

**IN ORDER TO BID ON THIS PROJECT,  
PLANS MUST BE PURCHASED.**

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FOR DETAILS.**

**STATE OF DELAWARE  
DEPARTMENT OF FACILITIES MANAGEMENT  
CONTRACT # CN 1240 D**

**SPECIFICATIONS  
FOR**

**Sussex Technical School District  
Chiller Replacement**

**IN**

**Georgetown, Delaware**

**PREPARED  
BY**

**Gipe Associates, Inc.**

**BID DOCUMENTS  
APRIL 16, 2014**



*Sussex Technical School District  
Chiller Replacement*

Georgetown, Delaware

**PROJECT MANUAL**

BID DOCUMENTS  
GAI WO#: 13107

APRIL 16, 2014



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## **INSTRUCTIONS TO BIDDERS**

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**ARTICLE 1: GENERAL**

## 1.1 DEFINITIONS

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

1.2 STATE: The State of Delaware.

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

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

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

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

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

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

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

1.10 ADDENDA: Written or graphic instruments issued by the Owner/Engineer 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.

## **ARTICLE 2: BIDDER'S REPRESENTATIONS**

- 2.1 PRE-BID MEETING
- 2.1.1 A pre-bid meeting for this project will be held at the time and place designated. Attendance at this meeting is a pre-requisite for submitting a Bid, unless this requirement is specifically waived elsewhere in the Bid Documents.
- 2.2 By submitting a Bid, the Bidder represents that:
- 2.2.1 The Bidder has read and understands the Bidding Documents and that the Bid is made in accordance therewith.
- 2.2.2 The Bidder has visited the site, become familiar with existing conditions under which the Work is to be performed, and has correlated the Bidder's his 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.

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**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 and shall submit a valid Delaware Business License Number with their Bid or shall state that the process of application for a Delaware Business License has been initiated.
- 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 Engineer 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 Engineer immediately.
- 3.1.4 The Agency and Engineer 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.

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## 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 Engineer.
- 3.2.2 Bidders or Sub-bidders requiring clarification or interpretation of the Bidding Documents shall make a written request to the Engineer 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 Engineer 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 Engineer's decision of approval or disapproval shall be final. The Engineer is to notify Owner prior to any approvals.
- 3.3.3 If the Engineer 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 Engineer 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 Engineer to have received a complete set of the Bidding Documents.

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- 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 4 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.

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## 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 As required by Delaware Code, Title 29, section 6962(d)(10)b, 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. A Bid will be considered non-responsive unless the completed list is included.

4.3.2 Provide the Name and Address for each listed subcontractor. Addresses by City, Town or Locality, plus State, will be acceptable.

4.3.3 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 EQUALITY OF EMPLOYMENT OPPORTUNITY ON PUBLIC WORKS

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

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

B. The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive

consideration for employment without regard to race, creed, sex, color, sexual orientation, gender identity or national origin."

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## 4.5 PREVAILING WAGE REQUIREMENT

4.5.1 Wage Provisions: In accordance with Delaware Code, Title 29, Section 6960, renovation projects whose total cost shall exceed \$15,000, and \$100,000 for new construction, 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.

4.5.2 The prevailing wage shall be the wage paid to a majority of employees performing similar work as reported in the Department's annual prevailing wage survey or in the absence of a majority, the average paid to all employees reported.

4.5.3 The employer shall pay all mechanics and labors employed directly upon the site of work, 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.

4.5.4 The scale of the wages to be paid shall be posted by the employer in a prominent and easily accessible place at the site of the work.

4.5.5 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.

## 4.6 SUBMISSION OF BIDS

4.6.1 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.

4.6.2 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.

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

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

4.6.5 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.

## 4.7 MODIFICATION OR WITHDRAW OF BIDS

4.7.1 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 Engineer. A request for withdraw by letter or fax, if the Engineer 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.

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

4.7.3 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;

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- C. The Bidder's written safety plan;
- D. Whether the Bidder is qualified legally to contract with the State;
- E. Whether the Bidder supplied all necessary information concerning its responsibility; and,
- F. Any other specific criteria for a particular procurement, which an agency may establish; provided however, that, the criteria be set forth in the Invitation to Bid and is otherwise in conformity with State and/or Federal law.

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

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

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

5.3.3.2 Evidence of collusion among Bidders.

5.3.3.3 Unsatisfactory performance record as evidenced by past experience.

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

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

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

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

#### 5.4 ACCEPTANCE OF BID AND AWARD OF CONTRACT

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

5.4.2 Per Section 6962(d)(13) a., Title 29, Delaware Code, "The contracting agency shall award any public works contract within thirty (30) days of the bid opening to the lowest 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."

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.

**INSTRUCTIONS TO BIDDERS**

00 21 13-10

- 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. 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 one year after the date of substantial completion.
- 5.4.6 If the successful Bidder fails to execute the required Contract and Bond, 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) or a Delaware business license number, and should the vendor be awarded a contract, such vendor shall provide to the agency the taxpayer identification or Delaware business 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. Prior to execution of the resulting contract, the successful Bidder shall be required to produce proof of its Delaware business license if not provided in its bid.
- 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 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 **BUSINESS DESIGNATION FORM**
- 6.2.1 Successful bidder shall be required to accurately complete an Office of Management and Budget Business Designation Form for Subcontractors.

**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.

INSTRUCTIONS TO BIDDERS

00 21 13-11

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 AGENCY 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 INSTRUCTIONS TO BIDDERS

STATE OF DELAWARE

DIVISION OF FACILITIES MANAGEMENT

INSTRUCTIONS TO BIDDERS

00 21 13-12

**SECTION 00 30 00: INFORMATION AVAILABLE TO BIDDERS**

PART 1 GENERAL

1.1 DESCRIPTION

A. Existing Test and Balance Report for the Chilled Water System.

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

REVISED SEPTEMBER 2009

DATE: OCT. 08-DEC. 08 PAGE: 28

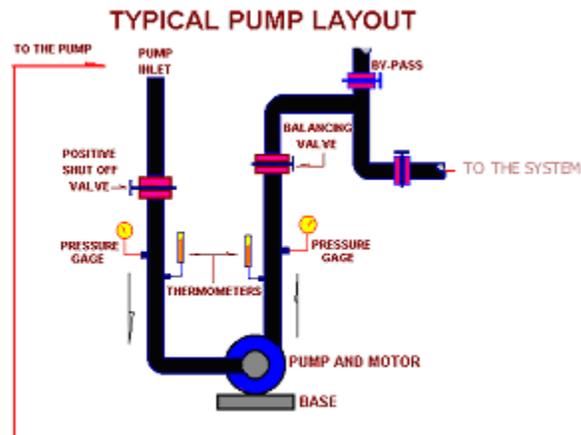
## PUMP DATA

MANUFACTURER= NECO

MODEL= 99R4069112A

PUMP NUMBER= P-1

SYSTEM = CHILLED WATER



DESIGN GPM = 900

ACTUAL GPM = 944

DESIGN RPM = 1750

TOTAL DYNAMIC HEAD:

DESIGN = 100

ACTUAL= 81.7'

ACTUAL BLOCK OFF OR DEAD HEAD PRESSURE = 120.3' DISCHARGE= 68.5 SUCTION= 16.4

IMPELLAR SIZE:

DESIGN = 11.0"

ACTUAL= 11.0"

DESIGN PRESSURE DIFFERENTIAL (TDH X .433) = 43.3

PSI: SUCTION = 14.5

DISCHARGE = 49.9

ACTUAL PD = 35.4'

MOTOR AMPS:

DESIGN = 72/36

ACTUAL = 35.5/35.6/36 58.5HZ

MOTOR VOLTS:

DESIGN = 230/460

ACTUAL = 480/479/480

DESIGN HP (CUTS/SUBMITTALS) = 30

MOTOR TAG HORSEPOWER = 30

### PUMP BALANCING & OR READ OUT DRIVE INFORMATION

MANUFACTURER = WHEATLEY

SIZE = 8"

SETTING = 100%

FEET/INCHES OF HEAD = 9.6'

## ULTRA SONIC FLOW METER DATA SHEET

SYSTEM NUMBER= CHILLED WATER      DESIGN GPM= 900

ACTUAL VELOCITY= 3.64      ACTUAL GPM= 944

### FLOWMETER SETTINGS

NOMINAL PIPE SIZE= 10"	PIPE OUTSIDE DIAMETER= 10.750"
PIPE WALL THICKNESS= 0.365"	PIPE MATERIAL= STEEL
TRANSDUCER NUMBER= 113	PIPE LINING= NONE
FLOW MEDIUM= WATER	TEMPERATURE OF MEDIUM= 55F
NUMBER OF TRAVERSES= 2	
TRANSDUCER SPACING= 9.101"	

### DIAGNOSTICS

SIGNAL STRENGTH-UP= 3274	SIGNAL STRENGTH DOWN= 3569
SOUND SPEED= 5284.6 FT./S	

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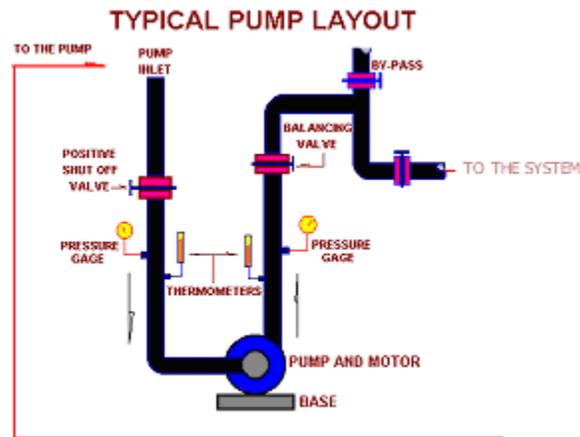
PUMP DATA

MANUFACTURER= NECO

MODEL= 99R4069112B

PUMP NUMBER= P-2

SYSTEM = CHILLED WATER



DESIGN GPM = 900

ACTUAL GPM = 940

DESIGN RPM = 1750

TOTAL DYNAMIC HEAD:

DESIGN = 100'

ACTUAL= 82.4'

ACTUAL BLOCK OFF OR DEAD HEAD PRESSURE = 122.1' DISCHARGE= 66.9 SUCTION= 14.0

IMPELLAR SIZE:

DESIGN = 11.0"

ACTUAL= 11.0"

DESIGN PRESSURE DIFFERENTIAL (TDH X .433) = 4.33

PSI: SUCTION = 14.3

DISCHARGE = 50.0

ACTUAL PD = 35.7

MOTOR AMPS:

DESIGN = 72/36

ACTUAL = 34.8/34.5/34.5

MOTOR VOLTS:

DESIGN = 230/460

ACTUAL = 481/480/480

DESIGN HP (CUTS/SUBMITTALS) = 30

MOTOR TAG HORSEPOWER = 30

PUMP BALANCING & OR READ OUT DRIVE INFORMATION

MANUFACTURER = WHEATLEY

SIZE = 8"

SETTING = 100%

FEET/INCHES OF HEAD = 4.6'

## ULTRA SONIC FLOW METER DATA SHEET

SYSTEM NUMBER= CHILLED WATER      DESIGN GPM= 900

ACTUAL VELOCITY= 3.65 FT./S      ACTUAL GPM= 940

### FLOWMETER SETTINGS

NOMINAL PIPE SIZE= 10"	PIPE OUTSIDE DIAMETER= 10.750"
PIPE WALL THICKNESS= 0.365"	PIPE MATERIAL= STEEL
TRANSDUCER NUMBER= 113	PIPE LINING= NONE
FLOW MEDIUM= WATER	TEMPERATURE OF MEDIUM= 54F
NUMBER OF TRAVERSES= 2	
TRANSDUCER SPACING= 9.101"	

### DIAGNOSTICS

SIGNAL STRENGTH-UP= 3489	SIGNAL STRENGTH DOWN= 3227
SOUND SPEED= 5286.6 FT./S	

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## ULTRA SONIC FLOW METER DATA SHEET

SYSTEM NUMBER= CHILLED WATER      DESIGN GPM= 677

ACTUAL VELOCITY= 2.70 FT./S      ACTUAL GPM= 715

### FLOWMETER SETTINGS

NOMINAL PIPE SIZE= 8.0"

PIPE OUTSIDE DIAMETER= 8.625"

PIPE WALL THICKNESS= 0.322"

PIPE MATERIAL=NONE

TRANSDUCER NUMBER= 113

PIPE LINING= NONE

FLOW MEDIUM= WATER

TEMPERATURE OF MEDIUM= 48.0F

NUMBER OF TRAVERSES= 2

TRANSDUCER SPACING= 7.357"

### DIAGNOSTICS

SIGNAL STRENGTH-UP= 3144

SIGNAL STRENGTH DOWN= 3766

SOUND SPEED= 5260 FT./S

### ULTRA SONIC FLOW METER DATA SHEET

SYSTEM NUMBER= CHILLED WATER      DESIGN GPM= 222.5

ACTUAL VELOCITY= 1.32 FT./S      ACTUAL GPM= 225

### FLOWMETER SETTINGS

NOMINAL PIPE SIZE= 8"      PIPE OUTSIDE DIAMETER= 8.625"  
PIPE WALL THICKNESS= 0.322"      PIPE MATERIAL= NONE  
TRANSDUCER NUMBER= 113      PIPE LINING= NONE  
FLOW MEDIUM= WATER      TEMPERATURE OF MEDIUM= 48.0F  
NUMBER OF TRAVERSES= 2  
TRANSDUCER SPACING= 7.357"

### DIAGNOSTICS

SIGNAL STRENGTH-UP= 2887      SIGNAL STRENGTH DOWN= 3839  
SOUND SPEED= 5261 FT./S

### ULTRA SONIC FLOW METER DATA SHEET

SYSTEM NUMBER= CHILLED WATER      DESIGN GPM= 92.5

ACTUAL VELOCITY= 0.91 FT./S      ACTUAL GPM= 92.8

### FLOWMETER SETTINGS

NOMINAL PIPE SIZE= 6.0"

PIPE OUTSIDE DIAMETER= 6.625"

PIPE WALL THICKNESS= 0.280"

PIPE MATERIAL=STEEL

TRANSDUCER NUMBER= 113

PIPE LINING= NONE

FLOW MEDIUM= WATER

TEMPERATURE OF MEDIUM= 48.0F

NUMBER OF TRAVERSES= 2

TRANSDUCER SPACING= 5.653"

### DIAGNOSTICS

SIGNAL STRENGTH-UP= 3844

SIGNAL STRENGTH DOWN= 3411

SOUND SPEED= 5389.9 FT./S





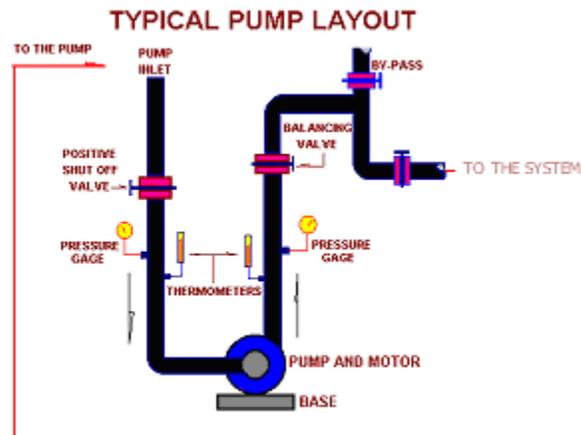
PUMP DATA

MANUFACTURER= PACO

MODEL= 99R4069118A

PUMP NUMBER= P-3

SYSTEM = CONDENSOR



DESIGN GPM = 700

ACTUAL GPM = 703

DESIGN RPM = 1750

TOTAL DYNAMIC HEAD:

DESIGN = 80

ACTUAL = 65.3

ACTUAL BLOCK OFF OR DEAD HEAD PRESSURE = (1)

IMPELLAR SIZE:

DESIGN = 9.9

ACTUAL = (1)

DESIGN PRESSURE DIFFERENTIAL (TDH X .433) = 34.6

PSI: SUCTION = 1.3

DISCHARGE = 29.3

ACTUAL PD = 28.3

MOTOR AMPS:

DESIGN = 50/25

ACTUAL = 24.9/24.5/25.0

MOTOR VOLTS:

DESIGN = 230/460

ACTUAL = 486/485/488

DESIGN HP (CUTS/SUBMITTALS) = 15

MOTOR TAG HORSEPOWER =

PUMP BALANCING & OR READ OUT DRIVE INFORMATION

MANUFACTURER = WHEATLEY

SIZE = 8"

SETTING = 80%

FEET/INCHES OF HEAD = (2)

(1)= THE UNIT WAS NOT DEAD HEADED DUE BECAUSE IT WOULD TRIGGER ALARMS IN THE CHILLER

(2)= THE PORTS ARE CLOGGED. IT WAS NOT POSSIBLE TO GET READINGS.

### ULTRA SONIC FLOW METER DATA SHEET

SYSTEM NUMBER= P-3

DESIGN GPM= 700

ACTUAL VELOCITY= 4.40 FT./S

ACTUAL GPM= 703

### FLOWMETER SETTINGS

NOMINAL PIPE SIZE= 8"

PIPE OUTSIDE DIAMETER= 8.625"

PIPE WALL THICKNESS= 0.322"

PIPE MATERIAL= STEEL

TRANSDUCER NUMBER= 113

PIPE LINING= NONE

FLOW MEDIUM= WATER

TEMPERATURE OF MEDIUM= 82.0F

NUMBER OF TRAVERSES= 2

TRANSDUCER SPACING= 7.372"

### DIAGNOSTICS

SIGNAL STRENGTH-UP= 2177

SIGNAL STRENGTH DOWN= 2069

SOUND SPEED= 4948.7 FT./S

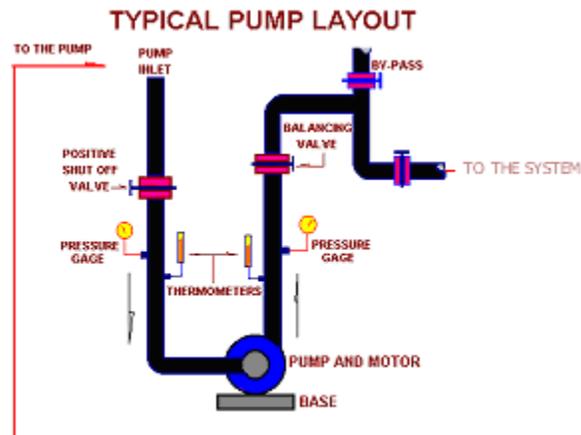
PUMP DATA

MANUFACTURER= PACO

MODEL= 99R4069118B

PUMP NUMBER= P-4

SYSTEM = CONDENSOR



DESIGN GPM = 700

ACTUAL GPM = 705

DESIGN RPM = 1750

TOTAL DYNAMIC HEAD:

DESIGN = 80

ACTUAL= 71.6

ACTUAL BLOCK OFF OR DEAD HEAD PRESSURE = (1)

IMPELLAR SIZE:

DESIGN = 9.9

ACTUAL= (1)

DESIGN PRESSURE DIFFERENTIAL (TDH X .433) = 34.6

PSI: SUCTION = 1.0

DISCHARGE = 32.0

ACTUAL PD = 31.0

MOTOR AMPS:

DESIGN = 50/25

ACTUAL = 24.4/25.0/24.6

MOTOR VOLTS:

DESIGN = 230/460

ACTUAL = 484/485/485

DESIGN HP (CUTS/SUBMITTALS) = 15

MOTOR TAG HORSEPOWER = 20

PUMP BALANCING & OR READ OUT DRIVE INFORMATION

MANUFACTURER = WHEATLEY

SIZE = 8"

SETTING = 80%

FEET/INCHES OF HEAD = (2)

(1)= THIS PUMP WAS NOT DEAD HEADED BECAUSE IS WOULD TRIGGER ALARMS IN THE CHILLER.

(2)= THE PORTS ARE CLOGGED. IT WAS NOT POSSIBLE TO GET READINGS.

## ULTRA SONIC FLOW METER DATA SHEET

SYSTEM NUMBER= P-4

DESIGN GPM= 700

ACTUAL VELOCITY= 4.42 FT./S

ACTUAL GPM= 705

## FLOWMETER SETTINGS

NOMINAL PIPE SIZE= 8"

PIPE OUTSIDE DIAMETER= 8.625"

PIPE WALL THICKNESS= 0.322"

PIPE MATERIAL=STEEL

TRANSDUCER NUMBER= 113

PIPE LINING= NONE

FLOW MEDIUM= WATER

TEMPERATURE OF MEDIUM= 82.0F

NUMBER OF TRAVERSES= 2

TRANSDUCER SPACING= 7.372

## DIAGNOSTICS

SIGNAL STRENGTH-UP= 2055

SIGNAL STRENGTH DOWN= 2183

SOUND SPEED= 4944.6 FT./S



SUSSEX TECHNICAL HIGH SCHOOL CHILLER REPLACEMENT  
GEORGETOWN, DELAWARE  
GAI PROJECT NUMBER: 13107

**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 sixty (60) days from the date of opening of bids, 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 120 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
- Bid Security
- (Others as Required by Project Manuals)

SUSSEX TECHNICAL HIGH SCHOOL CHILLER REPLACEMENT  
GEORGETOWN, DELAWARE  
GAI PROJECT NUMBER: 13107

**BID FORM**

**SUBCONTRACTOR LIST**

In accordance with Title 29, Chapter 6962 (d)(10)b Delaware Code, the following sub-contractor listing must accompany the bid submittal. The name and address of the sub-contractor **must be listed for each category** where the bidder intends to use a sub-contractor to perform that category of work. In order to provide full disclosure and acceptance of the bid by the *Owner*, **it is required that bidders list themselves as being the sub-contractor for all categories where he/she is qualified and intends to perform such work.**

<u>Subcontractor Category</u>	<u>Subcontractor</u>	<u>Address (City &amp; State)</u>	<u>Subcontractors tax payer ID # or Delaware Business license #</u>
1. CHILLER MANUFACTURER	_____	_____	_____
2. MECHANICAL	_____	_____	_____
3. AUTOMATIC TEMPERATURE CONTROL	_____	_____	_____
4. ELECTRICAL	_____	_____	_____
5.	_____	_____	_____
6.	_____	_____	_____
7.	_____	_____	_____
8.	_____	_____	_____
9.	_____	_____	_____

SUSSEX TECHNICAL HIGH SCHOOL CHILLER REPLACEMENT  
GEORGETOWN, DELAWARE  
GAI PROJECT NUMBER: 13107

**BID FORM**  
**NON-COLLUSION STATEMENT**

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

All the terms and conditions of (*Project or Contract Number*) 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.**

STATE OF DELAWARE  
OFFICE OF MANAGEMENT AND BUDGET

**BID BOND**

TO ACCOMPANY PROPOSAL  
(Not necessary if security is used)

KNOW ALL MEN BY THESE PRESENTS That: \_\_\_\_\_  
\_\_\_\_\_ of \_\_\_\_\_ in the County of \_\_\_\_\_  
\_\_\_\_\_ and State of \_\_\_\_\_ as **Principal**, and \_\_\_\_\_  
\_\_\_\_\_ of \_\_\_\_\_ in the County of \_\_\_\_\_  
and State of \_\_\_\_\_ as **Surety**, legally authorized to do business in the State of Delaware  
("State"), are held and firmly unto the **State** in the sum of \_\_\_\_\_  
\_\_\_\_\_ Dollars (\$ \_\_\_\_\_), or \_\_\_\_\_ percent not to exceed \_\_\_\_\_  
\_\_\_\_\_ Dollars (\$ \_\_\_\_\_)  
of amount of bid on Contract No. \_\_\_\_\_, 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

**STANDARD FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR A101-2007**

The contract to be utilized on this project shall be the "Standard Form of Agreement Between Owner and Contractor" AIA Document A101-2007.



