, exhaust fan shall be energized and outside air motor operated damper shall open. Subject to a limit switch on the exhaust air damper, the exhaust fan shall start. During the building's scheduled unoccupied mode, the fan shall be deenergized and OA damper closed.
3. The following items shall be displayed at the OWS:
 - a. Fan status via current switch: on/off.
 - b. Commanded status of fan and damper.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Install system and materials in accordance with manufacturer's instructions and roughing-in drawings, and details and drawings. Install electrical work and use electrical products complying with requirements of these specifications. Mount controllers at convenient locations and heights.
- B. All wiring shall be properly supported and run in a neat and workmanlike manner. All wiring exposed and in equipment rooms shall run parallel to or at right angles to the building structure. All wiring within enclosures shall be neatly bundled and anchored to prevent obstruction to devices and terminals. All wiring shall be in accordance with all local and national codes. Wiring in all locations shall be installed in EMT conduit. All electronic wiring shall be #18 AWG minimum THHN and shielded if required, except standard network (Ethernet, LonWorks, etc.) cabling shall be as tested and recommended in lieu of #18 gauge twisted, #22 or #24 gauge is acceptable if used as a part of an engineered structured cabling system. The control manufacturer must submit technical and application documentation demonstrating that this cabling system has been tested and approved for use by the manufacturer of both the control system and the engineered structured cabling system.

- C. Provide all sensing, control, and interlock wiring for the following:

System inputs and outputs

System communications

System power

System interlocks

Unit controls

- D. The Control Manufacturer shall enter all computer data into the Host computer including all graphics, control programs, initial approved parameters and settings, and English descriptors. The Control Manufacturer shall maintain diskette copies of all data file and application software for reload use in the event of a system crash or memory failure. One copy shall be delivered to the owner during training sessions, and one copy shall be archived in the Control Manufacturer's local software vault.

3.2 DATA CONTROL (D/C) AND GRAPHICS SUMMARY

- A. All hardware, custom software, application software, graphics, etc., necessary to accomplish the control sequences and display the graphics specified shall be provided as part of this contract. Provide all controllers, inputs, outputs, valves, dampers, actuators and flow meters required to provide the control and graphic data described. Provide software setpoints required for display in logical groups and graphics.
- B. Each digital output shall have a software-associated monitored input. Any time the monitored input does not track its associated command output within a programmable time interval, a "command failed" alarm shall be reported.
- C. Where calculated points (such as CFM) are shown, they shall appear in their respective logical groups.
- D. Unless otherwise specified or approved prior to bidding, the primary analog input and the analog output of each DDC loop shall be resident in a single remote panel containing the DDC algorithm, and shall function independent of any primary or UC communication links. Secondary (reset type) analog inputs may be received from the primary network, but approved default values and/or procedures shall be substituted in the DDC algorithm for this secondary input if network communications fail or if the secondary input becomes erroneous or invalid.

3.3 ACCEPTANCE

- A. The Control Manufacturer shall completely check out, calibrate and test all connected hardware and software to ensure that the system performs in accordance with the approved specifications and sequences of operations approved.
- B. Witnessed acceptance demonstration shall display and demonstrate each type of data entry to show site specific customizing capability; demonstrate parameter changes; execute digital and analog commands; and demonstrate DDC loop stability via trend of inputs and outputs.

3.4 MANUALS

- A. The following manuals will be provided:
 - 1. An Operators Manual shall be provided with graphic explanations of keyboard use for all operator functions specified under Operator Training.
- B. Computerized printouts of all GPC data file including all point processing assignments, physical terminal relationships, scales and offsets, command and alarm limits, etc.
- C. A manual shall be provided including revised as-built documents of all materials required under the paragraph "SUBMITTALS" on this specification.

- D. Two Operators Manuals, and two As-Built Manuals shall be provided to the owner.

3.5 TRAINING

- A. All training shall be by the BMCS contractor and shall utilize operators manuals and as-built documentation.
- B. Operator training shall include one (1) four-hour session encompassing modifying text and graphics, sequence of operation review, selection of all displays and reports, use of all specified OWS functions, troubleshooting of sensors (determining bad sensors), and password assignment and modification.