# AIA<sup>®</sup> Document A101<sup>™</sup> – 2007

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

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

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

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

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

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

The Owner and Contractor agree as follows.

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

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

AIA Document A201<sup>™</sup>-2007, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

Int.

**TABLE OF ARTICLES**

- 1 THE CONTRACT DOCUMENTS
- 2 THE WORK OF THIS CONTRACT
- 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION
- 4 CONTRACT SUM
- 5 PAYMENTS
- 6 DISPUTE RESOLUTION
- 7 TERMINATION OR SUSPENSION
- 8 MISCELLANEOUS PROVISIONS
- 9 ENUMERATION OF CONTRACT DOCUMENTS
- 10 INSURANCE AND BONDS

**ARTICLE 1 THE CONTRACT DOCUMENTS**

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

**ARTICLE 2 THE WORK OF THIS CONTRACT**

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

**ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION**

§ 3.1 The date of commencement of the Work shall be the date of this Agreement unless a different date is stated below or provision is made for the date to be fixed in a notice to proceed issued by the Owner.

*(Insert the date of commencement if it differs from the date of this Agreement or, if applicable, state that the date will be fixed in a notice to proceed.)*

If, prior to the commencement of the Work, the Owner requires time to file mortgages and other security interests, the Owner's time requirement shall be as follows:

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

§ 3.3 The Contractor shall achieve Substantial Completion of the entire Work not later than ( ) days from the date of commencement, or as follows:

*(Insert number of calendar days. Alternatively, a calendar date may be used when coordinated with the date of commencement. If appropriate, insert requirements for earlier Substantial Completion of certain portions of the Work.)*

**Portion of Work**

**Substantial Completion Date**

, subject to adjustments of this Contract Time as provided in the Contract Documents.  
*(Insert provisions, if any, for liquidated damages relating to failure to achieve Substantial Completion on time or for bonus payments for early completion of the Work.)*

**ARTICLE 4 CONTRACT SUM**

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

§ 4.2 The Contract Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:

*(State the numbers or other identification of accepted alternates. If the bidding or proposal documents permit the Owner to accept other alternates subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)*

§ 4.3 Unit prices, if any:

*(Identify and state the unit price; state quantity limitations, if any, to which the unit price will be applicable.)*

Item	Units and Limitations	Price Per Unit (\$0.00)
------	-----------------------	-------------------------

§ 4.4 Allowances included in the Contract Sum, if any:

*(Identify allowance and state exclusions, if any, from the allowance price.)*

Item	Price
------	-------

**ARTICLE 5 PAYMENTS**

**§ 5.1 PROGRESS PAYMENTS**

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

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

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

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

init.

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

§ 5.1.6 Subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

- .1 Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Contract Sum allocated to that portion of the Work in the schedule of values, less retainage of percent ( %). Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute shall be included as provided in Section 7.3.9 of AIA Document A201™–2007, General Conditions of the Contract for Construction;
- .2 Add that portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction (or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing), less retainage of percent ( %);
- .3 Subtract the aggregate of previous payments made by the Owner; and
- .4 Subtract amounts, if any, for which the Architect has withheld or nullified a Certificate for Payment as provided in Section 9.5 of AIA Document A201–2007.

§ 5.1.7 The progress payment amount determined in accordance with Section 5.1.6 shall be further modified under the following circumstances:

- .1 Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to the full amount of the Contract Sum, less such amounts as the Architect shall determine for incomplete Work, retainage applicable to such work and unsettled claims; and  
*(Section 9.8.5 of AIA Document A201–2007 requires release of applicable retainage upon Substantial Completion of Work with consent of surety, if any.)*
- .2 Add, if final completion of the Work is thereafter materially delayed through no fault of the Contractor, any additional amounts payable in accordance with Section 9.10.3 of AIA Document A201–2007.

§ 5.1.8 Reduction or limitation of retainage, if any, shall be as follows:

*(If it is intended, prior to Substantial Completion of the entire Work, to reduce or limit the retainage resulting from the percentages inserted in Sections 5.1.6.1 and 5.1.6.2 above, and this is not explained elsewhere in the Contract Documents, insert here provisions for such reduction or limitation.)*

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

## § 5.2 FINAL PAYMENT

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

- .1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Section 12.2.2 of AIA Document A201–2007, and to satisfy other requirements, if any, which extend beyond final payment; and
- .2 a final Certificate for Payment has been issued by the Architect.

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

## ARTICLE 6 DISPUTE RESOLUTION

### § 6.1 INITIAL DECISION MAKER

The Architect will serve as Initial Decision Maker pursuant to Section 15.2 of AIA Document A201–2007, unless the parties appoint below another individual, not a party to this Agreement, to serve as Initial Decision Maker.

*(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)*

**§ 6.2 BINDING DISPUTE RESOLUTION**

For any Claim subject to, but not resolved by, mediation pursuant to Section 15.3 of AIA Document A201–2007, the method of binding dispute resolution shall be as follows:

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

- Arbitration pursuant to Section 15.4 of AIA Document A201–2007
- Litigation in a court of competent jurisdiction
- Other *(Specify)*

**ARTICLE 7 TERMINATION OR SUSPENSION**

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2007.

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2007.

**ARTICLE 8 MISCELLANEOUS PROVISIONS**

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2007 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

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

%

§ 8.3 The Owner's representative:  
*(Name, address and other information)*

§ 8.4 The Contractor's representative:  
*(Name, address and other information)*

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

§ 8.6 Other provisions:

#### ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 The Contract Documents, except for Modifications issued after execution of this Agreement, are enumerated in the sections below.

§ 9.1.1 The Agreement is this executed AIA Document A101-2007, Standard Form of Agreement Between Owner and Contractor.

§ 9.1.2 The General Conditions are AIA Document A201-2007, General Conditions of the Contract for Construction.

§ 9.1.3 The Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages
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§ 9.1.4 The Specifications:  
(Either list the Specifications here or refer to an exhibit attached to this Agreement.)

Section	Title	Date	Pages
---------	-------	------	-------

§ 9.1.5 The Drawings:  
(Either list the Drawings here or refer to an exhibit attached to this Agreement.)

Number	Title	Date
--------	-------	------

§ 9.1.6 The Addenda, if any:

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

§ 9.1.7 Additional documents, if any, forming part of the Contract Documents:

- .1 AIA Document E201™-2007, Digital Data Protocol Exhibit, if completed by the parties, or the following:
- .2 Other documents, if any, listed below:  
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201-2007 provides that bidding requirements such as advertisement or invitation to bid, Instructions to Bidders, sample forms and the Contractor's bid are not part of the Contract Documents)

*unless enumerated in this Agreement. They should be listed here only if intended to be part of the Contract Documents.)*

**ARTICLE 10 INSURANCE AND BONDS**

The Contractor shall purchase and maintain insurance and provide bonds as set forth in Article 11 of AIA Document A201-2007.

*(State bonding requirements, if any, and limits of liability for insurance required in Article 11 of AIA Document A201-2007.)*

**Type of insurance or bond**

**Limit of liability or bond amount (\$0.00)**

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

\_\_\_\_\_  
**OWNER** *(Signature)*

\_\_\_\_\_  
**CONTRACTOR** *(Signature)*

\_\_\_\_\_  
*(Printed name and title)*

\_\_\_\_\_  
*(Printed name and title)*

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**SUPPLEMENT TO AGREEMENT BETWEEN OWNER AND CONTRACTOR A101-2007**

The following supplements modify the "Standard Form of Agreement Between Owner and Contractor," AIA Document A101-2007. 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 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 Engineer 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."

**ARTICLE 6: DISPUTE RESOLUTION**

## 6.2 BINDING DISPUTE RESOLUTION

Check Other – and add the following sentence:

"Any remedies available in law or in equity."

**ARTICLE 8: MISCELLANEOUS PROVISIONS**

8.2 Insert the following:

"Payments are due 30 days after receipt of a valid Application for Payment. After that 30 day period, interest may be charged at the rate of 1% per month not to exceed 12% per annum."

8.5 Delete paragraph 8.5 in its entirety and replace with the following:

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

END OF SUPPLEMENT TO AGREEMENT BETWEEN OWNER AND CONTRACTOR

STATE OF DELAWARE  
OFFICE OF MANAGEMENT AND BUDGET

**PERFORMANCE BOND**

Bond Number: \_\_\_\_\_

KNOW ALL PERSONS BY THESE PRESENTS, that we, \_\_\_\_\_, as principal (“**Principal**”), and \_\_\_\_\_, a \_\_\_\_\_ corporation, legally authorized to do business in the State of Delaware, as surety (“**Surety**”), are held and firmly bound unto the \_\_\_\_\_ (“**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: \_\_\_\_\_

\_\_\_\_\_  
Name:

(Corporate Seal)

By: \_\_\_\_\_ (SEAL)  
Name:  
Title:

SURETY

Name: \_\_\_\_\_

Witness or Attest: Address: \_\_\_\_\_

\_\_\_\_\_  
Name:

(Corporate Seal)

By: \_\_\_\_\_ (SEAL)  
Name:  
Title:

STATE OF DELAWARE  
OFFICE OF MANAGEMENT AND BUDGET

**PAYMENT BOND**

Bond Number: \_\_\_\_\_

KNOW ALL PERSONS BY THESE PRESENTS, that we, \_\_\_\_\_, as principal (“**Principal**”), and \_\_\_\_\_, a \_\_\_\_\_ corporation, legally authorized to do business in the State of Delaware, as surety (“**Surety**”), are held and firmly bound unto the \_\_\_\_\_ (“**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:

GENERAL CONDITIONS

TO THE

CONTRACT

The General Conditions of this Contract are as stated in the American Institute of Engineers Document AIA A201 (2007 Edition) entitled General Conditions of the Contract for Construction and is part of this project manual as if herein written in full.



# AIA<sup>®</sup> Document A201<sup>™</sup> – 2007

## General Conditions of the Contract for Construction

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

THE OWNER:  
(Name and address)

THE ARCHITECT:  
(Name and address)

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- 1 GENERAL PROVISIONS
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- 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS
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- 12 UNCOVERING AND CORRECTION OF WORK
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- 14 TERMINATION OR SUSPENSION OF THE CONTRACT
- 15 CLAIMS AND DISPUTES

### ADDITIONS AND DELETIONS:

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

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

Init.

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## **ARTICLE 1 GENERAL PROVISIONS**

### **§ 1.1 BASIC DEFINITIONS**

#### **§ 1.1.1 THE CONTRACT DOCUMENTS**

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding requirements.

#### **§ 1.1.2 THE CONTRACT**

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

#### **§ 1.1.3 THE WORK**

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

#### **§ 1.1.4 THE PROJECT**

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by separate contractors.

#### **§ 1.1.5 THE DRAWINGS**

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

#### **§ 1.1.6 THE SPECIFICATIONS**

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

#### **§ 1.1.7 INSTRUMENTS OF SERVICE**

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

#### **§ 1.1.8 INITIAL DECISION MAKER**

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2 and certify termination of the Agreement under Section 14.2.2.

### **§ 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS**

**§ 1.2.1** The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

### § 1.3 CAPITALIZATION

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles or (3) the titles of other documents published by the American Institute of Architects.

### § 1.4 INTERPRETATION

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

### § 1.5 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and will retain all common law, statutory and other reserved rights, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce the Instruments of Service provided to them solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers may not use the Instruments of Service 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 the Architect's consultants.

### § 1.6 TRANSMISSION OF DATA IN DIGITAL FORM

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they shall endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Agreement or the Contract Documents.

## ARTICLE 2 OWNER

### § 2.1 GENERAL

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

### § 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

§ 2.2.1 Prior to commencement of the Work, the Contractor may request in writing that the Owner provide reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. Thereafter, the Contractor may only request such evidence if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) a change in the Work materially changes the Contract Sum; or (3) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due. The Owner shall furnish such evidence as a condition precedent to commencement or continuation of the Work or the

portion of the Work affected by a material change. After the Owner furnishes the evidence, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.2 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.2.3 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.2.4 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.2.5 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

### § 2.3 OWNER'S RIGHT TO STOP THE WORK

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

### § 2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

## ARTICLE 3 CONTRACTOR

### § 3.1 GENERAL

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

## § 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.2.3, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall make Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

## § 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

## § 3.4 LABOR AND MATERIALS

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

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§ 3.4.2 Except in the case of minor changes in the Work authorized by the Architect in accordance with Sections 3.12.8 or 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

### § 3.5 WARRANTY

The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

### § 3.6 TAXES

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

### § 3.7 PERMITS, FEES, NOTICES, AND COMPLIANCE WITH LAWS

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 **Concealed or Unknown Conditions.** If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 21 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor in writing, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may proceed as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

### § 3.8 ALLOWANCES

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- .1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- .3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

### § 3.9 SUPERINTENDENT

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the name and qualifications of a proposed superintendent. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to the proposed superintendent or (2) that the Architect requires additional time to review. Failure of the Architect to reply within the 14 day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

### § 3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

§ 3.10.2 The Contractor shall prepare a submittal schedule, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for the Architect's approval. The Architect's approval shall not unreasonably be delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

### § 3.11 DOCUMENTS AND SAMPLES AT THE SITE

The Contractor shall maintain at the site for the Owner one copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect and shall be delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

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**§ 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES**

**§ 3.12.1** Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

**§ 3.12.2** Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

**§ 3.12.3** Samples are physical examples that illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

**§ 3.12.4** Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. Their purpose is to demonstrate the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

**§ 3.12.5** The Contractor shall review for compliance with the Contract Documents, approve and submit to the Architect Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors.

**§ 3.12.6** By submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

**§ 3.12.7** The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Architect.

**§ 3.12.8** The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's approval thereof.

**§ 3.12.9** The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such written notice, the Architect's approval of a resubmission shall not apply to such revisions.

**§ 3.12.10** The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and

completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

### § 3.13 USE OF SITE

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

### § 3.14 CUTTING AND PATCHING

§ 3.14.1 The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting and patching shall be restored to the condition existing prior to the cutting, fitting and patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

### § 3.15 CLEANING UP

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and Owner shall be entitled to reimbursement from the Contractor.

### § 3.16 ACCESS TO WORK

The Contractor shall provide the Owner and Architect access to the Work in preparation and progress wherever located.

### § 3.17 ROYALTIES, PATENTS AND COPYRIGHTS

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Architect. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Architect.

### § 3.18 INDEMNIFICATION

§ 3.18.1 To the fullest extent permitted by law the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

#### ARTICLE 4 ARCHITECT

##### § 4.1 GENERAL

§ 4.1.1 The Owner shall retain an architect lawfully licensed to practice architecture or an entity lawfully practicing architecture in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 4.1.2 Duties, responsibilities and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner, Contractor and Architect. Consent shall not be unreasonably withheld.

§ 4.1.3 If the employment of the Architect is terminated, the Owner shall employ a successor architect as to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

##### § 4.2 ADMINISTRATION OF THE CONTRACT

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate For Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and report to the Owner (1) known deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (2) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

##### § 4.2.4 COMMUNICATIONS FACILITATING CONTRACT ADMINISTRATION

Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect about matters arising out of or relating to the Contract. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

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§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5 and 3.12. The Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may authorize minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more project representatives to assist in carrying out the Architect's responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

## ARTICLE 5 SUBCONTRACTORS

### § 5.1 DEFINITIONS

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

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

§ 5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to any such proposed person or entity or (2) that the Architect requires additional time for review. Failure of the Owner or Architect to reply within the 14 day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person or entity previously selected if the Owner or Architect makes reasonable objection to such substitution.

## § 5.3 SUBCONTRACTUAL RELATIONS

By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

## § 5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor in writing; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon such assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the

Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

## **ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS**

### **§ 6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS**

**§ 6.1.1** The Owner reserves the right to perform 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 construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Article 15.

**§ 6.1.2** When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

**§ 6.1.3** The Owner shall provide for coordination of the activities of the Owner's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the Owner until subsequently revised.

**§ 6.1.4** Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights that apply to the Contractor under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6 and Articles 10, 11 and 12.

### **§ 6.2 MUTUAL RESPONSIBILITY**

**§ 6.2.1** The Contractor shall afford the Owner and separate contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

**§ 6.2.2** If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

**§ 6.2.3** The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a separate contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a separate contractor's delays, improperly timed activities, damage to the Work or defective construction.

**§ 6.2.4** The Contractor shall promptly remedy damage the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or separate contractors as provided in Section 10.2.5.

**§ 6.2.5** The Owner and each separate contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

### **§ 6.3 OWNER'S RIGHT TO CLEAN UP**

If a dispute arises among the Contractor, separate contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

## ARTICLE 7 CHANGES IN THE WORK

### § 7.1 GENERAL

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor and Architect; a Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or order for a minor change in the Work.

### § 7.2 CHANGE ORDERS

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor and Architect stating their agreement upon all of the following:

- .1 The change in the Work;
- .2 The amount of the adjustment, if any, in the Contract Sum; and
- .3 The extent of the adjustment, if any, in the Contract Time.

### § 7.3 CONSTRUCTION CHANGE DIRECTIVES

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.7.

§ 7.3.4 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 7.3.5 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.6 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.7 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount

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for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 shall be limited to the following:

- .1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;
- .2 Costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and
- .5 Additional costs of supervision and field office personnel directly attributable to the change.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

#### § 7.4 MINOR CHANGES IN THE WORK

The Architect has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes will be effected by written order signed by the Architect and shall be binding on the Owner and Contractor.

### ARTICLE 8 TIME

#### § 8.1 DEFINITIONS

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

#### § 8.2 PROGRESS AND COMPLETION

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance.

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§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

### § 8.3 DELAYS AND EXTENSIONS OF TIME

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner; or by changes ordered in the Work; or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor's control; or by delay authorized by the Owner pending mediation and arbitration; or by other causes that the Architect determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

## ARTICLE 9 PAYMENTS AND COMPLETION

### § 9.1 CONTRACT SUM

The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

### § 9.2 SCHEDULE OF VALUES

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit to the Architect, before the first Application for Payment, a schedule of values allocating the entire Contract Sum to the various portions of the Work and prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

### § 9.3 APPLICATIONS FOR PAYMENT

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2., for completed portions of the Work. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or material supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage and transportation to the site for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or

encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

#### § 9.4 CERTIFICATES FOR PAYMENT

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data comprising the Application for Payment, that, to the best of the Architect's knowledge, information and belief, the Work has progressed to the point indicated and that the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Architect. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (2) reviewed construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment, or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

#### § 9.5 DECISIONS TO WITHHOLD CERTIFICATION

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a separate contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.3 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or material or equipment suppliers to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Architect will reflect such payment on the next Certificate for Payment.

#### § 9.6 PROGRESS PAYMENTS

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

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§ 9.6.2 The Contractor shall pay each Subcontractor no later than seven days after receipt of payment from the Owner the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and material and equipment suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor, except as may otherwise be required by law.

§ 9.6.5 Contractor payments to material and equipment suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors and suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

#### § 9.7 FAILURE OF PAYMENT

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' written 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 shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

#### § 9.8 SUBSTANTIAL COMPLETION

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety, if any, the Owner shall make payment of retainage applying to such Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

#### § 9.9 PARTIAL OCCUPANCY OR USE

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.3.1.5 and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

#### § 9.10 FINAL COMPLETION AND FINAL PAYMENT

§ 9.10.1 Upon receipt of the Contractor's written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection and, when the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- .1 liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents; or
- .3 terms of special warranties required by the Contract Documents.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

## ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

### § 10.1 SAFETY PRECAUTIONS AND PROGRAMS

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract.

### § 10.2 SAFETY OF PERSONS AND PROPERTY

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to

- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors; and
- .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

§ 10.2.3 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3, except damage or loss attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

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§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

### § 10.2.8 INJURY OR DAMAGE TO PERSON OR PROPERTY

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

### § 10.3 HAZARDOUS MATERIALS

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing.

§ 10.3.2 Upon receipt of the Contractor's written notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall indemnify the Owner for the cost and expense the Owner incurs (1) for remediation of a material or substance the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall indemnify the Contractor for all cost and expense thereby incurred.

## § 10.4 EMERGENCIES

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

## ARTICLE 11 INSURANCE AND BONDS

### § 11.1 CONTRACTOR'S LIABILITY INSURANCE

§ 11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- .1 Claims under workers' compensation, disability benefit and other similar employee benefit acts that are applicable to the Work to be performed;
- .2 Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
- .3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
- .4 Claims for damages insured by usual personal injury liability coverage;
- .5 Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
- .6 Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;
- .7 Claims for bodily injury or property damage arising out of completed operations; and
- .8 Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

§ 11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

§ 11.1.3 Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness.

§ 11.1.4 The Contractor shall cause the commercial liability coverage required by the Contract Documents to include (1) the Owner, the Architect and the Architect's Consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations.

### § 11.2 OWNER'S LIABILITY INSURANCE

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

### § 11.3 PROPERTY INSURANCE

§ 11.3.1 Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all-risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract Modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project.

§ 11.3.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such insured loss.

§ 11.3.1.2 If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to commencement of the Work. The Contractor may then effect insurance that will protect the interests of the Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order the cost thereof shall be charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor in writing, then the Owner shall bear all reasonable costs properly attributable thereto.

§ 11.3.1.3 If the property insurance requires deductibles, the Owner shall pay costs not covered because of such deductibles.

§ 11.3.1.4 This property insurance shall cover portions of the Work stored off the site, and also portions of the Work in transit.

§ 11.3.1.5 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

### § 11.3.2 BOILER AND MACHINERY INSURANCE

The Owner shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

### § 11.3.3 LOSS OF USE INSURANCE

The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused. The Owner waives all rights of action against the Contractor for loss of use of the Owner's property, including consequential losses due to fire or other hazards however caused.

§ 11.3.4 If the Contractor requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

§ 11.3.5 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment

property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, the Owner shall waive all rights in accordance with the terms of Section 11.3.7 for damages caused by fire or other causes of loss covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

§ 11.3.6 Before an exposure to loss may occur, the Owner shall file with the Contractor a copy of each policy that includes insurance coverages required by this Section 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 days' prior written notice has been given to the Contractor.

#### § 11.3.7 WAIVERS OF SUBROGATION

The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents and employees, each of the other, and (2) the Architect, Architect's consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

§ 11.3.8 A loss insured under the Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.3.9 If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the Owner shall distribute in accordance with such agreement as the parties in interest may reach, or as determined in accordance with the method of binding dispute resolution selected in the Agreement between the Owner and Contractor. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

§ 11.3.10 The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss to the Owner's exercise of this power; if such objection is made, the dispute shall be resolved in the manner selected by the Owner and Contractor as the method of binding dispute resolution in the Agreement. If the Owner and Contractor have selected arbitration as the method of binding dispute resolution, the Owner as fiduciary shall make settlement with insurers or, in the case of a dispute over distribution of insurance proceeds, in accordance with the directions of the arbitrators.

#### § 11.4 PERFORMANCE BOND AND PAYMENT BOND

§ 11.4.1 The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or specifically required in the Contract Documents on the date of execution of the Contract.

§ 11.4.2 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

## ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

### § 12.1 UNCOVERING OF WORK

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

### § 12.2 CORRECTION OF WORK

#### § 12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

#### § 12.2.2 AFTER SUBSTANTIAL COMPLETION

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

### § 12.3 ACCEPTANCE OF NONCONFORMING WORK

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

## ARTICLE 13 MISCELLANEOUS PROVISIONS

### § 13.1 GOVERNING LAW

The Contract shall be governed by the law of the place where the Project is located except that, if the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

### § 13.2 SUCCESSORS AND ASSIGNS

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to covenants, agreements and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate such assignment.

### § 13.3 WRITTEN NOTICE

Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or entity, or to an officer of the corporation for which it was intended; or if delivered at, or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice.

### § 13.4 RIGHTS AND REMEDIES

§ 13.4.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

§ 13.4.2 No action or failure to act by the Owner, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach there under, except as may be specifically agreed in writing.

### § 13.5 TESTS AND INSPECTIONS

§ 13.5.1 Tests, inspections and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and (2) tests, inspections or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor.

§ 13.5.2 If the Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.5.3, shall be at the Owner's expense.

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by

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such failure including those of repeated procedures and compensation for the Architect's services and expenses shall be at the Contractor's expense.

§ 13.5.4 Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.5.5 If the Architect is to observe tests, inspections or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.5.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

#### § 13.6 INTEREST

Payments due and unpaid under the Contract Documents shall bear interest from 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.

#### § 13.7 TIME LIMITS ON CLAIMS

The Owner and Contractor shall commence all claims and causes of action, whether in contract, tort, breach of warranty or otherwise, against the other arising out of or related to the Contract in accordance with the requirements of the final dispute resolution method selected in the Agreement within the time period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all claims and causes of action not commenced in accordance with this Section 13.7.

### ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

#### § 14.1 TERMINATION BY THE CONTRACTOR

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor promptly, upon the Contractor's request, reasonable evidence as required by Section 2.2.1.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, repeated suspensions, delays or interruptions of the entire Work by the Owner as described in Section 14.3 constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, including reasonable overhead and profit, costs incurred by reason of such termination, and damages.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

**§ 14.2 TERMINATION BY THE OWNER FOR CAUSE**

**§ 14.2.1** The Owner may terminate the Contract if the Contractor

- .1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
- .3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

**§ 14.2.2** When any of the above reasons exist, the Owner, upon certification by the Initial Decision Maker that sufficient cause exists to justify such action, may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

**§ 14.2.3** When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

**§ 14.2.4** If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

**§ 14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE**

**§ 14.3.1** The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine.

**§ 14.3.2** The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay or interruption as described in Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- .1 that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

**§ 14.4 TERMINATION BY THE OWNER FOR CONVENIENCE**

**§ 14.4.1** The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

**§ 14.4.2** Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

**§ 14.4.3** In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination, along with reasonable overhead and profit on the Work not executed.

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## ARTICLE 15 CLAIMS AND DISPUTES

### § 15.1 CLAIMS

#### § 15.1.1 DEFINITION

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim.

#### § 15.1.2 NOTICE OF CLAIMS

Claims by either the Owner or Contractor must be initiated by written notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

#### § 15.1.3 CONTINUING CONTRACT PERFORMANCE

Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents. The Architect will prepare Change Orders and issue Certificates for Payment in accordance with the decisions of the Initial Decision Maker.

#### § 15.1.4 CLAIMS FOR ADDITIONAL COST

If the Contractor wishes to make a Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

#### § 15.1.5 CLAIMS FOR ADDITIONAL TIME

§ 15.1.5.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.5.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction.

#### § 15.1.6 CLAIMS FOR CONSEQUENTIAL DAMAGES

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.6 shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

### § 15.2 INITIAL DECISION

§ 15.2.1 Claims, excluding those arising under Sections 10.3, 10.4, 11.3.9, and 11.3.10, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Initial Decision Maker with no decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

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§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of such request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of an initial decision, demand in writing that the other party file for mediation within 60 days of the initial decision. If such a demand is made and the party receiving the demand fails to file for mediation within the time required, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

### § 15.3 MEDIATION

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.6 shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

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§ 15.3.3 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

#### § 15.4 ARBITRATION

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

#### § 15.4.4 CONSOLIDATION OR JOINDER

§ 15.4.4.1 Either party, at its sole discretion, may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Either party, at its sole discretion, may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as the Owner and Contractor under this Agreement.

**SUPPLEMENTARY GENERAL CONDITIONS A201-2007**

The following supplements modify the "General Conditions of the Contract for Construction," AIA Document A201-2007. 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
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12. UNCOVERING AND CORRECTION OF WORK
13. MISCELLANEOUS PROVISIONS
14. TERMINATION OR SUSPENSION OF THE CONTRACT

**ARTICLE 1: GENERAL PROVISIONS****1.1 BASIC DEFINITIONS****1.1.1 THE CONTRACT DOCUMENTS**

Delete the last sentence 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 Paragraph:

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.

**1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS**

Add the following Paragraphs:

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 Engineer’s interpretation.

1.2.5 The word “PROVIDE” as used in the Contract Documents shall mean “FURNISH AND INSTALL” and shall include, without limitation, all labor, materials, equipment, transportation, services and other items required to complete the Work.

1.2.6 The word “PRODUCT” as used in the Contract Documents means all materials, systems and equipment.

**1.5 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE**

Delete Paragraph 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 Engineer 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 Engineer. 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 Engineer and the Engineer’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, Engineer and Engineer’s consultants.

The Engineer shall not be liable for injury or damage resulting from the re-use of drawings and specifications if the Engineer is not involved in the re-use Project. Prior to re-use of construction documents for a Project in which the Engineer is not also involved, the Owner will remove from such documents all identification of the original Engineer, including name, address and professional seal or stamp.”

Delete Paragraph 1.5.2 in its entirety.

## **ARTICLE 2: OWNER**

### **2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER**

To Subparagraph 2.2.3 – Add the following sentence:

“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.”

Delete Subparagraph 2.2.5 in its entirety and substitute the following:

2.2.5 The Contractor shall be furnished free of charge up to five (5) sets of the Drawings and Project Manuals. Additional sets will be furnished at the cost of reproduction, postage and handling.

## **ARTICLE 3: CONTRACTOR**

### **3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR**

Amend Paragraph 3.2.2 to state that any errors, inconsistencies or omissions discovered shall be reported to the Engineer and Owner immediately.

Delete the third sentence in Paragraph 3.2.3.

### **3.3 SUPERVISION AND CONSTRUCTION PROCEDURES**

Add the following Paragraphs:

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 Engineer 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 Engineer.

3.3.4 The Contractor must provide suitable storage facilities at the Site for the proper protection and safe storage of their materials. Consult the Owner and the Engineer before storing any materials.

3.3.5 When any room is used as a shop, storeroom, office, etc., by the Contractor or Subcontractor(s) during the construction of the Work, the Contractor making use of these areas will be held responsible for any repairs, patching or cleaning arising from such use.

### 3.4 LABOR AND MATERIALS

Add the Following Paragraphs:

3.4.4 Before starting the Work, each Contractor shall carefully examine all preparatory Work that has been executed to receive their Work. Check carefully, by whatever means are required, to insure that its Work and adjacent, related Work, will finish to proper contours, planes and levels. Promptly notify the General Contractor/Construction Manager 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 Paragraphs:

3.5.1 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 guarantee.

3.5.2 Defects appearing during the period of guarantee 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 guarantee will have elapsed.

3.5.3 In addition to the General Guarantee there are other guarantees 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 guarantees will commence at the same time as the General Guarantee.

3.5.4 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.

### 3.11 DOCUMENTS AND SAMPLES AT THE SITE

Add the following Paragraphs:

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 reproducible drawings from the Engineer, and neatly transfer all information outlined in 3.11.1 to provide a complete record of the as-built conditions.

3.11.3 The Contractor shall provide two (2) prints of the as-built conditions, along with the reproducible drawings themselves, to the Owner and one (1) set to the Engineer. In addition, attach one complete set to each of the Operating and Maintenance Instructions/Manuals.

3.17 In the second sentence of the paragraph, insert "indemnify" between "shall" and "hold".

#### **ARTICLE 4: ADMINISTRATION OF THE CONTRACT**

##### **4.2 ADMINISTRATION OF THE CONTRACT**

Delete the first sentence of Paragraph 4.2.7 and replace with the following:

The Engineer 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.

Delete the second sentence of Paragraph 4.2.7 and replace with the following:

The Engineer'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 Paragraph:

4.2.10.1 There will be no full-time project representative provided by the Owner or Engineer on this project.

Add to Paragraph 4.2.13 "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**

Delete Paragraph 5.2.3 in its entirety and replace with the following:

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

#### **ARTICLE 6: CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS**

##### **6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS**

Delete Paragraph 6.1.4 in its entirety.

##### **6.2 MUTUAL RESPONSIBILITY**

6.2.3 In the second sentence, strike the word "shall" and insert the word "may".

**ARTICLE 7: CHANGES IN THE WORK**

(SEE ARTICLE 7: CHANGES IN WORK IN THE GENERAL REQUIREMENTS)

**ARTICLE 8: TIME****8.2 PROGRESS AND COMPLETION**

Add the following Paragraphs:

8.2.1.1 Refer to Specification Section SUMMARY OF WORK for Contract time requirements.

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 "arbitration" and insert "remedies at law or in equity".

Add the following Paragraph:

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.

Delete Paragraph 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 Paragraph 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 Paragraph:

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 Paragraphs:

9.2.1 The Schedule of Values shall be submitted using AIA Document G702, Continuation Sheet to G703.

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% of the initial contract amount.

## 9.3 APPLICATIONS FOR PAYMENT

Add the following Paragraph:

- 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.

Add the following Paragraphs:

- 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 Engineer 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 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

Delete Paragraph 9.6.1 in its entirety and replace with the following:

- 9.6.1 After the Engineer 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.

## 9.7 FAILURE OF PAYMENT

In first sentence, strike "seven" and insert "thirty (30)". Also strike "binding dispute resolution" and insert "remedies at law or in equity".

## 9.8 SUBSTANTIAL COMPLETION

To Subparagraph 9.8.3 - Add the following sentence:

"If the Engineer 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 Engineer's fees."

- 9.8.5 In the second sentence, strike "shall" and insert "may".

**ARTICLE 10: PROTECTION OF PERSONS AND PROPERTY**

## 10.1 SAFETY PRECAUTIONS AND PROGRAMS

Add the following Paragraphs:

10.1.1.1.1 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 Engineer 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 Engineer, 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 Paragraph:

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.

## 10.3 HAZARDOUS MATERIALS

Delete Paragraph 10.3.3 in its entirety.

Delete Paragraph 10.3.6 in its entirety.

**ARTICLE 11: INSURANCE AND BONDS**

## 11.1 CONTRACTOR'S LIABILITY INSURANCE

11.1.4 Strike "the Owner" immediately following "(1)" and strike "and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations."

## 11.2 OWNER'S LIABILITY INSURANCE

Delete Paragraph 11.2 in its entirety.

## 11.3 PROPERTY INSURANCE

Delete Paragraph 11.3 in its entirety and replace with the following:

11.3 The State will not provide Builder's All Risk Insurance for the Project. The Contractor and all Subcontractors shall provide property coverage for their tools and equipment, as necessary. Any mandatory deductible required by the Contractor's Insurance shall be the responsibility of the Contractor.

**11.4 PERFORMANCE BOND AND PAYMENT BOND**

- 11.4.1 Add the following sentence: "The bonds will conform to those forms approved by the Office of Management and Budget."

**ARTICLE 12: UNCOVERING AND CORRECTION OF WORK****12.2.2 AFTER SUBSTANTIAL COMPLETION**

Add the following Paragraph:

- 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 defective work and that required under contract including any damage to the structure.

- 12.2.2.1 Strike "one" and insert "two".

- 12.2.2.2 Strike "one" and insert "two".

- 12.2.2.3 Strike "one" and insert "two".

- 12.2.5 In second sentence, strike "one" and insert "two".

**ARTICLE 13: MISCELLANEOUS PROVISIONS****13.1 GOVERNING LAW**

Strike "except that, if the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4."

**13.6 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." Insert "30 days of presentment of the authorized Certificate of Payment at the annual rate of 12% or 1% per month."

**13.7 TIME LIMITS ON CLAIMS**

Strike the last sentence.

Add the following Paragraph:

**13.8 CONFLICTS WITH FEDERAL STATUTES OR REGULATIONS**

- 13.8.1 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 Engineer and Owner immediately upon discovery.

**ARTICLE 14: TERMINATION OR SUSPENSION OF THE CONTRACT**

14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

Delete Paragraph 14.4.3 in its entirety and replace with the following:

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

**ARTICLE 15: CLAIMS AND DISPUTES**

15.1.2 Throughout the Paragraph strike "21" and insert "45".

15.1.6 CLAIMS FOR CONSEQUENTIAL DAMAGES

Delete Paragraph 15.1.6 in its entirety.

15.2 INITIAL DECISION

Delete Paragraph 15.2.5 in its entirety and replace with the following:

15.2.5 The Engineer 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 Engineer shall be subject to mediation and other remedies at law or in equity.

Delete Paragraph 15.2.6 and its subparagraphs in their entirety.

15.3 MEDIATION

15.3.1 Strike "binding dispute resolution" and insert "any or all remedies at law or in equity".

15.3.2 In the first sentence, delete "administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedure in effect on the date of the Agreement," Strike "binding dispute resolution" and insert "remedies at law and in equity".

15.4 ARBITRATION

Delete Paragraph 15.4 and its sub-sections in its entirety.

END OF SUPPLEMENTARY GENERAL CONDITIONS

**SECTION 00 73 46: WAGE RATE REQUIREMENTS**

PART 1 GENERAL

1.1 DESCRIPTION

- A. Copy of the State of Delaware Prevailing Wages for Building Construction

PART 2 PRODUCTS

NOT USED

PART 3 EXECUTION

NOT USED

END OF SECTION

STATE OF DELAWARE  
DEPARTMENT OF LABOR  
DIVISION OF INDUSTRIAL AFFAIRS  
OFFICE OF LABOR LAW ENFORCEMENT  
PHONE: (302) 451-3423

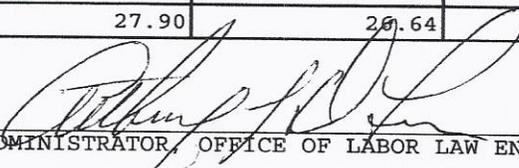
Mailing Address:  
225 CORPORATE BOULEVARD  
SUITE 104  
NEWARK, DE 19702

Located at:  
225 CORPORATE BOULEVARD  
SUITE 104  
NEWARK, DE 19702

PREVAILING WAGES FOR BUILDING CONSTRUCTION EFFECTIVE MARCH 14, 2014

CLASSIFICATION	NEW CASTLE	KENT	SUSSEX
ASBESTOS WORKERS	21.87	26.94	39.20
BOILERMAKERS	65.47	33.22	48.83
BRICKLAYERS	48.08	48.08	48.08
CARPENTERS	50.91	50.91	40.47
CEMENT FINISHERS	31.52	29.11	21.20
ELECTRICAL LINE WORKERS	43.49	37.29	28.44
ELECTRICIANS	62.10	62.10	62.10
ELEVATOR CONSTRUCTORS	77.78	40.93	30.55
GLAZIERS	65.60	65.60	20.15
INSULATORS	51.48	51.48	51.48
IRON WORKERS	59.62	59.62	59.62
LABORERS	39.75	39.75	39.75
MILLWRIGHTS	63.53	63.53	50.10
PAINTERS	44.94	44.94	44.94
PILEDRIVERS	69.32	37.64	30.45
PLASTERERS	21.60	28.55	17.50
PLUMBERS/PIPEFITTERS/STEAMFITTERS	60.20	45.65	47.28
POWER EQUIPMENT OPERATORS	58.31	58.31	24.13
ROOFERS-COMPOSITION	22.35	19.07	17.63
ROOFERS-SHINGLE/SLATE/TILE	17.59	17.50	16.45
SHEET METAL WORKERS	63.24	63.24	63.24
SOFT FLOOR LAYERS	47.12	47.12	47.12
SPRINKLER FITTERS	52.73	52.73	52.73
TERRAZZO/MARBLE/TILE FNRS	52.50	52.50	45.45
TERRAZZO/MARBLE/TILE STRS	60.28	60.28	52.63
TRUCK DRIVERS	27.90	20.64	20.03

CERTIFIED: 3/14/14

BY: 

ADMINISTRATOR, OFFICE OF LABOR LAW ENFORCEMENT

NOTE: THESE RATES ARE PROMULGATED AND ENFORCED PURSUANT TO THE PREVAILING WAGE REGULATIONS ADOPTED BY THE DEPARTMENT OF LABOR ON APRIL 3, 1992.

CLASSIFICATIONS OF WORKERS ARE DETERMINED BY THE DEPARTMENT OF LABOR. FOR ASSISTANCE IN CLASSIFYING WORKERS, OR FOR A COPY OF THE REGULATIONS OR CLASSIFICATIONS, PHONE (302) 451-3423.

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

THESE RATES ARE BEING PROVIDED IN ACCORDANCE WITH DELAWARE'S FREEDOM OF INFORMATION ACT.

THEY ARE NOT INTENDED TO APPLY TO ANY SPECIFIC PROJECT.

## **GENERAL REQUIREMENTS**

### **TABLE OF ARTICLES**

1. GENERAL PROVISIONS
2. OWNER
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7. CHANGES IN THE WORK
8. TIME
9. PAYMENTS AND COMPLETION
10. PROTECTION OF PERSONS AND PROPERTY
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12. UNCOVERING AND CORRECTION OF WORK
13. MISCELLANEOUS PROVISIONS
14. TERMINATION OR SUSPENSION OF THE CONTRACT

**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.

**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 require, 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.

## 5.2 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 Engineer. 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 direct salary plus customary fringe benefits (prevailing wage rates) and documented statutory costs such as workman's compensation insurance, Social Security/Medicare, and unemployment insurance (a maximum multiplier of 1.35 times DPE).
- 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, 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. 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 subcontractors work. These mark-ups shall include all costs including, but not limited to: overhead, profit, bonds, insurance, supervision, etc. No markup is permitted on the work of the subcontractors subcontractor. 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.

**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, Engineer 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 existing hazardous material such as lead, PCBs, asbestos, etc. is encountered on the project. The Owner will arrange with a qualified specialist for the identification, testing, removal, handling and protection against exposure or environmental pollution, to comply with applicable regulation laws and ordinances. The Contractor and Engineer will not be required to participate in or to perform this operation. Upon completion of this work, the Owner will notify the Contractor and Engineer in writing the area has been cleared and approved by the authorities in order for the work to proceed. The Contractor shall attach documentation from the authorities of said approval.
- 10.3 As required in the Hazardous Chemical Information Act of June 1984, all vendors supplying any materials that may be defined as hazardous, must provide Material Safety Data Sheets for those products. Any chemical product should be considered hazardous if it has a warning caution on the label relating to a potential physical or health hazard, if it is known to be present in the work place, and if employees may be exposed under normal conditions or in any foreseeable emergency situation. Material Safety Data Sheets must be provided directly to the Owner along with the shipping slips that include those products.

- 10.4 The Contractor shall certify to the Owner that materials incorporated into the Work are free of all asbestos. This certification may be in the form of Material Safety Data Sheet (MSDS) provided by the product manufacturer for the materials used in construction, as specified or as provided by the Contractor.

#### ARTICLE 11: INSURANCE AND BONDS

- 11.1 The Contractor shall carry all insurance required by law, such as Unemployment Insurance, etc. The Contractor shall carry such insurance coverage as they desire on their own property such as a field office, storage sheds or other structures erected upon the project site that belong to them and for their own use. The Subcontractors involved with this project shall carry whatever insurance protection they consider necessary to cover the loss of any of their personal property, etc.
- 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, shall not 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	\$500,000 \$1,000,000 \$1,000,000	for each person for each occurrence aggregate
Property Damage	\$500,000 \$1,000,000	for each occurrence aggregate

11.7.2 Contractor's Protective Liability Insurance

Minimum coverage to be:

Bodily Injury	\$500,000	for each person
	\$1,000,000	for each occurrence
	\$1,000,000	aggregate
Property Damage	\$500,000	for each occurrence
	\$500,000	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 Delaware Archaeological Board 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 in the State Museum.

**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 OF 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 GENERAL REQUIREMENTS



## SECTION 011000 – SUMMARY OF WORK

## 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 the following:

1. Work covered by the Contract Documents.
2. Type of the Contract.
3. Use of premises.
4. Owner's occupancy requirements.
5. Work restrictions.
6. Specification formats and conventions.