3.6 SERVICE GUARANTEE

- A. The control system herein specified shall be free from defects in workmanship and material under normal use and service. After completion of the installation, the control manufacturer shall regulate and adjust all thermostats, control valves, motors and other equipment provided under this contract. If within twenty-four (24) months from date of acceptance either for beneficial use of final acceptance, whichever is earlier, any of the equipment herein described is proven to be defective in workmanship or materials, it will be replaced or repaired free of charge. The control manufacturer shall, after acceptance, provide any service incidental to the proper performance of the control system under guarantee outlined above for the period of two years. Normal maintenance of the system or adjustments of components is not to be considered part of the guarantee. The control manufacturer will upon completion of the installation, during the warranty period, make available to the Owner, an annual service agreement covering all labor and material required to efficiently maintain the control system.

3.7 FINAL ADJUSTMENT

- A. After completion of installation, adjust thermostats, control valves, motors and similar equipment provided as work of this section.
- B. Final adjustment shall be performed by specially trained personnel in direct employ of installer of primary temperature control system.

END OF SECTION 23 09 00

SECTION 23 09 50 – TESTING & BALANCING OF MECHANICAL SYSTEMS

PART 1 – GENERAL

1.1 JOB CONDITIONS

- A. Systems shall be completely installed and in continuous operation as required to accomplish the tests.
- B. Heating, ventilating and air conditioning equipment shall be completely installed and in continuous operation as required to accomplish the balance work specified.
- C. Adjust and balance shall be performed when outside conditions approximate design conditions indicated for heating and cooling functions.
- D. Make at least two inspections of the mechanical systems during construction to verify that balancing procedures may be accomplished. Report findings to the Architect/Engineer/Construction Manager.
- E. Balancing firm shall balance Mechanical System two (2) times. The first time shall be considered a rough balance. Any discrepancy in air flow shall be addressed to the Architect/Engineer/Construction Manager. The final balancing will be accomplished after review of rough balance reports.
- F. The final balancing reports shall be submitted and approved prior to project's being considered complete; i.e., commencement of warranties.

1.2 ENGINEER QUALIFICATIONS

- A. The firm shall be an independent organization having no affiliation with construction contractors, equipment sales or design engineering.
- B. The firm shall specialize in balancing heating, ventilating and air conditioning systems.
- C. The firm shall show proof of having balanced and tested at least five projects of similar size and scope.
- D. All field work shall be under the direct supervision of a registered Professional Engineer who is a full-time employee of the balancing firm.
- E. The firm shall be certified by and a member of the AABC (Associated Air Balance Council), or NEBB (National Environmental Balancing Bureau).

1.3 REPORT

- A. Data Sheets:
 - 1. Submit data sheets on each item of testing equipment required.
 - 2. Include name of device, manufacturer's name, model number, latest date of calibration and correction factors.
- B. Report Forms:
 - 1. Submit specimen copies of report forms.

2. Forms shall be 8-1/2 x 11 inch paper for loose-leaf binding, with blanks for listing of the required test ratings and for certification of report.
3. Reports shall be on standard forms published by AABC or NEBB.

PART 2 – PRODUCTS

2.1 AIR BALANCE INSTRUMENTS

- A. Alnor Velometer with probes and alnor pitot tube.
- B. Rotating Vane Anemometer: 4-inch size.
- C. ASHRAE Standard Pitot Tubes, stainless steel 5/16 inch outside diameter, lengths 18 inches and 36 inches.
- D. Magnehelic Differential Air Pressure Gauges, 0 to 0.5 inches, 0 to 1.0 inch and 0 to 5.0 inches water pressure ranges, each arranged as a portable unit for use with a standard Pitot tube.
- E. Combination Inclined-Vertical Portable Manometer, range 0 to 5.0 inches water.

2.2 WATER BALANCING INSTRUMENTS

- A. 30 Inch Mercury U-Tube Manometer, 200 psig, with 3 valve bypass assembly and return wells or mercury check valves.
- B. Inspector's gauge testing set.
- C. Water Differential Pressure Gauge, 4-1/2 inch dial, 0 to 100 psi range.
- D. Pressure gauge measurement points, quick connect couplings, 1/4 inch psi.