- B. Related Sections include the following:

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

## 1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Identification: Sussex Tech High School Chiller Replacement

1. Project Location: Sussex Tech High School, 17099 County Seat Highway, Georgetown, Delaware.

- B. Owner: Sussex Technical School District

1. Owner's Project Manager: Terry Little, Director of Facilities/Operations, 17137 County Seat Highway, P.O. Box 351, Georgetown, Delaware, 302-856-2548; [tlittle@sussexvt.k12.de.us](mailto:tlittle@sussexvt.k12.de.us)
2. Owner's Construction Manager: Mike Horsey, Common Sense Solutions, 14127 Rottwaller Rd., Laurel, Delaware, 302-875-4510

- C. M/E/P Engineer:

1. David Hoffman, P.E., Gipe Associates, Inc., 8719 Brooks Drive, Easton, MD 21601, (410) 822-8688; [dhoffman@gipe.net](mailto:dhoffman@gipe.net)
2. George Wilburt, P.E., Gipe Associates, Inc., 8719 Brooks Drive, Easton, MD 21601, (410) 822-8688; [gwilburt@gipe.net](mailto:gwilburt@gipe.net)

- D. The Work consists of the following:

1. The scope of our work shall include mechanical/electrical work related to replacing the existing chiller.

#### 1.4 TYPE OF CONTRACT

- A. Project will be constructed under a single prime contract.

#### 1.5 USE OF PREMISES

- A. General: Contractor shall have limited use of premises for construction operations.
- B. Construction permits shall be required by the Contractor per OSHA, local and State of Delaware requirements. Obtain and pay for all costs required for permits by the City of Georgetown.
- C. Use of Site: Limit use of premises 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 constructions operations to the building where work is to be performed.
  2. Owner Occupancy: Allow for Owner occupancy of Project site.
  3. Driveways and Entrances: Keep driveways, 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. Schedule deliveries to minimize use of driveways and entrances.
    - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- D. Use of Existing Buildings: Maintain existing buildings in a weathertight condition throughout construction period. Repair damage caused by construction operations. Protect buildings and occupants during construction period.
- E. Equipment storage: Equipment shall not be stored in site. Equipment shall be delivered to site and installed in its permanent location. Valves, conduit, piping, and wiring may be suitably stored on site in the designated staging area.
- F. Parking: Contractor will be allowed to park on site in areas designated by the Owner.

#### 1.6 OWNER'S OCCUPANCY REQUIREMENTS

- A. Full Owner Occupancy: Owner will occupy site and existing buildings 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 authorities having jurisdiction.
2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

#### 1.7 WORK RESTRICTIONS

- A. On-Site Work Hours: Work shall be generally performed inside the existing buildings site and manholes during normal business working hours of 7:00 a.m. to 4:00 p.m., Monday through Friday, except otherwise indicated.
1. Weekend Hours: As pre-approved by Owner. Where required to meet schedule and/or shutdowns.
  2. Early Morning Hours: As pre-approved by Owner. Where required to meet schedule and/or shutdowns.
  3. Hours for Utility Shutdowns: As pre-approved by Owner. Where required to meet schedule and/or shutdowns.
- B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify Owner not less than 14 calendar days in advance of proposed utility interruptions.
  2. Do not proceed with utility interruptions without Owner's written permission.
  3. Submit Sussex Technical School District Utility Outage Request Form prior to interrupting existing utilities. The Sussex Technical School District Utility Outage Request Form shall be distributed at the Work Initiation Conference.
- C. Smoking: Smoking is not permitted.

#### 1.8 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the 26-division format and CSI/CSC's "MasterFormat" numbering system.
1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
  2. Division 01: Sections in Division 01 govern the execution of the Work of all Sections in the Specifications.

- B. 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. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
  2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
    - a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 011400 - WORK RESTRICTIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 USE OF PREMISES

- A. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of site beyond areas in which the Work is indicated.
  - 1. Limits: Confine construction operations to areas shown on drawings.
  - 2. Owner Occupancy: Allow for Owner occupancy of site.
  - 3. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
    - a. Schedule deliveries to minimize use of driveways and entrances.
    - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- B. Use of Existing Building: Maintain existing building in a weathertight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.
- C. Parking for contractor shall be established on Campus with Sussex Tech High School's Owner Representative and Construction Manager.

1.3 OCCUPANCY REQUIREMENTS

- A. Full Owner Occupancy: Owner will occupy site and existing building 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 operations.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011400

## SECTION 012300 - ALTERNATES

## 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 alternates.

## 1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
  - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
  - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

## 1.4 PROCEDURES

- A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
  - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: Automatic Temperature Control Vendor.

1. Base Bid: Provide ATC system by any listed vendor. Work shall include new ATC panel, controls, wiring, sensors and devices as specified to accomplish the sequences of operation and to monitor the new chiller base bid shall also include all costs associated with interlocking the new chiller with the existing chilled water pumps, condenser water pumps, and cooling tower. Web based interface shall be provided and interlocked with computer provided by Owner.
2. Alternate: Provide the additional cost associated with utilizing Modern Controls and interlocking the new chiller with the existing ATC system. If Modern Controls is the apparent low bidder than the alternate value shall be \$0.

END OF SECTION 012300

## SECTION 012600 - 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. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Sections include the following:
  - 1. Division 01 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

## 1.3 MINOR CHANGES IN THE WORK

- A. Engineer 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, "Engineer's Supplemental Instructions."

## 1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Engineer will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. Proposal Requests issued by Engineer are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
  - 2. Within (7) seven days 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 additional 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.

- B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Engineer.
  - 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 "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.
  
- C. The Proposal Request shall include the Allowable Overhead and Profit Mark-Up scheduled in the General Conditions.

#### 1.5 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Proposal Request, the Engineer will issue a Change Order for signatures of Owner, Contractor and Engineer.

#### 1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Engineer 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



**AIA**<sup>®</sup>

# Document G701™ – 2001

## Change Order

<b>PROJECT</b> <i>(Name and address):</i>	<b>CHANGE ORDER NUMBER:</b> 001	<b>OWNER:</b> <input type="checkbox"/>
	<b>DATE:</b>	<b>ARCHITECT:</b> <input type="checkbox"/>
<b>TO CONTRACTOR</b> <i>(Name and address):</i>	<b>ARCHITECT'S PROJECT NUMBER:</b>	<b>CONTRACTOR:</b> <input type="checkbox"/>
	<b>CONTRACT DATE:</b>	<b>FIELD:</b> <input type="checkbox"/>
	<b>CONTRACT FOR:</b> General Construction	<b>OTHER:</b> <input type="checkbox"/>

**THE CONTRACT IS CHANGED AS FOLLOWS:**

*(Include, where applicable, any undisputed amount attributable to previously executed Construction Change Directives)*

The original Contract Sum was	\$	0.00
The net change by previously authorized Change Orders	\$	0.00
The Contract Sum prior to this Change Order was	\$	0.00
The Contract Sum will be increased by this Change Order in the amount of	\$	0.00
The new Contract Sum including this Change Order will be	\$	0.00

The Contract Time will be increased by Zero (0) days.

The date of Substantial Completion as of the date of this Change Order therefore is

**NOTE:** This Change Order does not include changes in the Contract Sum, Contract Time or Guaranteed Maximum Price which have been authorized by Construction Change Directive until the cost and time have been agreed upon by both the Owner and Contractor, in which case a Change Order is executed to supersede the Construction Change Directive.

**NOT VALID UNTIL SIGNED BY THE ARCHITECT, CONTRACTOR AND OWNER.**

_____ <b>ARCHITECT</b> <i>(Firm name)</i>	_____ <b>CONTRACTOR</b> <i>(Firm name)</i>	_____ <b>OWNER</b> <i>(Firm name)</i>
_____ <b>ADDRESS</b>	_____ <b>ADDRESS</b>	_____ <b>ADDRESS</b>
_____ <b>BY</b> <i>(Signature)</i>	_____ <b>BY</b> <i>(Signature)</i>	_____ <b>BY</b> <i>(Signature)</i>
_____ <i>(Typed name)</i>	_____ <i>(Typed name)</i>	_____ <i>(Typed name)</i>
_____ <b>DATE</b>	_____ <b>DATE</b>	_____ <b>DATE</b>

 **AIA<sup>®</sup> Document G709<sup>™</sup> – 2001**

**Work Changes Proposal Request**

PROJECT *(Name and address):*

PROPOSAL REQUEST NUMBER: 001

OWNER:

DATE OF ISSUANCE:

ARCHITECT:

OWNER *(Name and address):*

CONTRACT FOR: General Construction

CONSULTANT:

CONTRACT DATE:

CONTRACTOR:

FROM ARCHITECT *(Name and address):*

ARCHITECT'S PROJECT NUMBER:

FIELD:

OTHER:

TO CONTRACTOR *(Name and address):*

Please submit an itemized proposal for changes in the Contract Sum and Contract Time for proposed modifications to the Contract Documents described herein. Within Zero (0) days, the Contractor must submit this proposal or notify the Architect, in writing, of the date on which proposal submission is anticipated.

**THIS IS NOT A CHANGE ORDER, A CONSTRUCTION CHANGE DIRECTIVE OR A DIRECTION TO PROCEED WITH THE WORK DESCRIBED IN THE PROPOSED MODIFICATIONS.**

DESCRIPTION *(Insert a written description of the Work):*

ATTACHMENTS *(List attached documents that support description):*

REQUESTED BY THE ARCHITECT:

\_\_\_\_\_  
*(Signature)*

\_\_\_\_\_  
*(Printed name and title)*

 **AIA<sup>®</sup> Document G710<sup>™</sup> – 1992**

**Architect's Supplemental Instructions**

PROJECT *(Name and address):*

ARCHITECT'S SUPPLEMENTAL  
INSTRUCTION NO: 001

OWNER:

ARCHITECT:

OWNER *(Name and address):*

DATE OF ISSUANCE:

CONSULTANT:

CONTRACTOR:

CONTRACT FOR: General Construction

FIELD:

FROM ARCHITECT *(Name and  
address):*

CONTRACT DATE:

OTHER:

TO CONTRACTOR *(Name and  
address):*

ARCHITECT'S PROJECT NUMBER:

The Work shall be carried out in accordance with the following supplemental instructions issued in accordance with the Contract Documents without change in Contract Sum or Contract Time. Proceeding with the Work in accordance with these instructions indicates your acknowledgment that there will be no change in the Contract Sum or Contract Time.

DESCRIPTION:

ATTACHMENTS:

*(Here insert listing of documents that support description.)*

ISSUED BY THE ARCHITECT:

\_\_\_\_\_  
*(Signature)*

\_\_\_\_\_  
*(Printed name and title)*



# AIA<sup>®</sup> Document G714<sup>™</sup> – 2007

## Construction Change Directive

PROJECT: *(Name and address)*

DIRECTIVE NUMBER: 001

OWNER:

DATE:

ARCHITECT:

CONTRACT FOR: General Construction

TO CONTRACTOR: *(Name and address)*

CONTRACT DATED:

CONSULTANT:

ARCHITECT'S PROJECT NUMBER:

CONTRACTOR:

FIELD:

OTHER:

You are hereby directed to make the following change(s) in this Contract:  
*(Describe briefly any proposed changes or list any attached information in the alternative)*

### PROPOSED ADJUSTMENTS

1. The proposed basis of adjustment to the Contract Sum or Guaranteed Maximum Price is:

• Lump Sum decrease of \$0.00

• Unit Price of \$        per

• As provided in Section 7.3.3 of AIA Document A201-2007

• As follows:

2. The Contract Time is proposed to (remain unchanged). The proposed adjustment, if any, is 0 days.

When signed by the Owner and Architect and received by the Contractor, this document becomes effective IMMEDIATELY as a Construction Change Directive (CCD), and the Contractor shall proceed with the change(s) described above.

Contractor signature indicates agreement with the proposed adjustments in Contract Sum and Contract Time set forth in this CCD.

\_\_\_\_\_  
ARCHITECT *(Firm name)*

\_\_\_\_\_  
OWNER *(Firm name)*

\_\_\_\_\_  
CONTRACTOR *(Firm name)*

\_\_\_\_\_  
ADDRESS

\_\_\_\_\_  
ADDRESS

\_\_\_\_\_  
ADDRESS

\_\_\_\_\_  
BY *(Signature)*

\_\_\_\_\_  
BY *(Signature)*

\_\_\_\_\_  
BY *(Signature)*

\_\_\_\_\_  
*(Typed name)*

\_\_\_\_\_  
*(Typed name)*

\_\_\_\_\_  
*(Typed name)*

\_\_\_\_\_  
DATE

\_\_\_\_\_  
DATE

\_\_\_\_\_  
DATE

## SECTION 012900 - 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. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Sections include the following:
  - 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 preparation and submittal of Contractor's Construction Schedule and Submittals Schedule.

## 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. Correlate 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. Submittals Schedule.
    - c. Contractor's Construction Schedule.
  - 2. Submit the Schedule of Values to Engineer at earliest possible date but no later than the Work Initiation Conference.
  - 3. Subschedules: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.

- B. Format and Content: Use the 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 Engineer.
    - c. Engineer's project number.
    - d. Contractor's name and address.
    - e. Date of submittal.
  2. Submit draft of AIA Document G703 Continuation Sheets.
  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.
      - 1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
  4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate.
  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 specified, include evidence of insurance or bonded warehousing.
  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. 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.

10. 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 shall be consistent with previous applications and payments as certified by Engineer 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 Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Engineer 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 of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to Engineer 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.
- F. 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. Contractor's Construction Schedule (preliminary if not final).
  4. Products list.
  5. Submittals Schedule (preliminary if not final).
  6. List of Contractor's staff assignments.
  7. List of Contractor's principal consultants.
  8. Copies of building permits.
  9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
  10. Initial progress report.
  11. Report of preconstruction conference.

12. Certificates of insurance and insurance policies.
  13. Performance and payment bonds.
  14. Data needed to acquire Owner's insurance.
  15. Initial settlement survey and damage report if required.
- G. Application for Payment at Substantial Completion and in accordance with the applicable sections in the School's General Terms and Conditions: After issuing 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 Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- H. Final Payment Application and in accordance with the applicable sections in the School's General Terms and Conditions: 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. AIA Document G707, "Consent of Surety to Final Payment."
  7. Evidence that claims have been settled.
  8. Final, liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION



# AIA Document G702™ - 1992

## Application and Certificate for Payment

**TO OWNER:** PROJECT: MASTER FORMS APPLICATION NO: 001  
 PERIOD TO: \_\_\_\_\_  
**FROM CONTRACTOR:** CONTRACTOR: \_\_\_\_\_  
 VIA ARCHITECT: \_\_\_\_\_  
 CONTRACT FOR: General Construction ARCHITECT: \_\_\_\_\_  
 CONTRACT DATE: \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_ CONTRACTOR: \_\_\_\_\_  
 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

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
<b>TOTALS</b>	<b>\$ 0.00</b>	<b>\$ 0.00</b>
NET CHANGES by Change Order	\$	0.00

**CONTRACTOR'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

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: \_\_\_\_\_ Date: \_\_\_\_\_  
 By: \_\_\_\_\_  
 State of: \_\_\_\_\_  
 County of: \_\_\_\_\_  
 Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_  
 Notary Public: \_\_\_\_\_  
 My Commission expires: \_\_\_\_\_

# AIA<sup>®</sup> Document G703<sup>™</sup> - 1992

## Continuation Sheet

AIA Document G702, APPLICATION AND CERTIFICATION FOR PAYMENT, containing Contractor's signed certification is attached.  
 In tabulations below, amounts are stated to the nearest dollar.  
 Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NO: 001

APPLICATION DATE:

PERIOD TO:

ARCHITECT'S PROJECT NO:

A ITEM NO.	B DESCRIPTION OF WORK	C SCHEDULED VALUE	D WORK COMPLETED		E WORK COMPLETED THIS PERIOD	F MATERIALS PRESENTLY STORED (NOT IN D O R E)	G TOTAL COMPLETED AND STORED TO DATE (D+E+F)	H BALANCE TO FINISH (C - G)	I RETAINAGE (IF VARIABLE RATE)
			FROM PREVIOUS APPLICATION (D + E)						
		\$ 0.00	\$ 0.00		\$ 0.00	\$ 0.00	0.00 %	\$ 0.00	\$ 0.00
	<b>GRAND TOTAL</b>	\$ 0.00	\$ 0.00		\$ 0.00	\$ 0.00	0.00 %	\$ 0.00	\$ 0.00

**CONTRACTOR'S AFFIDAVIT OF  
PAYMENT OF DEBTS AND CLAIMS**  
AIA DOCUMENT G706 - ELECTRONIC FORMAT

OWNER   
ARCHITECT   
CONTRACTOR   
SURETY   
OTHER

*THIS DOCUMENT HAS IMPORTANT LEGAL CONSEQUENCES; CONSULTATION WITH AN ATTORNEY IS ENCOURAGED WITH RESPECT TO ITS COMPLETION OR MODIFICATION. AUTHENTICATION OF THIS ELECTRONICALLY DRAFTED AIA DOCUMENT MAY BE MADE BY USING AIA DOCUMENT D401.*

TO OWNER:  
*(Name and address)*

ARCHITECT'S PROJECT NO.:

PROJECT:  
*(Name and address)*

CONTRACT FOR:

CONTRACT DATED:

STATE OF:  
COUNTY OF:

The undersigned hereby certifies that, except as listed below, payment has been made in full and all obligations have otherwise been satisfied for all materials and equipment furnished, for all work, labor, and services performed, and for all known indebtedness and claims against the Contractor for damages arising in any manner in connection with the performance of the Contract referenced above for which the Owner or Owner's property might in any way be held responsible or encumbered.

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

CONTRACTOR:  
*(Name and address)*

1. Consent of Surety to Final Payment. Whenever Surety is involved, Consent of Surety is required. AIA Document G707, Consent of Surety, may be used for this purpose.

Indicate attachment:  yes  no

BY: \_\_\_\_\_  
*(Signature of authorized representative)*

*The following supporting documents should be attached hereto if required by the Owner:*

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.
3. Contractor's Affidavit of Release of Liens (AIA Document G706A).

\_\_\_\_\_  
*(Printed name and title)*

Subscribed and sworn to before me on this date:

Notary Public: \_\_\_\_\_

**CONTRACTOR'S AFFIDAVIT OF  
RELEASE OF LIENS**

AIA DOCUMENT G706A - ELECTRONIC FORMAT

OWNER	<input type="checkbox"/>
ARCHITECT	<input type="checkbox"/>
CONTRACTOR	<input type="checkbox"/>
SURETY	<input type="checkbox"/>
OTHER	<input type="checkbox"/>

THIS DOCUMENT HAS IMPORTANT LEGAL CONSEQUENCES; CONSULTATION WITH AN ATTORNEY IS ENCOURAGED WITH RESPECT TO ITS COMPLETION OR MODIFICATION. AUTHENTICATION OF THIS ELECTRONICALLY DRAFTED AIA DOCUMENT MAY BE MADE BY USING AIA DOCUMENT D401.

TO OWNER:  
*(Name and address)*

ARCHITECT'S PROJECT NO.:

PROJECT:  
*(Name and address)*

CONTRACT FOR:

CONTRACT DATED:

STATE OF:  
COUNTY OF:

The undersigned hereby certifies that to the best of the undersigned's knowledge, information and belief, except as listed below, the Releases or Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and equipment, and all performers of Work, labor or services who have or may have liens or encumbrances or the right to assert liens or encumbrances against any property of the Owner arising in any manner out of the performance of the Contract referenced above.

EXCEPTIONS:

STARTING DOCUMENTS ATTACHED HERETO:

CONTRACTOR:  
*(Name and address)*

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.

BY

\_\_\_\_\_  
*(Signature of authorized representative)*

2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

\_\_\_\_\_  
*(Printed name and title)*

Subscribed and sworn to before me on this date:

\_\_\_\_\_  
Notary Public:

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My Commission Expires: \_\_\_\_\_

**CONSENT OF SURETY  
TO FINAL PAYMENT**

AIA DOCUMENT G707 - ELECTRONIC FORMAT

OWNER	<input type="checkbox"/>
ARCHITECT	<input type="checkbox"/>
CONTRACTOR	<input type="checkbox"/>
SURETY	<input type="checkbox"/>
OTHER	<input type="checkbox"/>

*THIS DOCUMENT HAS IMPORTANT LEGAL CONSEQUENCES; CONSULTATION WITH AN ATTORNEY IS ENCOURAGED WITH RESPECT TO ITS COMPLETION OR MODIFICATION. AUTHENTICATION OF THIS ELECTRONICALLY DRAFTED AIA DOCUMENT MAY BE MADE BY USING AIA DOCUMENT D401.*

TO OWNER: \_\_\_\_\_ ARCHITECT'S PROJECT NO.: \_\_\_\_\_  
*(Name and address)*

PROJECT: \_\_\_\_\_ CONTRACT FOR: \_\_\_\_\_  
*(Name and address)*

CONTRACT DATED: \_\_\_\_\_

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the  
*(Insert name and address of Surety)*

on bond of \_\_\_\_\_, SURETY,  
*(Insert name and address of Contractor)*

hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall not relieve the Surety of  
its obligations to \_\_\_\_\_, CONTRACTOR,  
*(Insert name and address of Owner)*

as set forth in said Surety's bond. \_\_\_\_\_, OWNER,

IN WITNESS WHEREOF, the Surety has hereunto set its hand on this date:  
*(Insert in writing the month followed by the numeric date and year.)*

\_\_\_\_\_  
*(Surety)*

Attest: \_\_\_\_\_  
*(Signature of authorized representative)*

*(Seal):* \_\_\_\_\_  
*(Printed name and title)*

## SECTION 013100 - 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. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
  - 1. Coordination Drawings.
  - 2. Administrative and supervisory personnel.
  - 3. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility will be assigned to a specific contractor.
- C. Related Sections include the following:
  - 1. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractor's Construction Schedule (Accepted Baseline and Monthly Updates).
  - 2. Division 01 Section "Execution Requirements" 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 Contract closeout.

## 1.3 COORDINATION

- 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.
- 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 accessibility for required maintenance, service, and repair.
  3. Make adequate provisions to accommodate items scheduled for later installation.
  4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.
- 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 (Accepted Baseline and Monthly Updates).
  2. Preparation of the Schedule of Values.
  3. Installation and removal of temporary facilities and controls.
  4. Delivery and processing of submittals.
  5. Progress meetings.
  6. Pre-installation conferences.
  7. Project closeout activities.
  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.
1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

#### 1.4 SUBMITTALS

- A. Contractor Deliverables:
- B. Monthly Progress Report Deliverables: Prepare and submit Monthly Deliverables as described below:
1. Project Narrative providing executive summary, any schedule deviations, and current issues.
  2. Progress Photographs.
  3. Update Schedule providing status of individual Activity Time and Cost Progress projected to end of month.
  4. Safety Log providing to-date summary lists of incidents or illnesses.
  5. Submittal Log.
  6. RFI Log.

7. Change Order Log.
8. Quality Assurance/Quality Control Log, with summary statement.

C. Coordination Drawings: Prepare Coordination Drawings.

1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
  - a. Indicate functional and spatial relationships of components of Civil, mechanical, and electrical systems.
  - b. Indicate required installation sequences.
  - c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Engineer for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
2. Sheet Size: At least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 40 inches (750 by 1000 mm).
3. Number of Copies: Submit two opaque copies of each submittal. Engineer will return one copy.
  - a. Submit five copies where Coordination Drawings are required for operation and maintenance manuals. Engineer will retain two copies; remainder will be returned.
4. Refer to individual Sections for Coordination Drawing requirements for Work in those Sections.

D. Key Personnel Names: Within 15 days of receiving Notice To Proceed, 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 and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys 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 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.

1. Include special personnel required for coordination of operations with other contractors.

## 1.6 PROJECT MEETINGS

- A. General: Engineer shall schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
1. Attendees: Contractor shall inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Engineer of scheduled meeting dates and times.
  2. Agenda: Engineer shall prepare the meeting agenda. Distribute the agenda to all invited attendees.
  3. Minutes: Engineer shall record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Contractor, within three days of the meeting.
- B. Preconstruction Conference: Schedule a Work Initiation Conference before starting construction, at a time convenient to Owner and Engineer, but no later than 15 days after Notice To Proceed. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
1. Attendees: Authorized representatives of Owner, Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Tentative construction schedule.
    - b. Critical work sequencing and long-lead items.
    - c. Designation of key personnel and their duties.
    - d. Procedures for processing field decisions and Change Orders.
    - e. Procedures for requests for interpretations (RFIs).
    - f. Procedures for testing and inspecting.
    - g. Procedures for processing Applications for Payment.
    - h. Distribution of the Contract Documents.
    - i. Submittal procedures.
    - j. Preparation of Record Documents.
    - k. Use of the premises and existing building.
    - l. Work restrictions.
    - m. Owner's occupancy requirements.
    - n. Responsibility for temporary facilities and controls.
    - o. Parking availability.
    - p. Office, work, and storage areas.
    - q. Equipment deliveries and priorities.
    - r. First aid.
    - s. Security.
    - t. Working hours.
  3. Minutes: Engineer will record and distribute meeting minutes.
- C. Progress Meetings: Conduct progress meetings at biweekly intervals. Coordinate dates of meetings with preparation of payment requests.

1. Attendees: In addition to representatives of Owner and Engineer, 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 conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. 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.
    - 1) Review schedule for next period.
  - 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) Access.
    - 6) Site utilization.
    - 7) Temporary facilities and controls.
    - 8) Work hours.
    - 9) Hazards and risks.
    - 10) Quality and work standards.
    - 11) Status of correction of deficient items.
    - 12) Field observations.
    - 13) Requests for interpretations (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.
3. Minutes: Engineer will record and distribute to Contractor the meeting minutes.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
  - a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

## SECTION 013200 - 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. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Baseline Construction Schedule.
2. Update Construction Schedule.
3. Submittals Schedule.
4. Daily construction reports.
5. Material location reports.
6. Field condition reports.
7. Special reports.

- B. Related Sections include the following:

1. Division 01 Section "Payment Procedures" for submitting the Schedule of Values.
2. Division 01 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
3. Division 01 Section "Submittal Procedures" for submitting schedules and reports.

## 1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
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 Engineer.

- 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. Days: Unit of time duration in calendar days, unless specifically indicated to be work days.
- F. Event: The starting or ending point of an activity.
- G. 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.
- H. Fragment: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.
- I. Major Area: A story of construction, a separate building, or a similar significant construction element.
- J. Milestone: A key or critical point in time for reference or measurement.
- K. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.
- L. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

#### 1.4 SUBMITTALS

- A. Submittals Schedule: Submit three copies of schedule. Arrange the following information in a tabular format:
  - 1. Scheduled date for first submittal.
  - 2. Specification Section number and title.
  - 3. Submittal category (action or informational).
  - 4. Name of subcontractor.
  - 5. Description of the Work covered.
  - 6. Scheduled date for Engineer's final release or approval.
- B. Baseline Construction Schedule: Submit two opaque copies.
  - 1. Approval of cost-loaded Baseline Construction Schedule will not constitute approval of Schedule of Values for cost-loaded activities.

- C. Update Construction Schedule: Submit two opaque copies of Update Construction Schedule, large enough to show entire schedule for entire construction period.
  - 1. Submit an electronic copy of schedule, using software indicated, on CD-R, and labeled to comply with requirements for submittals. Include type of schedule (Initial or Updated) and date on label.
- D. Daily Construction Reports: Submit two copies at monthly intervals.
- E. Material Location Reports: Submit two copies at monthly intervals.
- F. Field Condition Reports: Submit two copies at time of discovery of differing conditions.

## 1.5 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- B. Coordinate Contractor's Baseline and Update Construction Schedules with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
  - 1. Secure time commitments for performing critical elements of the Work from parties involved.
  - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

## PART 2 - PRODUCTS

### 2.1 SUBMITTALS SCHEDULE

- A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.
  - 1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Baseline and Update Construction Schedule.
  - 2. Initial Submittal: Submit concurrently with preliminary bar-chart schedule. Include submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
    - a. At Contractor's option, show submittals on the Baseline Construction Schedule, instead of tabulating them separately.
  - 3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Baseline Construction Schedule.

## 2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."
- B. Contractor's Construction Schedule Acceptance is represented in two forms: 1) Accepted Baseline Schedule, and 2) Accepted Monthly Update Schedule.
- C. Time Frame: Extend schedule from date established for the Notice to Proceed 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.
- D. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:
  - 1. Activity Duration: Define activities so no activity is longer than 30 days, unless specifically allowed by Engineer.
  - 2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 30 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
    - a. New Chiller
    - b. ATC Controls
  - 3. Submittal Review Time: Include review and re-submittal times indicated in Division 1 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
  - 4. Startup and Testing Time: Include not less than 14 days for startup and testing.
  - 5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Engineer's administrative procedures necessary for certification of Substantial Completion.
- E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Equipment Deliveries Complete, Equipment in Place, Systems Ready for Test, Substantial Completion, and Final Completion
- F. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragments to demonstrate the effect of the proposed change on the overall project schedule.

## 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 during the Work Initiation Conference. Schedule will be reviewed and become the agenda for a Schedule Confirmation Meeting where the schedule contents are discussed and agreement is reached on an Accepted Baseline Schedule. This schedule is then used for basis of subsequent monthly updates.

- 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 60 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. Changes to the number or description of schedule activities, as well as alteration to the Critical Path represented in the Accepted Baseline Schedule, shall not be performed without the express approval of the Engineer.

## 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.
  - 7. Accidents.
  - 8. Meetings and significant decisions.
  - 9. Unusual events (refer to special reports).
  - 10. Stoppages, delays, shortages, and losses.
  - 11. Emergency procedures.
  - 12. Orders and requests of authorities having jurisdiction.
  - 13. Change Orders received and implemented.
  - 14. Construction Change Directives received and implemented.
  - 15. Services connected and disconnected.
  - 16. Equipment or system tests and startups.
  - 17. Substantial Completions authorized.
- B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.
- C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation on CSI Form 13.2A. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

## PART 3 - EXECUTION

## 3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. 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 Actual Completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Engineer, 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



# REQUEST FOR INTERPRETATION

Project: \_\_\_\_\_

R.F.I. Number: \_\_\_\_\_

\_\_\_\_\_

From: \_\_\_\_\_

To: \_\_\_\_\_

Date: \_\_\_\_\_

\_\_\_\_\_

A/E Project Number: \_\_\_\_\_

Re: \_\_\_\_\_

Contract For: \_\_\_\_\_

Specification Section:

Paragraph:

Drawing Reference:

Detail:

Request:

Signed by:

Date:

Response:

Attachments

Response From:

To:

Date Rec'd:

Date Ret'd:

Signed by:

Date:

Copies:  Owner  Consultants  \_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_  File

## SECTION 013300 - 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. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Sections include the following:
  - 1. Division 01 Section "Payment Procedures" for submitting Applications for Payment and the Schedule of Values.
  - 2. Division 01 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes and for submitting Coordination Drawings.
  - 3. Division 01 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule.
  - 4. Division 01 Section "Closeout Procedures" for submitting warranties.
  - 5. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
  - 6. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
  - 7. Division 01 Section "Demonstration and Training" for training of Owner's personnel.
  - 8. Divisions 02 through 26 Sections for specific requirements for submittals in those Sections.

## 1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires Engineer's responsive action.
- B. Informational Submittals: Written information that does not require Engineer's responsive action. Submittals may be rejected for not complying with requirements.

## 1.4 SUBMITTAL PROCEDURES

- A. General: Electronic copies of CAD Drawings of the Contract Drawings will be provided by Engineer for Contractor's use in preparing submittals at the cost identified in Paragraph 1.5.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    - a. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Submittals Schedule: Comply with requirements in Division 01 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.
- D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
  2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
  3. Resubmittal Review: Allow 15 days for review of each resubmittal.
  4. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Engineer and to Engineer's consultants, allow 15 days for review of each submittal. Submittal will be returned to Engineer before being returned to Contractor.
- E. Identification: Place a permanent label or title block on each submittal for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
  2. Provide a space approximately 6 by 8 inches (150 by 200 mm) on label or beside title block to record Contractor's review and approval markings and action taken by Engineer.
  3. Include the following information on label for processing and recording action taken:
    - a. Project name.
    - b. Date.
    - c. Name and address of Engineer.
    - d. Name and address of Contractor.
    - e. Name and address of subcontractor.
    - f. Name and address of supplier.
    - g. Name of manufacturer.
    - h. Submittal number or other unique identifier, including revision identifier.
    - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).

- i. Number and title of appropriate Specification Section.
  - j. Drawing number and detail references, as appropriate.
  - k. Location(s) where product is to be installed, as appropriate.
  - l. Other necessary identification.
- F. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.
- G. Additional Copies: Unless additional copies are required for final submittal, and unless Engineer observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
  1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Engineer.
  2. Additional copies submitted for maintenance manuals will be marked with action taken and will be returned.
- H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Engineer will return submittals, without review, received from sources other than Contractor.
  1. Transmittal Form: Use CSI Form 12.1A at the end of Section.
  2. Transmittal Form: Provide locations on form for the following information:
    - a. Project name.
    - b. Date.
    - c. Destination (To:).
    - d. Source (From:).
    - e. Names of subcontractor, manufacturer, and supplier.
    - f. Category and type of submittal.
    - g. Submittal purpose and description.
    - h. Specification Section number and title.
    - i. Drawing number and detail references, as appropriate.
    - j. Transmittal number.
    - k. Submittal and transmittal distribution record.
    - l. Remarks.
    - m. Signature of transmitter.
  3. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Engineer on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same label information as related submittal.
- I. 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 " Approved" or "Approved as Noted."

4. For any submittal requiring more than two (2) reviews by the Engineer (including those caused by a change in subcontractor or supplier) the Owner will withhold contractor's funds by a change order to the contract to cover the cost of additional reviews. One review is counted for each action including rejection or return of any reason.
  - J. 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.
  - K. Use for Construction: Use only final submittals with mark indicating "Approved" or "Approved as Noted" taken by Engineer.
- 1.5 CONTRACTOR'S USE OF ENGINEER'S CAD FILES
- A. General: At Contractor's written request, copies of Engineer's CAD files will be provided to Contractor for Contractor's use in connection with Project, subject to the following conditions:
  - B. General: Electronic copies of CAD Drawings of the Contract Drawings may be provided by Engineer for Contractor's use in preparing submittals.
    1. The Documents for this project were prepared using commercial software on computers.

## PART 2 - PRODUCTS

### 2.1 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
  1. Submit electronic submittals directly to extranet specifically established for Project.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
  1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
  2. Mark each copy of each submittal to show which products and options are applicable.
  3. Include the following information, as applicable:
    - a. Manufacturer's written recommendations.
    - b. Manufacturer's product specifications.
    - c. Manufacturer's installation instructions.
    - d. Standard color charts.
    - e. Manufacturer's catalog cuts.
    - f. Wiring diagrams showing factory-installed wiring.
    - g. Printed performance curves.
    - h. Operational range diagrams.
    - i. Standard product operation and maintenance manuals.
    - j. Compliance with specified referenced standards.

- k. Testing by recognized testing agency.
    - l. Application of testing agency labels and seals.
    - m. Notation of coordination requirements.
  4. Submit Product Data before or concurrent with Samples.
  5. Number of Copies: Submit three copies of Product Data, unless otherwise indicated. Engineer will return two copies. Mark up and retain one returned copy as a Project Record Document.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal of Engineer's CAD Drawings are otherwise permitted.
  1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    - a. Dimensions.
    - b. Identification of products.
    - c. Fabrication and installation drawings.
    - d. Roughing-in and setting diagrams.
    - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
    - f. Shopwork manufacturing instructions.
    - g. Templates and patterns.
    - h. Schedules.
    - i. Compliance with specified standards.
    - j. Notation of coordination requirements.
    - k. Notation of dimensions established by field measurement.
    - l. Relationship to adjoining construction clearly indicated.
    - m. Seal and signature of professional engineer if specified.
    - n. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
  2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 40 inches (750 by 1000 mm).
  3. Number of Copies: Submit two opaque (bond) copies of each submittal. Engineer will return one copy.
  4. Number of Copies: Submit three opaque copies of each submittal, unless copies are required for operation and maintenance manuals. Submit five copies where copies are required for operation and maintenance manuals. Engineer will retain two copies; remainder will be returned.
  5. 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.
- D. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation" for Construction Manager's action.
- E. Submittals Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."
- F. Application for Payment: Comply with requirements specified in Division 01 Section "Payment Procedures."
- G. Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."
- H. 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. Use CSI Form 1.5A. Include the following information in tabular form:
  - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
  - 2. Number and title of related Specification Section(s) covered by subcontract.
  - 3. Drawing number and detail references, as appropriate, covered by subcontract.
  - 4. Number of Copies: Submit three copies of subcontractor list, unless otherwise indicated. Engineer will return two copies.
- a. Mark up and retain one returned copy as a Project Record Document.

## 2.2 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
  - 1. Number of Copies: Submit two copies of each submittal, unless otherwise indicated. Engineer will not return copies.
  - 2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
- B. Coordination Drawings: Comply with requirements specified in Division 01 Section "Project Management and Coordination."
- C. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."
- D. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

- E. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- F. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."
- G. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
1. Preparation of substrates.
  2. Required substrate tolerances.
  3. Sequence of installation or erection.
  4. Required installation tolerances.
  5. Required adjustments.
  6. Recommendations for cleaning and protection.
- H. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
1. Name, address, and telephone number of factory-authorized service representative making report.
  2. Statement on condition of substrates and their acceptability for installation of product.
  3. Statement that products at Project site comply with requirements.
  4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
  5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  6. Statement whether conditions, products, and installation will affect warranty.
  7. Other required items indicated in individual Specification Sections.
- I. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.
- J. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Engineer.
1. Engineer will not review submittals that include MSDSs and will return the entire submittal for resubmittal.

## PART 3 - EXECUTION

## 3.1 CONTRACTOR'S REVIEW

- A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

## 3.2 ENGINEER'S / ACTION

- A. General: Engineer will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Engineer will review each submittal, make marks to indicate corrections or modifications required, and return it. Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
  - 1. Reviewed: Approved.
  - 2. Reviewed: Submittals which require no corrections.
  - 3. Rejected: Not Approved. Constricting to requirement of the Contract Documents. Do not perform work illustrated.
  - 4. Resubmit as specified: Item required major correction, future clarification and/or completion. Do not perform work illustrated.
  - 5. For Information only/Not Reviewed: Submittals that are not required by Contract Documents to be reviewed by Engineer.
  - 6. Approved as Noted: Make corrections noted.
  - 7. Revise & Resubmit: To be corrected and returned for approval. Do not perform work as illustrated.
  - 8. Resubmit for Record Only: Proceed with work and re-submit information submitted for Engineers records.
- C. Informational Submittals: Engineer will review each submittal and will not return it, or will return it if it does not comply with requirements. Engineer will forward each submittal to appropriate party.
- D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION



SUBMITTAL TRANSMITTAL

Project: \_\_\_\_\_ Date: \_\_\_\_\_
A/E Project Number: \_\_\_\_\_

TRANSMITTAL A To (Contractor): \_\_\_\_\_ Date: \_\_\_\_\_ Submittal No. \_\_\_\_\_
From (Subcontractor): \_\_\_\_\_ By: \_\_\_\_\_ [ ] Resubmission

Table with 4 columns: Qty., Reference / Number, Title / Description / Manufacturer, Spec. Section Title and Paragraph / Drawing Detail Reference

- Submitted for review and approval
Resubmitted for review and approval
Complies with contract requirements
Will be available to meet construction schedule
A/E review time included in construction schedule
Substitution involved - Substitution request attached
If substitution involved, submission includes point-by-point comparative data or preliminary details
Items included in submission will be ordered immediately upon receipt of approval

Other remarks on above submission: [ ] One copy retained by sender

TRANSMITTAL B To (A/E): \_\_\_\_\_ Attn: \_\_\_\_\_ Date Rec'd by Contractor: \_\_\_\_\_
From (Contractor): \_\_\_\_\_ By: \_\_\_\_\_ Date Trnsmt'd by Contractor: \_\_\_\_\_

- Approved
Approved as noted
Revise / Resubmit
Rejected / Resubmit

Other remarks on above submission: [ ] One copy retained by sender

TRANSMITTAL C To (Contractor): \_\_\_\_\_ Attn: \_\_\_\_\_ Date Rec'd by A/E: \_\_\_\_\_
From (A/E): \_\_\_\_\_ [ ] Other By: \_\_\_\_\_ Date Trnsmt'd by A/E: \_\_\_\_\_

- Approved
Approved as noted
Not subject to review
No action required
Revise / Resubmit
Rejected / Resubmit
Approved as noted / Resubmit
Provide file copy with corrections identified
Sepia copies only returned
Point-by-point comparative data required to complete approval process
Submission Incomplete / Resubmit

Other remarks on above submission: [ ] One copy retained by sender

TRANSMITTAL D To (Subcontractor): \_\_\_\_\_ Attn: \_\_\_\_\_ Date Rec'd by Contractor: \_\_\_\_\_
From (Contractor): \_\_\_\_\_ By: \_\_\_\_\_ Date Trnsmt'd by Contractor: \_\_\_\_\_

Copies: [ ] Owner [ ] Consultants [ ] \_\_\_\_\_ [ ] \_\_\_\_\_ [ ] \_\_\_\_\_ [ ] One copy retained by sender

## SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Sections include the following:
  - 1. Division 01 Section "Summary" for limitations on utility interruptions and other work restrictions.
  - 2. Division 01 Section "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.
  - 3. Division 01 Section "Execution Requirements" for progress cleaning requirements.
  - 4. Divisions 02 through 26 Sections for temporary heat requirements for products in those Sections.

## 1.3 USE CHARGES

- A. General: Utility usage shall not be metered. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Engineer, testing agencies, and authorities having jurisdiction.
- B. Water Service: Water service usage shall not be metered. Provide connections and extensions of services as required for construction operations.
- C. Electric Power Service: Utility usage shall not be metered. Provide connections and extensions of services as required for construction operations.

## 1.4 SUBMITTALS

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

## 1.5 QUALITY ASSURANCE

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

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

#### 1.6 PROJECT CONDITIONS

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

#### 1.7 ALTERNATES

- A. Refer to Division 01 Section, *Alternates* for description of work under this section affected by alternates.

### PART 2 - PRODUCTS

#### 2.1 TEMPORARY FACILITIES

- A. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
  - 1. Store combustible materials apart from building.

#### 2.2 EQUIPMENT

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

### PART 3 - EXECUTION

#### 3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

#### 3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Water Service: Use of Owner's existing water service facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
  1. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.
- C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- D. Electric Power Service: Use of Owner's existing electric power service will be permitted, as long as equipment is maintained in a condition acceptable to Owner.

### 3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
  1. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines. Comply with NFPA 241.
  2. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Parking: Use designated areas of Owner's existing parking areas for construction personnel.
- C. Project Identification and Temporary Signs: Provide Project identification and other signs. Install signs where indicated to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted.
  1. Provide temporary, directional signs for construction personnel and visitors.
  2. Maintain and touchup signs so they are legible at all times.
- D. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
  1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

### 3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
  1. Comply with work restrictions specified in Division 01 Section "Summary."

- B. Stormwater: Comply with Delaware Department of the Environment (regarding stormwater run-off control and the erection of silt fences and the erection of silt fences).
- C. Temporary Fencing: Provide temporary fencing around and enclosing the construction site to prevent unauthorized entrance by visitors/workers.
- D. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- E. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities.

### 3.5 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
  - 1. Maintain operation of temporary enclosures, heating, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
  - 1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
  - 2. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION

## SECTION 016000 - 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. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.
- B. Related Sections include the following:
  - 1. Division 01 Section "Closeout Procedures" for submitting warranties for Contract closeout.
  - 2. Divisions 02 through 26 Sections for specific requirements for warranties on products and installations specified to be warranted.

## 1.3 DEFINITIONS

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
  - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
  - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
  - 3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
- C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service

performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

#### 1.4 SUBMITTALS

- A. Product List: Submit a list, in tabular form, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.
1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
  2. Form: Tabulate information for each product under the following column headings:
    - a. Specification Section number and title.
    - b. Generic name used in the Contract Documents.
    - c. Proprietary name, model number, and similar designations.
    - d. Manufacturer's name and address.
    - e. Supplier's name and address.
    - f. Installer's name and address.
    - g. Projected delivery date or time span of delivery period.
    - h. Identification of items that require early submittal approval for scheduled delivery date.
  3. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.
    - a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.
  4. Completed List: Within 60 days after date of commencement of the Work, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
  5. Engineer's Action: Engineer will respond in writing to Contractor within 15 days of receipt of completed product list. Engineer's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Engineer's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.
- B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Substitution Request Form: Use CSI Form 13.1A.
  2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified material or product cannot be provided.

- b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
  - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
  - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
  - e. Samples, where applicable or requested.
  - f. List of similar installations for completed projects with project names and addresses and names and addresses of Engineers and owners.
  - g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
  - h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
  - i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
  - j. Cost information, including a proposal of change, if any, in the Contract Sum.
  - k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
  - l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation within 7 days of receipt of a request for substitution. Engineer will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
- a. Form of Acceptance: Change Order.
  - b. Use product specified if Engineer cannot make a decision on use of a proposed substitution within time allocated.
- C. Comparable Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Engineer will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
- a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."