2.3 SYSTEM PERFORMANCE MEASURING INSTRUMENTS

- A. Insertion Thermometers, with graduation at 0.5 degrees F for air and 0.1 degrees F for water.
- B. Sling Psychrometer.

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS

- A. Arrange and pay for all tests.
- B. Notify Architect/Engineer/Construction Manager at least three working days in advance of test and conduct in presence of Architect/Engineer/Construction Manager.
- C. Tests to be performed prior to insulation, covering or concealment.
- D. Provide signed report of completion of test with signature of witnesses. Report shall indicate:
 1. System Tested

2. Date

3. Specified test requirements and actual testing results

- E. The balancing firm shall report to and review the work required with the Architect/Engineer before beginning field balance work. The balancing firm shall make at least two inspections of the air systems during construction and shall report his findings in writing to the Architect/Engineer.
- F. The balancing firm shall cooperate with the Architect/Engineer/Construction Manager and the Mechanical Contractor to effect smooth coordination of the balancing work with the job schedule.
- G. The balancing firm shall be responsible for getting the various systems into proper operation. They shall enlist the aid of the equipment suppliers and Mechanical Contractor as may be required to effect proper operation consistent with the contract plans and specifications.
- H. When the balancing firm cannot balance a belt-driven piece of equipment with the supplied belts and sheaves, inform the Mechanical Contractor that the Mechanical Contractor shall provide additional sheaves as spelled out in other Division 23 Sections.

3.2 CIRCULATING WATER SYSTEM TEST

- A. All piping tests shall be applied not only to piping, but also to all devices and equipment connected thereto with the exception of control valves, boilers or any other equipment which may be damaged by the test pressure. All valves shall be full open.
- B. Test at 100 psi hydrostatic pressure for 6 hours:
 - 1. Record pressures each hour
 - 2. Repair all leaks
 - 3. Retest until 6 hours can be completed with no leaks or loss of pressure.
- C. After completion of successful test, strainers shall be cleaned, then system shall be backflushed and strainers cleaned again.

3.3 BALANCING PROCEDURE

- A. Air System Balance:
 - 1. With the exhaust fan system the balancing firm shall perform the following tests and compile the following information:

Exhaust Fan

 - a. Design Conditions:
 - (1) CFM
 - (2) Static Pressure
 - (3) Fan RPM

- b. Installed Equipment:
 - (1) Manufacturer
 - (2) Size/Model Number
 - (3) Motor HP, Voltage, Phase, Full Load Amperes
 - c. Field Test:
 - (1) Fan Speed
 - (2) No Load Operating Amperes
 - (3) Fan Motor Operating Amperes
 - (4) Calculated BHP
 - d. Test for Total Air:
 - (1) Size of exhaust ducts.
 - (2) Number and locations of Velocity Readings taken.
 - (3) Duct Average Velocity
 - (4) Total CFM
- B. Water Balance:
- 1. Water balance shall include heating water, chilled water and condenser water systems. The balancing agency shall perform the following tests, compile data and submit reports.
 - 2. Pumps:
 - a. Design Data
 - (1) GPM, head
 - (2) RPM, BHP
 - b. Installed Equipment
 - (1) Manufacturer, Size
 - (2) Type Drive
 - (3) Motor HP, Volts, Cycles and Phase
 - (4) Full Load Amperes
 - c. Field Test

- (1) Discharge Pressures: Full flow & no flow
 - (2) Suction Pressures: Full flow & no flow
 - (3) Operating Head and GPM
 - (4) No Load Amperes (where possible)
 - (5) Full Flow Amperes, No Flow Amperes
 - (6) Calculated BHP
- C. In addition to the above work, the Balancing Firm shall check the operation of all automatic temperature control equipment; verify all thermostat, aquastat, etc., set-points and operations; and enlist the aid of the Mechanical Contractor and the Control Subcontractor to make necessary adjustments where required.

END OF SECTION 23 09 50