- b. Use product specified if Engineer cannot make a decision on use of a comparable product request within time allocated.
- D. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 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, product selected shall be compatible with products previously selected, even if previously selected products were also options.
- 1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
  - 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Engineer will determine which products shall be used.

## 1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
- 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
  - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
  - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
  - 4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
- C. Storage:
- 1. Store products to allow for inspection and measurement of quantity or counting of units.
  - 2. Store materials in a manner that will not endanger Project structure.
  - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
  - 4. Store cementitious products and materials on elevated platforms.
  - 5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
  - 6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
  - 7. Protect stored products from damage and liquids from freezing.
  - 8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

## 1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
  2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
  2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
  3. Refer to Divisions 02 through 26 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, that are undamaged and, unless otherwise indicated, that are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
  2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
  3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
  4. Where products are accompanied by the term "as selected," Engineer will make selection.
  5. Where products are accompanied by the term "match sample," sample to be matched is Engineer's.
  6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
  7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Part 2 "Comparable Products" Article to obtain approval for use of an unnamed product.

## B. Product Selection Procedures:

1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
8. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.
9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Engineer's sample. Engineer's decision will be final on whether a proposed product matches.
  - a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.
10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.
  - a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Engineer will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
  - b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Engineer will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

## 2.2 PRODUCT SUBSTITUTIONS

- A. Timing: Engineer will consider requests for substitution if received within 15 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Engineer.
- B. Conditions: Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:
1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Engineer for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
  2. Requested substitution does not require extensive revisions to the Contract Documents.
  3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
  4. Substitution request is fully documented and properly submitted.
  5. Requested substitution will not adversely affect Contractor's Construction Schedule.
  6. Requested substitution has received necessary approvals of authorities having jurisdiction.
  7. Requested substitution is compatible with other portions of the Work.
  8. Requested substitution has been coordinated with other portions of the Work.
  9. Requested substitution provides specified warranty.
  10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

### 2.3 COMPARABLE PRODUCTS

- A. Conditions: Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
  2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
  3. Evidence that proposed product provides specified warranty.
  4. List of similar installations for completed projects with project names and addresses and names and addresses of Engineers and owners, if requested.
  5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION



# SUBSTITUTION REQUEST (After the Bidding Phase)

Project: \_\_\_\_\_ Substitution Request Number: \_\_\_\_\_  
 \_\_\_\_\_  
 From: \_\_\_\_\_  
 To: \_\_\_\_\_ Date: \_\_\_\_\_  
 \_\_\_\_\_  
 A/E Project Number: \_\_\_\_\_  
 Re: \_\_\_\_\_ Contract For: \_\_\_\_\_

Specification Title: \_\_\_\_\_ Description: \_\_\_\_\_  
 Section: \_\_\_\_\_ Page: \_\_\_\_\_ Article/Paragraph: \_\_\_\_\_

Proposed Substitution: \_\_\_\_\_  
 Manufacturer: \_\_\_\_\_ 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 (Continued)

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by 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 017300 - EXECUTION REQUIREMENTS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

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

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

- B. Related Sections include the following:

1. Division 01 Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
2. Division 01 Section "Submittal Procedures" for submitting surveys.
3. Division 01 Section "Cutting and Patching" for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.
4. Division 01 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.

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

- B. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
    - a. Description of the Work.
    - b. List of detrimental conditions, including substrates.
    - c. List of unacceptable installation tolerances.
    - d. Recommended corrections.
  2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
  3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Engineer. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents. Submit requests on CSI Form 13.2A, "Request for Interpretation", form enclosed in Division 01 Section "Construction Progress Documentation."

### 3.3 CONSTRUCTION LAYOUT

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

### 3.4 INSTALLATION

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

1. Make vertical work plumb and make horizontal work level.
  2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Engineer.
  2. Allow for piping, building movement, including thermal expansion and contraction.
  3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

### 3.5 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).
  3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
  - 1. Remove liquid spills promptly.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- F. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- G. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- H. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- I. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### 3.6 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 01 Section "Quality Requirements."

### 3.7 PROTECTION OF INSTALLED CONSTRUCTION

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

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

3.8 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 01 Section "Cutting and Patching."
  - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

END OF SECTION

## SECTION 017310 - 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 Demolition" for demolition of selected portions.
  - 2. Divisions 02 through 26 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

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

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- 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 minimize 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: 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 02 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.
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION

## SECTION 017320 - SELECTIVE DEMOLITION

## 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 the following:
  - 1. Demolition and removal of selected portions of elevator and elevator components.
- B. Related Sections include the following:
  - 1. Division 01 Section "Summary" for use of premises and Owner-occupancy requirements.
  - 2. Division 01 Section "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for selective demolition operations.
  - 3. Division 01 Section "Cutting and Patching" for cutting and patching procedures.

## 1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- C. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

## 1.4 MATERIALS OWNERSHIP

- A. Items of interest or value to Owner that may be encountered during selective demolition remain Owner's property. Carefully remove each item or object in a manner to prevent damage and deliver promptly to Owner.

## 1.5 SUBMITTALS

- A. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Locations of proposed dust- and noise-control temporary partitions and means of egress.
6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
7. Means of protection for items to remain and items in path of waste removal from building.

#### 1.6 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Standards: Comply with ANSI A10.6 and NFPA 241.

#### 1.7 PROJECT CONDITIONS

- A. Owner will occupy portions of building and site immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
  1. Comply with requirements specified in Division 01 Section "Summary."
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
  1. Hazardous materials will be removed by Owner before start of the Work.
  2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Engineer and Owner. Owner will remove hazardous materials under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain existing site fire-protection facilities in service during selective demolition operations.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Engineer.

### 3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
  1. Comply with requirements for existing services/systems interruptions specified in Division 01 Section "Summary."
- B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
  1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
  2. Arrange to shut off indicated utilities with utility companies.
  3. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
  4. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

### 3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  1. Comply with requirements for access and protection specified in Division 01 Section "Temporary Facilities and Controls."

- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
  2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
  3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
  4. Cover and protect furniture, furnishings, and equipment that have not been removed.
  5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 01 Section "Temporary Facilities and Controls."
- C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
1. Strengthen or add new supports when required during progress of selective demolition.

### 3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
  2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
  4. Maintain adequate ventilation when using cutting torches.
  5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
  6. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  7. Dispose of demolished items and materials promptly.
- B. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Engineer, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
  - 1. Do not allow demolished materials to accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
  - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.6 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION

## SECTION 017700 - CLOSEOUT PROCEDURES

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
  - 1. Inspection procedures.
  - 2. Warranties.
  - 3. Final cleaning.
- B. Related Sections include the following:
  - 1. Division 01 Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.
  - 2. Division 01 Section "Execution Requirements" for progress cleaning of Project site.
  - 3. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
  - 4. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
  - 5. Division 01 Section "Demonstration and Training" for requirements for instructing Owner's personnel.
  - 6. Divisions 02 through 26 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

## 1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
  - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
  - 2. Advise Owner of pending insurance changeover requirements.
  - 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  - 4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  - 5. Prepare and submit Project Record Documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.

6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
  7. Complete startup testing of systems.
  8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
  9. Advise Owner of changeover in heat and other utilities.
  10. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
  11. Complete final cleaning requirements, including touchup painting.
  12. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Engineer, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
  2. Results of completed inspection will form the basis of requirements for Final Completion.

#### 1.4 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
  2. Submit certified copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Engineer. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
  3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  4. Submit pest-control final inspection report and warranty.
  5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training videotapes.
- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer 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. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

## 1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction. Use CSI Form 14.1A , enclosed at the end of Part 3.
1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
  2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
  3. Include the following information at the top of each page:
    - a. Project name.
    - b. Date.
    - c. Name of Engineer.
    - d. Name of Contractor.
    - e. Page number.

## 1.6 WARRANTIES

- A. Submittal Time: Submit written warranties on request of Engineer for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (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.
- 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.

## PART 3 - EXECUTION

## 3.1 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers for final cleaning. Comply with manufacturer's written instructions.
  - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
    - a. Remove tools, construction equipment, machinery, and surplus material from Project site.
    - b. Remove debris and surface dust from limited access spaces.
    - c. Remove labels that are not permanent.
    - d. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
      - 1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
    - e. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
- C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION



# PUNCH LIST

Project: \_\_\_\_\_  
\_\_\_\_\_

From (A/E): \_\_\_\_\_

Site Visit Date: \_\_\_\_\_

To (Contractor): \_\_\_\_\_  
\_\_\_\_\_

A/E Project Number: \_\_\_\_\_

Contract For: \_\_\_\_\_

The following items require the attention of the Contractor for completion or correction. This list may not be all-inclusive, and the failure to include any items on this list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

Item Number	Room Number	Location (Area)	Description	Correction/Completion Date	Verification A/E Check
-------------	-------------	-----------------	-------------	----------------------------	------------------------

Attachments

Signed by: \_\_\_\_\_ Date: \_\_\_\_\_

Copies:  Owner  Consultants  \_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_  \_\_\_\_\_  File

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Operation and maintenance documentation directory.
  - 2. Emergency manuals.
  - 3. Operation manuals for systems, subsystems, and equipment.
  - 4. Maintenance manuals for the care and maintenance of systems and equipment.
- B. Related Sections include the following:
  - 1. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
  - 2. Division 01 Section "Closeout Procedures" for submitting operation and maintenance manuals.
  - 3. Division 01 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
  - 4. Divisions 02 through 26 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 SUBMITTALS

- A. Initial Submittal: Submit 2 draft copies of each manual at least 15 days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Engineer will return both copy of draft and mark whether general scope and content of manual are acceptable.
- B. Final Submittal: Submit one copy of each manual in final form at least 15 days before final inspection. Engineer will return copy with comments within 15 days after final inspection.

1. Correct or modify each manual to comply with Engineer's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Engineer's comments.

## 1.5 COORDINATION

- A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

## PART 2 - PRODUCTS

### 2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Organization: Include a section in the directory for each of the following:
  1. List of documents.
  2. List of equipment.
  3. Table of contents.
- B. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- C. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- D. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

### 2.2 MANUALS, GENERAL

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
  1. Title page.
  2. Table of contents.
  3. Manual contents.
- B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
  1. Subject matter included in manual.
  2. Name and address of Project.
  3. Name and address of Owner.
  4. Date of submittal.

5. Name, address, and telephone number of Contractor.
  6. Name and address of Engineer.
  7. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
    - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
  2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
  3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
  4. Supplementary Text: Prepared on 8-1/2-by-11-inch (215-by-280-mm) white bond paper.
  5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
    - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

## 2.3 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

## 2.4 PRODUCT MAINTENANCE MANUAL

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Product Information: Include the following, as applicable:

1. Product name and model number.
  2. Manufacturer's name.
  3. Color, pattern, and texture.
  4. Material and chemical composition.
  5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
  2. Types of cleaning agents to be used and methods of cleaning.
  3. List of cleaning agents and methods of cleaning detrimental to product.
  4. Schedule for routine cleaning and maintenance.
  5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

### PART 3 - EXECUTION

#### 3.1 MANUAL PREPARATION

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
- B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
  2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
1. Do not use original Project Record Documents as part of operation and maintenance manuals.
  2. Comply with requirements of newly prepared Record Drawings in Division 01 Section "Project Record Documents."
- F. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.
- G. Refer to Division 23 and Division 26 sections for additional requirements related to preparation of the operation and maintenance manuals.

END OF SECTION

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:

- 1. Record Drawings.
- 2. Record Specifications.
- 3. Record Product Data.

- B. Related Sections include the following:

- 1. Division 01 Section "Closeout Procedures" for general closeout procedures.
- 2. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
- 3. Divisions 02 through 26 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.3 SUBMITTALS

- A. Record Drawings: Comply with the following:

- 1. Number of Copies: Submit one set(s) of marked-up Record Prints.

- B. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications.

- C. Record Product Data: Submit one copy of each Product Data submittal.

- 1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

## PART 2 - PRODUCTS

## 2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
    - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    - b. Accurately record information in an understandable drawing technique.
    - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
  2. Content: Types of items requiring marking include, but are not limited to, the following:
    - a. Dimensional changes to Drawings.
    - b. Revisions to details shown on Drawings.
    - c. Revisions to routing of piping and conduits.
    - d. Revisions to electrical circuitry.
    - e. Actual equipment locations.
    - f. Locations of concealed internal utilities.
    - g. Changes made by Change Order or Construction Change Directive.
    - h. Changes made following Engineer's written orders.
    - i. Details not on the original Contract Drawings.
    - j. Field records for variable and concealed conditions.
    - k. Record information on the Work that is shown only schematically.
    - l. If applicable, modification due to addendums.
    - m. If applicable, value engineering modifications.
  3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
  4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
  5. Mark important additional information that was either shown schematically or omitted from original Drawings.
  6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Transparencies: Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with Engineer. When authorized, prepare a full set of corrected transparencies of the Contract Drawings and Shop Drawings.
1. Incorporate changes and additional information previously marked on Record Prints. Erase, redraw, and add details and notations where applicable.

2. Refer instances of uncertainty to Engineer for resolution.
  3. Owner will furnish Contractor one set of transparencies of the Contract Drawings for use in recording information.
  4. Print the Contract Drawings and Shop Drawings for use as Record Transparencies. Engineer will make the Contract Drawings available to Contractor's print shop.
- C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
  2. Record Transparencies: Organize into unbound sets matching Record Prints. Place transparencies in durable tube-type drawing containers with end caps. Mark end cap of each container with identification. If container does not include a complete set, identify Drawings included.
  3. Identification: As follows:
    - a. Project name.
    - b. Date.
    - c. Designation "PROJECT RECORD DRAWINGS."
    - d. Name of Engineer.
    - e. Name of Contractor.

## 2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
  3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
  4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
  5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

## 2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.

3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Engineer's reference during normal working hours.

END OF SECTION

## SECTION 017900 - DEMONSTRATION AND TRAINING

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
  - 1. Demonstration of operation of systems, subsystems, and equipment.
  - 2. Training in operation and maintenance of systems, subsystems, and equipment.
- B. Related Sections include the following:
  - 1. Division 01 Section "Project Management and Coordination" for requirements for preinstruction conferences.
  - 2. Divisions 02 through 26 Sections for specific requirements for demonstration and training for products in those Sections.

## 1.3 SUBMITTALS

- A. Instruction Program: Submit two copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
  - 1. At completion of training, submit one complete training manual(s) for Owner's use.
- B. Attendance Record: For each training module, submit list of participants and length of instruction time.
- C. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

## 1.4 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Photographer Qualifications: A photographer who is experienced photographing construction projects.
- D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
  - 1. Inspect and discuss locations and other facilities required for instruction.
  - 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
  - 3. Review required content of instruction.
  - 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

## 1.5 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Engineer.

## PART 2 - PRODUCTS

### 2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
  - 1. Heating System
  - 2. Electrical Systems
  - 3. Automatic Temperature Control Systems
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:
  - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
    - a. System, subsystem, and equipment descriptions.

- b. Performance and design criteria if Contractor is delegated design responsibility.
  - c. Operating standards.
  - d. Regulatory requirements.
  - e. Equipment function.
  - f. Operating characteristics.
  - g. Limiting conditions.
  - h. Performance curves.
2. Documentation: Review the following items in detail:
    - a. Operations manuals.
    - b. Maintenance manuals.
    - c. Project Record Documents.
    - d. Identification systems.
    - e. Warranties and bonds.
    - f. Maintenance service agreements and similar continuing commitments.
  3. Operations: Include the following, as applicable:
    - a. Startup procedures.
    - b. Equipment or system break-in procedures.
    - c. Routine and normal operating instructions.
    - d. Regulation and control procedures.
    - e. Control sequences.
    - f. Safety procedures.
    - g. Instructions on stopping.
    - h. Normal shutdown instructions.
    - i. Operating procedures for emergencies.
    - j. Operating procedures for system, subsystem, or equipment failure.
    - k. Required sequences for electric or electronic systems.
    - l. Special operating instructions and procedures.
  4. Adjustments: Include the following:
    - a. Alignments.
    - b. Checking adjustments.
    - c. Noise and vibration adjustments.
    - d. Economy and efficiency adjustments.
  5. Troubleshooting: Include the following:
    - a. Diagnostic instructions.
    - b. Test and inspection procedures.
  6. Maintenance: Include the following:
    - a. Inspection procedures.
    - b. Procedures for preventive maintenance.
    - c. Procedures for routine maintenance.
    - d. Instruction on use of special tools.
  7. Repairs: Include the following:

- a. Diagnosis instructions.
- b. Repair instructions.
- c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
- d. Instructions for identifying parts and components.
- e. Review of spare parts needed for operation and maintenance.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.
- B. Set up instructional equipment at instruction location.

#### 3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
  1. Engineer will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
  2. Owner will furnish an instructor to describe Owner's operational philosophy.
  3. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
  1. Schedule training with Owner, through Engineer, with at least seven days' advance notice.

END OF SECTION

DIVISION 01  
SECTION 019113  
GENERAL COMMISSIONING REQUIREMENTS  
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## SECTION 019113 - GENERAL COMMISSIONING 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. This Section includes general requirements that apply to implementation of commissioning without regard to systems, subsystems, and equipment being commissioned.
- B. Related Sections include the following:
  - 1. Division 01 Section "*HVAC Commissioning Requirements*" for specific requirements for commissioning HVAC systems.
  - 2. Division 01 Section "*Contract Closeout*" for specific requirements for closeout at substantial and final completion.
  - 3. Division 01 Section "*Contract Closeout*" for Specific Requirements for training and demonstration of systems to Owner.
  - 4. Division 01 Section "*Contract Closeout*" for Specific Requirements related to the Preparation of systems operation and maintenance manuals.

## 1.3 DEFINITIONS

- A. CxA: Commissioning Authority.
- B. OPR: Owner's Project Requirements.
- C. Systems, Subsystems, and Equipment: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, and equipment.
- D. TAB: Testing, Adjusting, and Balancing.

## 1.4 COMMISSIONING TEAM

- A. Members Appointed by Contractor(s): Individuals, each having authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated actions. The commissioning team shall consist of, but not be limited to, representatives of Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.

## B. Members Appointed by Owner:

1. CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract. The CxA for this project shall be performed by Gipe Associates, Inc., 8719 Brooks Drive, Easton, Maryland 21601, (410) 822-8688 - telephone, (410) 822-6306 – fax.
2. Representatives of the facility user and operation and maintenance personnel.
3. Architect and engineering design professionals.

## 1.5 OWNER'S RESPONSIBILITIES

## A. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities including, but not limited to, the following:

1. Coordination meetings.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Testing meetings.
4. Demonstration of operation of systems, subsystems, and equipment.

## 1.6 CONTRACTOR'S RESPONSIBILITIES

## A. Provide utility services required for the commissioning process.

## B. Contractor shall assign representatives with expertise and authority to act on behalf of the Contractor and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:

1. Participate in commissioning and construction-phase coordination meetings.
2. Participate in maintenance orientation and inspection.
3. Participate in operation and maintenance training sessions.
4. Participate in final review at acceptance meeting.
5. Certify that Work is complete and systems are operational according to the Contract Documents, including calibration of instrumentation and controls.
6. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
7. Review and approve final commissioning documentation.
8. Certify that all pre-test work is complete and operational prior to scheduling performed testing by CxA.
9. The mechanical contractor, test/balance subcontractor, and automatic temperature control subcontractor must be present during all functional performance testing.

## C. Subcontractors shall assign representatives with expertise and authority to act on behalf of subcontractors and schedule them to participate in and perform commissioning team activities including, but not limited to, the following:

1. Participate in commissioning and construction-phase coordination meetings.
2. Participate in maintenance orientation and inspection.
3. Participate in procedures meeting for testing.

4. Participate in final review at acceptance meeting.
5. Provide schedule for operation and maintenance data submittals, equipment startup, and testing to CxA for incorporation into the commissioning plan. Update schedule on a weekly basis throughout the construction period.
6. Provide information to the CxA for developing construction-phase commissioning plan.
7. Participate in training sessions for Owner's operation and maintenance personnel.
8. Provide updated Project Record Documents to the CxA on a daily basis.
9. Gather and submit operation and maintenance data for systems, subsystems, and equipment to the CxA, as specified in Division 01 Section "Operation and Maintenance Data."
10. Provide technicians who are familiar with the construction and operation of installed systems and who shall develop specific test procedures and participate in testing of installed systems, subsystems, and equipment.
11. The test/balance subcontractor, mechanical contractor, and automatic temperature controls subcontractor must be on-site and provide assistance during all functional performance testing.

#### 1.7 CxA'S RESPONSIBILITIES

- A. Organize and lead the commissioning team.
- B. Prepare a construction-phase commissioning plan. Collaborate with Contractor and with subcontractors to develop test and inspection procedures. Include design changes and scheduled commissioning activities coordinated with overall Project schedule. Identify commissioning team member responsibilities, by name, firm, and trade specialty, for performance of each commissioning task.
- C. Convene commissioning team meetings for the purpose of coordination, communication, and conflict resolution; discuss progress of the commissioning processes. Responsibilities include arranging for facilities, preparing agenda and attendance lists, and notifying participants. The CxA shall prepare and distribute minutes to commissioning team members and attendees within five workdays of the commissioning meeting.
- D. At a mutually agreed upon time, conduct an initial construction-phase coordination meeting for the purpose of reviewing the commissioning activities and establishing tentative schedules for operation and maintenance submittals; operation and maintenance training sessions; TAB Work; and Project completion.
- E. Observe and inspect construction and report progress and deficiencies. In addition to compliance with the Contract Documents, inspect systems and equipment installation for adequate accessibility for maintenance and component replacement or repair.
- F. Prepare Project-specific test and inspection procedures and checklists.
- G. Schedule, direct, witness, and document tests, inspections, and systems startup.
- H. Compile test data, inspection reports, and certificates and include them in the systems manual and commissioning report.
- I. Certify date of acceptance and startup for each item of equipment for start of warranty periods.

- J. Review Project Record Documents for accuracy. Request revisions from Contractor to achieve accuracy. Project Record Documents requirements are specified in Division 01 Section "Project Record Documents."
- K. Review and comment on operation and maintenance documentation and systems manual outline for compliance with the Contract Documents. Operation and maintenance documentation requirements are specified in Division 01 Section "Operation and Maintenance Data."
- L. Assemble the final commissioning documentation, including the commissioning report and Project Record Documents.

## 1.8 COMMISSIONING DOCUMENTATION

- A. Commissioning Plan: A document, prepared by CxA, that outlines the schedule, allocation of resources, and documentation requirements of the commissioning process, and shall include, but is not limited to the following:
  - 1. Plan for delivery and review of submittals, systems manuals, and other documents and reports. Identification of the relationship of these documents to other functions and a detailed description of submittals that are required to support the commissioning processes. Submittal dates shall include the latest date approved submittals must be received without adversely affecting commissioning plan.
  - 2. Description of the organization, layout, and content of commissioning documentation (including systems manual) and a detailed description of documents to be provided along with identification of responsible parties.
  - 3. Identification of systems and equipment to be commissioned.
  - 4. Description of schedules for testing procedures along with identification of parties involved in performing and verifying tests.
  - 5. Identification of items that must be completed before the next operation can proceed.
  - 6. Description of responsibilities of commissioning team members.
  - 7. Description of observations to be made.
  - 8. Description of requirements for operation and maintenance training, including required training materials.
  - 9. Description of expected performance for systems, subsystems, equipment, and controls.
  - 10. Schedule for commissioning activities with specific dates coordinated with overall construction schedule.
  - 11. Identification of installed systems, subsystems, and equipment, including design changes that occurred during the construction phase.
  - 12. Process and schedule for documenting changes on a continuous basis to appear in Project Record Documents.
  - 13. Process and schedule for completing prestart and startup checklists for systems, subsystems, and equipment to be verified and tested.
  - 14. Step-by-step procedures for testing systems, subsystems, and equipment with descriptions for methods of verifying relevant data, recording the results obtained, and listing parties involved in performing and verifying tests.
- B. Test Checklists: CxA, with assistance of Contractor and Subcontractors, shall develop test checklists for each system, subsystem, or equipment including interfaces and interlocks, and include a separate entry, with space for comments, for each item to be tested. Prepare separate checklists for each mode of operation and provide space to indicate whether the mode under test

responded as required. Provide space for testing personnel to sign off on each checklist. Specific checklist content requirements are specified in Division 01 Section "HVAC Commissioning Requirements", "Electrical Commissioning Requirements" and "Plumbing System Commissioning Requirements." Test checklists will be jointly developed as the project progresses. Each checklist, regardless of system, subsystem, or equipment being tested, shall include, but not be limited to, the following:

1. Name and identification code of tested item.
  2. Test number.
  3. Time and date of test.
  4. Indication of whether the record is for a first test or retest following correction of a problem or issue.
  5. Dated signatures of the person performing test and of the witness, if applicable.
  6. Individuals present for test.
  7. Deficiencies.
  8. Issue number, if any, generated as the result of test.
- C. Certificate of Readiness: Certificate of Readiness shall be signed by Contractor, Subcontractor(s), Installer(s), and CxA certifying that systems, subsystems, equipment, and associated controls are ready for testing. Completed test checklists signed by the responsible parties shall accompany this certificate.
- D. Test and Inspection Reports: CxA shall record test data, observations, and measurements on test checklists. Photographs, forms, and other means appropriate for the application shall be included with data. CxA shall compile test and inspection reports and test and inspection certificates and include them in systems manual and commissioning report.
- E. Corrective Action Documents: CxA shall document corrective action taken for systems and equipment that fail tests. Include required modifications to systems and equipment and revisions to test procedures, if any. Retest systems and equipment requiring corrective action and document retest results.
- F. Issues Log: CxA shall prepare and maintain an issues log that describes design, installation, and performance issues that are at variance with the Contract Documents. Identify and track issues as they are encountered, documenting the status of unresolved and resolved issues.
1. Creating an Issues Log Entry:
    - a. Identify the issue with unique numeric or alphanumeric identifier by which the issue may be tracked.
    - b. Assign a descriptive title of the issue.
    - c. Identify date and time of the issue.
    - d. Identify test number of test being performed at the time of the observation, if applicable, for cross-reference.
    - e. Identify system, subsystem, and equipment to which the issue applies.
    - f. Identify location of system, subsystem, and equipment.
    - g. Include information that may be helpful in diagnosing or evaluating the issue.
    - h. Note recommended corrective action.
    - i. Identify commissioning team member responsible for corrective action.
    - j. Identify expected date of correction.
    - k. Identify person documenting the issue.

2. Documenting Issue Resolution:
    - a. Log date correction is completed or the issue is resolved.
    - b. Describe corrective action or resolution taken. Include description of diagnostic steps taken to determine root cause of the issue, if any.
    - c. Identify changes to the Contract Documents that may require action.
    - d. State that correction was completed and system, subsystem, and equipment is ready for retest, if applicable.
    - e. Identify person(s) who corrected or resolved the issue.
    - f. Identify person(s) documenting the issue resolution.
  3. Issues Log Report: On a periodic basis, but not less than for each commissioning team meeting, CxA shall prepare a written narrative for review of outstanding issues and a status update of the issues log. As a minimum, CxA shall include the following information in the issues log and expand it in the narrative:
    - a. Issue number and title.
    - b. Date of the identification of the issue.
    - c. Name of the commissioning team member assigned responsibility for resolution.
    - d. Expected date of correction.
- G. Commissioning Report: CxA shall document results of the commissioning process including unresolved issues and performance of systems, subsystems, and equipment. The commissioning report shall indicate whether systems, subsystems, and equipment have been completed and are performing according to the Contract Documents. The commissioning report shall include, but is not limited to, the following:
1. Lists and explanations of substitutions; compromises; variances in the Contract Documents; record of conditions; and, if appropriate, recommendations for resolution. This report shall be used to evaluate systems, subsystems, and equipment and shall serve as a future reference document during Owner occupancy and operation. It shall describe components and performance that exceed requirements of the Contract Documents and those that do not meet requirements of the Contract Documents. It may also include a recommendation for accepting or rejecting systems, subsystems, and equipment.
  2. Commissioning plan.
  3. Testing plans and reports.
  4. Corrective modification documentation.
  5. Issues log.
  6. Completed test checklists.
  7. Listing of off-season test(s) not performed and a schedule for their completion.
  8. All commissioning documents must be submitted to the building Owner within 90 days of the date of receipt of the Certificate of Occupancy.
- H. Systems Manual: CxA shall gather required information and compile systems manual. Systems manual shall include, but is not limited to, the following:
1. Project Record Documents as specified in Division 01 Section "Project Record Documents."
  2. Final commissioning plan.
  3. Commissioning report.
  4. Operation and maintenance data as specified in Division 01 Section "Operation and Maintenance Data."

## 1.9 SUBMITTALS

- A. Test Checklists and Report Forms: CxA shall submit sample checklists and forms to Contractor quality-control manager and subcontractors for review and comment. Submit two copies of each checklist and report form.
- B. Test and Inspection Reports: CxA shall submit test and inspection reports.
- C. Corrective Action Documents: CxA shall submit corrective action documents.

## 1.10 QUALITY ASSURANCE

- A. Instructor Qualifications: Factory-authorized service representatives, experienced in training, operation, and maintenance procedures for installed systems, subsystems, and equipment.
- B. Test Equipment Calibration: Comply with test equipment manufacturer's calibration procedures and intervals. Recalibrate test instruments immediately whenever instruments have been repaired following damage or dropping. Affix calibration tags to test instruments. Instruments shall have been calibrated within six months prior to use.

## 1.11 COORDINATION

- A. Coordinating Meetings: CxA shall conduct coordination meetings of the commissioning team to review progress on the commissioning plan, to discuss scheduling conflicts, and to discuss upcoming commissioning process activities.
- B. Pretesting Meetings: CxA shall conduct pretest meetings of the commissioning team to review startup reports, pretest inspection results, testing procedures, testing personnel and instrumentation requirements, and manufacturers' authorized service representative services for each system, subsystem, equipment, and component to be tested.
- C. Testing Coordination: CxA shall coordinate sequence of testing activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
  - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- D. Manufacturers' Field Services: CxA and Contractor shall coordinate services of manufacturers' field services.

## 1.12 ALTERNATES

- A. Refer to Division 01 Section, "Alternates" for description of work under this section affected by alternates.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 OPERATION AND MAINTENANCE TRAINING REQUIREMENTS

- A. Training Preparation Conference: Before operation and maintenance training, CxA shall convene a training preparation conference to include Owner's operation and maintenance personnel, Contractor, and subcontractors. In addition to requirements specified in Division 01 Section "Demonstration and Training," perform the following:
  - 1. Review installed systems, subsystems, and equipment.
  - 2. Review instructor qualifications.
  - 3. Review instructional methods and procedures.
  - 4. Review training module outlines and contents.
  - 5. Review course materials (including operation and maintenance manuals).
  - 6. Inspect and discuss locations and other facilities required for instruction.
  - 7. Review and finalize training schedule and verify availability of educational materials, instructors, audiovisual equipment, and facilities needed to avoid delays.
  - 8. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.
  
- B. Training Modules: Develop an instruction program that includes individual training modules for each system, subsystem, and equipment as specified in Division 01 Section "Demonstration and Training."

END OF SECTION

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SECTION 019115  
HVAC COMMISSIONING REQUIREMENTS  
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## SECTION 019115 - HVAC COMMISSIONING 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. This Section includes requirements for commissioning the HVAC system and its subsystems and equipment. This Section supplements the general requirements specified in Division 01 Section "General Commissioning Requirements."
- B. Related Sections include the following:
  - 1. Division 01 Section "General Commissioning Requirements" for general requirements for commissioning processes that apply to this Section.
- C. The following systems and/or equipment shall be commissioned:
  - 1. Chilled water system, including new chiller.
  - 2. Existing chilled water and condenser water pumps.
  - 3. Existing cooling tower.
  - 4. HVAC controls and sequences of operation.
  - 5. Flow measuring stations.
  - 6. All pumps.
  - 7. Variable frequency drives.
  - 8. Automatic Temperature Control System.

## 1.3 DEFINITIONS

- A. Architect: Includes Architect identified in the Contract for Construction between Owner and Contractor, plus consultant/design professionals responsible for design of HVAC, electrical, communications, controls for HVAC systems, and other related systems.
- B. CxA: Commissioning Authority.
- C. Systems, Subsystems, and Equipment: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, and equipment.
- D. TAB: Testing, Adjusting, and Balancing.

## 1.4 CONTRACTOR'S RESPONSIBILITIES

- A. The following responsibilities are in addition to those specified in Division 01 Section "General Commissioning Requirements."
- B. Contractor:
  - 1. Attend procedures meeting for TAB Work.
  - 2. Certify that TAB Work is complete.
- C. Mechanical Contractor:
  - 1. Attend TAB verification testing.
  - 2. Provide measuring instruments and logging devices to record test data, and data acquisition equipment to record data for the complete range of testing for the required test period.
- D. HVAC Instrumentation and Control Contractor: With the CxA, review control designs for compliance with the Contract Documents, controllability with respect to actual equipment to be installed, and recommend adjustments to control designs and sequence of operation descriptions.
- E. TAB Subcontractor:
  - 1. Contract Documents Review: With the CxA, review the Contract Documents before developing TAB procedures.
    - a. Verify the following:
      - 1) Accessibility of equipment and components required for TAB Work.
      - 2) Adequate number and placement of duct balancing dampers to allow proper balancing while minimizing sound levels in occupied spaces.
      - 3) Adequate number and placement of balancing valves to allow proper balancing and recording of water flow.
      - 4) Adequate number and placement of test ports and test instrumentation to allow reading and compilation of system and equipment performance data needed to conduct both TAB and commissioning testing.
      - 5) Air and water flow rates have been specified and compared to central equipment output capacities.
    - b. Identify discontinuities and omissions in the Contract Documents.
    - c. This review of the Contract Documents by the TAB Subcontractor satisfies requirements for a design review report as specified in Division 23 Section "Testing Adjusting & Balancing for HVAC & Plumbing."
  - 2. Additional Responsibilities: Participate in tests specified in Division 23 Sections "Instrumentation & Controls of HVAC & Plumbing Systems."
- F. Electrical Contractor:

1. With the Mechanical Contractor, coordinate installations and connections between and among electrical and HVAC systems, subsystems, and equipment.
2. Attend TAB verification testing.

#### 1.5 COMMISSIONING DOCUMENTATION

- A. The following are in addition to documentation specified in Division 01 Section "General Commissioning Requirements."
- B. Test Checklists: CxA with assistance of Contractor shall develop test checklists for HVAC systems, subsystems, and equipment, including interfaces and interlocks with other systems. CxA shall prepare separate checklists for each mode of operation and provide space to indicate whether the mode under test responded as required. In addition to the requirements specified in Division 01 Section "General Commissioning Requirements," checklists shall include, but not be limited to, the following:
  1. Calibration of sensors and sensor function.
  2. Testing conditions under which test was conducted, including (as applicable) ambient conditions, set points, override conditions, and status and operating conditions that impact the results of test.
  3. Control sequences for HVAC systems.
  4. Strength of control signal for each set point at specified conditions.
  5. Responses to control signals at specified conditions.
  6. Sequence of response(s) to control signals at specified conditions.
  7. Electrical demand or power input at specified conditions.
  8. Power quality and related measurements.
  9. Expected performance of systems, subsystems, and equipment at each step of test.
  10. Narrative description of observed performance of systems, subsystems, and equipment. Notation to indicate whether the observed performance at each step meets the expected results.
  11. Interaction of auxiliary equipment.
  12. Issues log.

#### 1.6 SUBMITTALS

- A. The following submittals are in addition to those specified in Division 01 Section "General Commissioning Requirements."
- B. Testing Procedures: CxA shall submit detailed testing plan, procedures, and checklists for each series of tests. Submittals shall include samples of data reporting sheets that will be part of the reports.
- C. Certificate of Readiness: CxA shall compile certificates of readiness from Contractor certifying that systems, subsystems, equipment, and associated controls are ready for testing.
- D. Certificate of Completion of Installation, Prestart, and Startup: CxA shall certify that installation, prestart, and startup activities have been completed. Certification shall include completed checklists provided by TAB Subcontractor as specified in Division 23 Section "Testing Adjusting & Balancing for HVAC & Plumbing."

- E. Test and Inspection Reports: CxA shall compile and submit test and inspection reports and certificates, and shall include them in systems manual and commissioning report.
- F. Corrective Action Documents: CxA shall submit corrective action documents.
- G. Certified TAB Reports: CxA shall submit verified, certified TAB reports.

## 1.7 ALTERNATES

- A. Refer to Division 01, *-Alternates* for description of work under this section affected by alternates.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 TESTING PREPARATION

- A. Prerequisites for Testing:
  - 1. Certify that HVAC systems, subsystems, and equipment have been completed, calibrated, and started; are operating according to the Contract Documents; and that Certificates of Readiness are signed and submitted.
  - 2. Certify that HVAC instrumentation and control systems have been completed and calibrated; are operating according to the Contract Documents; and that pretest set points have been recorded.
  - 3. Certify that TAB procedures have been completed, and that TAB reports have been submitted, discrepancies corrected, and corrective work approved.
  - 4. Test systems and intersystem performance after approval of test checklists for systems, subsystems, and equipment.
  - 5. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shut down, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).
  - 6. Verify each operating cycle after it has been running for a specified period and is operating in a steady-state condition.
  - 7. Inspect and verify the position of each device and interlock identified on checklists. Sign off each item as acceptable, or failed. Repeat this test for each operating cycle that applies to system being tested.
  - 8. Check safety cutouts, alarms, and interlocks with life-safety systems during each mode of operation.
  - 9. Annotate checklist or data sheet when a deficiency is observed.
  - 10. Verify equipment interface with monitoring and control system and TAB criteria; include the following:
    - a. Pump flow rates, pressure and amperage at each operating mode.
    - b. Sequences of operation of all HVAC equipment.
    - c. Variable speed drive parameters at each operated mode.
    - d. Operation/Accuracy of flow measuring stations at various flow rates.

- e. Chiller flow rates, temperatures, set points, and safeties.
  - f. Fluid flow rates and temperature for all water cooled equipment.
11. Verify proper responses of monitoring and control system controllers and sensors to include the following:
    - a. For each controller or sensor, record the indicated monitoring and control system reading and the test instrument reading. If initial test indicates that the test reading is outside of the control range of the installed device, check calibration of the installed device and adjust as required. Retest malfunctioning devices and record results on checklist or data sheet.
    - b. Report deficiencies and prepare an issues log entry.
  12. Verify that HVAC equipment field quality-control testing has been completed and approved. CxA shall direct, witness, and document field quality-control tests, inspections, and startup specified in individual Division 23 Sections.
- B. Testing Instrumentation: Install measuring instruments and logging devices to record test data for the required test period. Instrumentation shall monitor and record full range of operating conditions and shall allow for calculation of total capacity of system for each mode of operation. For individual room cooling tests, provide temporary heaters to impose a cooling load. Operational modes include the following:
1. Cooling Mode.
  2. Occupied and unoccupied.
  3. Life-safety and safety systems.
  4. Temporary upset of system operation.
  5. Lead/lag modes where redundant equipment is indicated.
  6. All alarms.

### 3.2 TAB VERIFICATION

- A. TAB Subcontractor shall coordinate with CxA for work required in Division 23 Section "Testing Adjusting & Balancing for HVAC & Plumbing." TAB Subcontractor shall copy CxA with required reports, sample forms, checklists, and certificates.
- B. Contractor, HVAC Contractor, and CxA shall witness TAB Work.
- C. TAB Preparation:
  1. TAB Subcontractor shall provide CxA with data required for "Pre-Field TAB Engineering Reports" specified in Division 23 Section "Testing Adjusting & Balancing for HVAC & Plumbing."
    - a. CxA shall use this data to certify that prestart and startup activities have been completed for systems, subsystems, and equipment installation.
- D. Verification of Final TAB Report:

1. CxA shall select, at random, 10 percent of report for field verification.
  2. CxA shall notify TAB Subcontractor 10 days in advance of the date of field verification; however, notice shall not include data points to be verified. The TAB Subcontractor shall use the same instruments (by model and serial number) that were used when original data were collected.
  3. Failure of an item is defined as follows:
    - a. For all readings a deviation of more than 10 percent.
  4. Failure of more than 10 percent of selected items shall result in rejection of final TAB report.
- E. If deficiencies are identified during verification testing, CxA shall notify the HVAC Contractor and Engineer, and shall take action to remedy the deficiency. Architect shall review final tabulated checklists and data sheets to determine if verification is complete and that system is operating according to the Contract Documents.
- F. CxA shall certify that TAB Work has been successfully completed.

### 3.3 TESTING

- A. Test systems and intersystem performance after test checklists for systems, subsystems, and equipment have been approved.
- B. Perform tests using design conditions whenever possible.
1. Simulate conditions by imposing an artificial load when it is not practical to test under design conditions and when written approval for simulated conditions is received from CxA. Before simulating conditions, calibrate testing instruments. Set and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.
  2. Alter set points when simulating conditions is not practical and when written approval is received from CxA.
  3. Alter sensor values with a signal generator when design or simulating conditions and altering set points are not practical. Do not use sensor to act as signal generator to simulate conditions or override values.
- C. Scope of HVAC Contractor Testing:
1. Testing scope shall include entire HVAC installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. It shall include measuring capacities and effectiveness of operational and control functions.
  2. Test all operating modes, interlocks, control responses, responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.
- D. Detailed Testing Procedures: CxA, with HVAC Contractor, TAB Subcontractor, and HVAC Instrumentation and Control Contractor, shall prepare detailed testing plans, procedures, and checklists for HVAC systems, subsystems, and equipment.

- E. HVAC Instrumentation and Control System Testing:
1. Field testing plans and testing requirements are specified in Division 23 Section "Instrumentation & Controls of HVAC & Plumbing Systems". The CxA, HVAC Contractor, Equipment Provider/Manufacturer and the HVAC Instrumentation and Control Contractor shall collaborate to prepare testing plans.
  2. CxA shall convene a meeting of appropriate entities to review test report of HVAC instrumentation and control systems.
- F. Refrigeration System Testing: HVAC Contractor shall prepare a testing plan to verify performance of chiller, refrigerant compressors and condensers, existing cooling tower, existing chilled water pumps, existing condenser water pumps, and other refrigeration systems. Plan shall include the following:
1. Sequence of testing and testing procedures for each item of equipment and section of pipe to be tested, identified by identification marker. Markers shall be keyed to Drawings showing the physical location of each item of equipment and pipe test section. Drawings shall be formatted to allow each item of equipment and section of piping to be physically located and identified when referred to in the system testing plan.
  2. Tracking checklist for managing and ensuring that all pipe sections have been tested.
  3. Variable refrigerant flow equipment volts, amps, temperatures, and modes of operation.
- G. HVAC Distribution System Testing: HVAC Contractor shall prepare a testing plan to verify performance of hydronic distribution systems; and other distribution systems. Include HVAC terminal equipment and unitary equipment. Plan shall include the following:
1. Sequence of testing and testing procedures for each item of equipment and section of pipe to be tested, identified by identification marker. Markers shall be keyed to Drawings showing the physical location of each item of equipment and pipe test section. Drawings shall be formatted to allow each item of equipment and section of piping to be physically located and identified when referred to in the system testing plan.
  2. Tracking checklist for managing and ensuring that all pipe sections have been tested.
  3. Equipment, fluid flow rates, safeties.
- H. Deferred Testing:
1. If tests cannot be completed because of a deficiency outside the scope of the HVAC system, the deficiency shall be documented and reported to Owner. Deficiencies shall be resolved and corrected by appropriate parties and test rescheduled.
  2. If the testing plan indicates specific seasonal testing, appropriate initial performance tests shall be completed and documented and additional tests scheduled.
- I. Testing Reports:
1. Reports shall include measured data, data sheets, and a comprehensive summary describing the operation of systems at the time of testing.
  2. Include data sheets for each controller to verify proper operation of the control system, the system it serves, the service it provides, and its location. For each controller, provide space for recording its readout, the reading at the controller's sensor(s), plus comments. Provide space for testing personnel to sign off on each data sheet.

3. Prepare a preliminary test report. Deficiencies will be evaluated by Engineer to determine corrective action. Deficiencies shall be corrected and test repeated.

END OF SECTION

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COMMON WORK RESULTS FOR HVAC  
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## SECTION 230500 COMMON WORK RESULTS FOR HVAC

## PART 1. GENERAL

## 1.1 SUMMARY

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Provide all labor, materials, equipment, and services necessary for and incidental to the complete installation and operation of all mechanical work.
- C. Unless otherwise specified, all submissions shall be made to, and acceptances and approvals made by the Engineer.
- D. Contract Drawings are generally diagrammatic and all offsets, fittings, transitions and accessories are not necessarily shown. Furnish and install all such items as may be required to fit the work to the conditions encountered. Arrange piping, equipment, and other work generally as shown on the contract drawings, providing proper clearance and access. Where departures are proposed because of field conditions or other causes, prepare and submit detailed shop drawings for approval in accordance with *Submittals* specified below. The right is reserved to make reasonable changes in location of equipment, piping, and ductwork, up to the time of rough-in or fabrication.
- E. Conform to the requirements of all rules, regulations and codes of local, state and federal authorities having jurisdiction.
- F. Coordinate the work under Division 23 with the work of all other construction trades.
- G. Be responsible for all construction means, methods, techniques, procedures, and phasing sequences used in the work. Furnish all tools, equipment and materials necessary to properly perform the work in first class, substantial, and workmanlike manner, in accordance with the full intent and meaning of the contract documents.

## 1.2 PERMITS AND FEES

- A. Obtain all permits and pay taxes, fees and other costs in connection with the work. File necessary plans, prepare documents, give proper notices and obtain necessary approvals. Deliver inspection and approval certificates to Owner prior to final acceptance of the work.
- B. Permits and fees shall comply with the Division 01, *General Requirements* of the specification.

## 1.3 EXAMINATION OF SITE

- A. Examine the site, determine all conditions and circumstances under which the work must be done, and make all necessary allowances for same. No additional cost to the Owner will be permitted for contractors' failure to do so.
- B. Examine and verify specific conditions described in individual specifications sections.

- C. Verify that utility services are available, of the correct characteristics, and in the correct locations.

#### 1.4 CONTRACTOR QUALIFICATION

- A. Any Contractor or Subcontractor performing work under Division 23 shall be fully qualified and acceptable to the Engineer and Owner. Submit the following evidence when requested:
  - 1. A list of not less than five comparable projects which the Contractor completed.
  - 2. Letter of reference from not less than three registered professional engineers, general contractors or building owners.
  - 3. Local and/or State License, where required.
  - 4. Membership in trade or professional organizations where required.
- B. A Contractor is any individual, partnership, or corporation, performing work by contract or subcontract on this project.
- C. Acceptance of a Contractor or Subcontractor will not relieve the Contractor or subcontractor of any contractual requirements or his responsibility to supervise and coordinate the work, of various trades.

#### 1.5 MATERIALS AND EQUIPMENT

- A. Materials and equipment installed as a permanent part of the project shall be new, unless otherwise indicated or specified, and of the specified type and quality. The Contractor shall be responsible for connecting all utilities as shown on the drawings, to equipment identified as existing.
- B. Where material or equipment is identified by proprietary name, model number and/or manufacturer, furnish named item, or its equal, subject to approval by Engineer. Substituted items shall be equal or better in quality and performance and must be suitable for available space, required arrangement, and application. Submit all data necessary to determine suitability of substituted items, for approval.
- C. The suitability of named item only has been verified. Where more than one item is named, only the first named item has been verified as suitable. Substituted items, including items other than first named shall be equal or better in quality and performance to that of specified items, and must be suitable for available space, required arrangement and application. Contractor, by providing other than the first named manufacturer, assumes responsibility for all necessary adjustments and modifications necessary for a satisfactory installation. Adjustments and modifications shall include but not be limited to electrical, structural, support, and architectural work.
- D. Substitution will not be permitted for specified items of material or equipment where noted.

- E. All items of equipment furnished shall have a service record of at least five (5) years.

#### 1.6 FIRE SAFE MATERIALS

- A. Unless otherwise indicated, materials and equipment shall conform to UL, NFPA and ASTM standards for fire safety with smoke and fire hazard rating not exceeding flame spread of 25 and smoke developed of 50.

#### 1.7 REFERENCED STANDARDS, CODES AND SPECIFICATIONS

- A. Specifications, Codes and Standards listed below are included as part of this specification, latest edition.
- B. AABC - Associated Air Balance Council
- C. ACCA - Air Conditioning Contractors of America
- D. ARI - Air Conditioning and Refrigeration Institute
- E. ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers
- F. ASME - American Society of Mechanical Engineers
- G. ASTM - American Society for Testing and Materials
- H. IBC - International Building Code
- I. IEEE - Institute of Electrical and Electronics Engineers
- J. MSSP - Manufacturers Standards Society of the Valve and Fittings Industry
- K. NEC - National Electrical Code
- L. NEMA - National Electrical Manufacturers Association
- M. NFPA - National Fire Protection Association
- N. SMACNA - Sheet Metal and Air Conditioning Contractors National Association
- O. UL - Underwriters' Laboratories
- P. All mechanical equipment and materials shall comply with the codes and standards listed in the latest edition of ASHRAE HVAC Applications Handbook, Chapter entitled *Codes and Standards*.

#### 1.8 SUBMITTALS, REVIEW AND ACCEPTANCE

- A. Equipment, materials, installation, workmanship and arrangement of work are subject to review and acceptance. No substitution will be permitted after acceptance of equipment or materials except where such substitution is considered by the Engineer to be in best interest of Owner.
- B. After acceptance of Material and Equipment List, submit three (3) copies or more as required under General Conditions of complete descriptive data for all items. Data shall consist of specifications, data sheets, samples, capacity ratings, performance curves, operating characteristics, catalog cuts, dimensional drawings, wiring diagrams, installation instructions, and any other information necessary to indicate complete compliance with Contract Documents. Edit submittal data specifically for application to this project.
- C. Thoroughly review and stamp all submittals to indicate compliance with contract requirements prior to submission. Coordinate installation requirements and any electrical requirements for equipment submitted. Contractor shall be responsible for correctness of

all submittals.

- D. Submittals will be reviewed for general compliance with design concept in accordance with contract documents, but dimensions, quantities, or other details will not be verified.
- E. Identify submittals, indicating intended application, location and service of submitted items. Refer to specification sections or paragraphs and drawings where applicable. Clearly indicate exact type, model number, style, size and special features of proposed item. Submittals of a general nature will not be acceptable. For substituted items, clearly list on the first page of the submittal all differences between the specified item and the proposed item. The contractor shall be responsible for corrective action and maintaining the specification requirements if differences have not been clearly indicated in the submittal.
- F. Submit actual operating conditions or characteristics for all equipment where required capacities are indicated. Factory order forms showing only required capacities will not be acceptable. Call attention, in writing, to deviation from contract requirements.
- G. Acceptance will not constitute waiver of contract requirements unless deviations are specifically indicated and clearly noted. Use only final or corrected submittals and data prior to fabrication and/or installation.
- H. For any submittal requiring more than two (2) reviews by the Engineer (including those caused by a change in subcontractor or supplier) the Owner will withhold contractor's funds by a change order to the contract to cover the cost of additional reviews. One review is counted for each action including rejection or return of any reason.

#### 1.9 SHOP DRAWINGS

- A. Prepare and submit shop drawings for all mechanical equipment, specially fabricated items, modifications to standard items, specially designed systems where detailed design is not shown on the contract drawings, or where the proposed installation differs from that shown on contract drawings.
- B. Submit data and shop drawings including but not limited to the list below, in addition to provisions of the paragraph above. Identify all shop drawings by the name of the item and system and the applicable specification paragraph number and drawing number.
- C. Every submittal including, but not limited to the list below, shall be forwarded with its own transmittal as a separate, distinct shop drawing. Grouping of items/systems that are not related shall be unacceptable.

D. Items and Systems

Antifreeze Fluids  
Automatic Temperature Control Systems and Equipment  
Central Control and Monitoring Systems (CCMS) and Equipment  
Chiller  
Flow Measuring Stations  
Flowmeter and Primary Elements (Flow Fittings)  
Identification Systems

Material and Equipment Lists  
Operations and Maintenance Manuals  
Pipe Materials Including Itemized Schedules  
Preliminary Testing and Balancing Reports  
Pumps  
Strainers  
Thermal Insulation Materials Include Table Summaries  
Thermometers and Gauges  
Water Treatment Services  
Wiring Diagrams, Flow Diagrams and Operating Instructions

- E. Contractor, additionally, shall submit for review any other shop drawings as required by the Engineer. No item shall be delivered to the site, or installed, until the Contractor has received a submittal from the Engineer marked *Reviewed* or *Comments Noted*. After the proposed materials have been reviewed, no substitution will be permitted except where approved by the Engineer.
- F. For any shop drawing requiring more than two (2) reviews by the Engineer (including those caused by a change in subcontractor or supplier) the Owner will withhold contractor's funds by a change order to the contract to cover the cost of additional reviews. One review is counted for each action including rejection or return of any reason.

#### 1.10 SUPERVISION AND COORDINATION

- A. Provide complete supervision, direction, scheduling, and coordination of all work under the Contract, including that of subcontractors.
- B. Coordinate rough-in of all work and installation of sleeves, anchors, and supports for piping, equipment, and other work performed under Division 23.
- C. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for mechanical installations.
- D. Coordinate electrical work required under Division 23 with that under Division 26. Coordinate all work under Division 23 with work under all other Divisions.
- E. Supply services of an experienced (10 year minimum) and competent Project Manager to be in constant charge of work at site.
- F. Where a discrepancy exists within the specifications or drawings or between the specifications and drawings, the more stringent (or costly) requirement shall apply until clarification can be obtained from the Engineer. Failure to clarify such discrepancies with the Engineer will not relieve the Contractor of the responsibility of conforming to the requirements of the Contract.
- G. Failure of contractor to obtain a full and complete set of contract documents (either before or after bidding) will not relieve the contractor of the responsibility of complying with the intent of the contract documents.

#### 1.11 CUTTING AND PATCHING

- A. Accomplish all cutting and patching necessary for the installation of work under Division 23. Damage resulting from this work to other work already in place, shall be repaired at Contractor's expense. Where cutting is required, perform work in neat and workmanlike manner. Restore disturbed work to match and blend with existing construction and finish, using materials compatible with the original. Use mechanics skilled in the particular trades required.
- B. Do not cut structural members without approval from the Engineer.

#### 1.12 PENETRATION OF WATERPROOF CONSTRUCTION

- A. Coordinate the work to minimize penetration of waterproof construction, including roofs, exterior walls, and interior waterproof construction. Where such penetrations are necessary, furnish and install all necessary curbs, sleeves, flashings, fittings and caulking to make penetrations absolutely watertight.

#### 1.13 CONCRETE AND MASONRY WORK

- A. Furnish and install concrete and masonry work for equipment foundations, supports, pads, and other items required under Division 23. Perform work in accordance with requirements of other applicable Divisions of these specifications.
- B. Concrete shall test not less than 3,000 psi compressive strength after 28 days.
- C. Grout shall be non-shrink, high strength mortar, free of iron or chlorides and suitable for use in contact with all metals, without caps or other protective finishes. Apply in accordance with manufacturer's instructions and standard grouting practices.

#### 1.14 CONNECTIONS AND ALTERATIONS TO EXISTING WORK

- A. Unless otherwise noted on the drawings, where existing mechanical work is removed, pipes, valves, ductwork, etc., shall be removed, including hangers, to a point below finished floors or behind finished walls and capped. Such point shall be far enough behind finished surfaces to allow for installation of normal thickness of required finish material.
- B. Where work specified in Division 23 connects to existing equipment, piping, ductwork, etc., Contractor shall perform all necessary alterations, cuttings, fittings, etc., of existing work as may be necessary to make satisfactory connections between new and existing work, and to leave completed work in a finished and workmanlike condition.
- C. Where the work specified under Division 23, or under other Divisions, requires relocation of existing equipment, piping, ductwork, etc., Contractor shall perform all work and make necessary changes to existing work as may be required to leave completed work in a finished and workmanlike condition. Where existing insulation is disturbed, replace insulation where removed or damaged equal to existing, in type, thickness, density, finish and thermal resistance (R-value) value.
- D. Where the relocation of existing equipment is required for access or the installation of new equipment, the contractor shall temporarily remove and/or relocate and re-install as

required to leave the existing and new work in a finished and workman like condition.

#### 1.15 DEMOLITION

- A. Unless otherwise noted all existing equipment, piping, ductwork, etc., shall remain.
- B. Where existing equipment is indicated to be removed, all associated piping, conduit, power, controls, insulation, hangers, and supports, etc., patch, paint and repair walls/roof/floor to match existing and/or new finishes.
- C. Provide necessary piping, valves, traps, temporary feeds, drips, etc., as required. Drain and refill piping systems as often as necessary to accommodate phasing and to minimize time lengths of outages.
- D. The Contractor shall be responsible for visiting the site and determining the existing conditions in which the work is to be performed.
- E. Where any abandoned pipes in existing floors, walls, pipe tunnels, ceilings, etc., conflict with new work, remove abandoned pipes as necessary to accommodate new work.
- F. The location of all existing equipment, piping, ductwork, etc., indicated is approximate only and shall be checked and verified. Install all new mechanical/plumbing/fire protection work to connect to or clear existing work as applicable.
- G. Maintain egress at all times. Coordinate egress requirements with the State Fire Marshal, the Owner and the authorities having jurisdiction.
- H. At completion of project all temporary piping, valves, controls, etc., shall be removed in their entirety.
- I. Existing piping, equipment, materials, etc., not required for re-use or re-installation in this project, shall be removed from the project site.
- J. Deliver to the Owner, on the premises where directed, existing equipment and materials which are removed and which are desired by the Owner or are indicated to remain the property of the Owner.
- K. All other materials and equipment which are removed shall become property of the Contractor and shall be promptly removed, from the premises, and disposed of by the Contractor, in an approved manner. Contractor shall be responsible for proper disposal of all removed equipment containing refrigerants. Contractor shall include in his bid all cost associated with the evacuation, removal and disposal of all existing equipment containing refrigerants in accordance with EPA and Health Department requirements.
- L. Where piping is removed, remove all pipe hangers which were supporting the removed piping. Patch the remaining penetration voids with like materials and paint to match existing construction.
- M. Where required, provide and coordinate removal and re-installation of existing equipment. Take care to protect materials and equipment indicated for reuse. Contractor shall repair or replace items which are damaged. Contractor shall have Owner's

representative present to confirm condition of equipment prior to demolition.

- N. Before demolition begins, and in the presence of the Owners representative, test and note all deficiencies in all existing systems affected by demolition but not completely removed by demolition. Provide a copy of the list of system deficiencies to the Owner and the Engineer. Videotape existing conditions in each space prior to beginning demolition work.
- O. The Owner shall have the first right of refusal for all fixtures, devices and equipment removed by the Contractor.
- P. All devices and equipment designated by the Owner to remain the property of the Owner shall be moved and stored by the Contractor at a location on site as designated by the Owner. It shall be the Contractor's responsibility to store all devices and equipment in a safe manner to prevent damage while stored.
- Q. All existing equipment refused by the Owner shall become the property of the Contractor and shall be removed from the site by the Contractor in a timely manner and disposed of in a legal manner.
- R. Terminate services and utilities in accordance with local laws, ordinances, rules and regulations.
- S. Where hydronic system piping and equipment is removed, Contractor shall be responsible for proper disposal of all contained fluids containing glycol (ethylene or propylene), hazardous waste and water treatment chemicals. Contractor shall include in his bid all associated costs with the removal, testing, and disposal of hydronic system fluid in accordance with EPA, Health Department, and the Local Authority Having Jurisdiction.

#### 1.16 VIBRATION ISOLATION

- A. Furnish and install vibration isolators, flexible connections, supports, anchors and/or foundations required to prevent transmission of vibration from equipment, piping or ductwork to building structure. See Division 23 Section, "Vibration Control for HVAC, Plumbing and Fire Protection Equipment".

#### 1.17 ALTERNATES

- A. Refer to Division 01 Section, "Alternates" for description of work under this section affected by alternates.

#### 1.18 FASTENERS/CAPS

- A. For all equipment containing refrigerant install lockable caps on service valves to prevent tampering.

#### 1.19 DEFINITIONS

- A. *Approve* - to permit use of material, equipment or methods conditional upon compliance with contract documents requirements.

- B. *Furnish and install or provide* means to supply, erect, install, and connect to complete for readiness for regular operation, the particular work referred to.
- C. *Contractor* means the mechanical contractor and any of his subcontractors, vendors, suppliers, or fabricators.
- D. *Piping* includes pipe, all fittings, valves, hangers, insulation, identification, and other accessories relative to such piping.
- E. *Concealed* means hidden from sight in chases, formed spaces, shafts, hung ceilings, embedded in construction or in crawl space.
- F. *Exposed* means not installed underground or *concealed* as defined above.
- G. *Invert Elevation* means the elevation of the inside bottom of pipe.
- H. *Finished Spaces*: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceiling, unexcavated spaces, crawl spaces, and tunnels.
- I. *Review* - limited observation or checking to ascertain general conformance with design concept of the work and with information given in contract documents. Such action does not constitute a waiver or alteration of the contract requirements.
- J. *Building Line*: Exterior wall of building.

#### 1.20 MINIMUM EFFICIENCY REQUIREMENTS

- A. All heating, ventilating, and air conditioning equipment shall be manufactured to provide the minimum efficiency requirements as specified in ASHRAE Standard 90.1, latest edition.
- B. All piping, ductwork, and equipment insulation shall comply with ASHRAE Standard 90.1, latest edition.
- C. All mechanical devices, controls, accessories, and components shall be manufactured to provide the minimum efficiency requirements as specified in ASHRAE Standard 90.1, latest edition.

#### 1.21 SYSTEM INTEGRATION

- A. For all HVAC equipment specified to be provided with packaged controls and interfaced with the automatic temperature control system, provide system integration between the equipment manufacturer and the automatic temperature control subcontractor.
- B. HVAC equipment submittals requiring system integration as defined above must identify all required system integration points.
- C. HVAC equipment manufacturers must coordinate with ATC subcontractor regarding system integration prior to submitting on the equipment.

- D. A system integration meeting must be arranged by the Mechanical Contractor and include, but not be limited to the systems integrator for the HVAC equipment manufacturer and the ATC Subcontractor. This portion of systems integration must occur prior to HVAC equipment being delivered to the project.
- E. Once the HVAC equipment is on site, a second systems integration meeting must be arranged by the Mechanical Contractor to coordinate the packaged controls with the ATC system. The HVAC equipment manufacturer's representative familiar with system integration and the ATC subcontractor familiar with programming must be present.
- F. A final system integrations meeting shall occur once all equipment is in place and ready for operation. The Mechanical Contractor, the HVAC equipment systems' integrator, and the ATC Subcontractor shall meet on site to jointly program, schedule, verify points, interlock devices, and fully set up all systems integration components.
- G. All systems integration coordination, programming, and graphics must be completed prior to requesting commissioning and/or inspections by the Engineer of Record.

## PART 2. ELECTRICAL REQUIREMENTS

### 2.1 GENERAL MOTOR AND ELECTRICAL REQUIREMENTS

- A. Furnish and install control and interlock wiring for the equipment furnished. In general, power wiring and motor starting equipment will be provided under Division 26. Carefully review the contract documents to coordinate the electrical work under Division 23 with the work under Division 26. Where the electrical requirements of the equipment furnished differ from the provisions made under Division 26, make the necessary allowances under Division 23. Where no electrical provisions are made under Division 26, include all necessary electrical work under Division 23.
- B. All electrical work performed under Division 23 shall conform to the applicable requirements of Division 26 and conforming to the National Electrical Code. All wiring, conduit, etc., installed in ceiling plenums must be plenum rated per NFPA and the International Building Code.
- C. Provide wiring diagrams with electrical characteristics and connection requirements.
- D. Test Reports: Indicate test results verifying nominal efficiency and power factor for three phase motors larger than five (5) horsepower.
- E. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weatherproof covering. For extended outdoor storage, remove motors from equipment and store separately.
- F. All motors shall be furnished with visible nameplate indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor and efficiency.
- G. Nominal efficiency and power factor shall be as scheduled at full load and rated voltage when tested in accordance with IEEE 112.

- H. Brake horsepower load requirement at specified duty shall not exceed 85 percent of nameplate horsepower times NEMA service factor for motors with 1.0 and 1.15 service factors.
- I. All single phase motors shall be provided with thermal protection: Internal protection shall automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature ratings of motor insulation. Thermal protection device shall automatically reset when motor temperature returns to normal range, unless otherwise indicated.

## 2.2 MOTORS AND CONTROLS

- A. Motors and controls shall conform to the latest requirements of IEEE, NEMA, NFPA-70 and shall be UL listed. Motor sizes are specified with the driven equipment. Motor starting and control equipment is specified either with the motor which is controlled or in an electrical specification section. The Contractor is advised to consult all specification sections to determine responsibility for motors and controls.
- B. Motors shall be designed, built and tested in accordance with the latest revision of NEMA Standard MG 1.
- C. Motors used with variable-frequency controllers shall have ratings, characteristics, and features coordinated with and approved by the variable frequency controller (drive) manufacturer. As a minimum the following shall apply to variable frequency controlled motors:
  - 1. Motors shall be manufactured to withstand peak voltages of 1600 volts with .1 microsecond rise time per NEMA MG-1.
  - 2. Critical vibration frequencies of motor shall not be within operating range of variable frequency controller output.
  - 3. Temperature rise: Match rating for Class B insulation.
  - 4. Insulation: Class F.
  - 5. Thermal Protection: Conform to MG1 requirements for thermally protected motors.
- D. Motors shall be suitable for use under the conditions and with the equipment to which applied, and designed for operation on the electrical systems specified or indicated.
  - 1. Motor capacities shall be such that the horsepower rating and the rated full-load current will not be exceeded while operating under the specified operating conditions. Under no condition shall the motor current exceed that indicated on the nameplates.
  - 2. Motor sizes noted in the individual equipment specifications are minimum requirements only. It is the responsibility of the equipment manufacturers and of the Contractor to furnish motors, electrical circuits and equipment of ample

capacity to operate the equipment without overloading, exceeding the rated full-load current, or overheating at full-load capacity under the most severe operating service of this equipment. Motors shall have sufficient torque to accelerate the total  $WR^2$  of the driven equipment to operating speed.

3. Motors shall be continuous duty type and shall operate quietly at all speeds and loads.
  4. Motors shall be designed for operation on 60 hertz power service. Unless otherwise specified or shown, motors less than 1/2 horsepower shall be single phase, and motors 1/2 horsepower and larger shall be 3 phase unless otherwise noted.
  5. Motors shall be mounted so that the motor can be removed without removing the entire driven unit.
- E. Single phase motors, smaller than 1/20 horsepower shall be ball or sleeve bearing; drip-proof, totally enclosed or explosion proof, as specified; 120 volts; permanent-split capacitor or shaded pole type. These motors shall not be used for general power purposes, and shall only be provided as built-in components of such mechanical equipment as fans, unit heaters, humidifiers and damper controllers. When approved by the Engineer, deviations from the specifications will be permitted as follows:
1. Open motors may be installed as part of an assembly where enclosure within a cabinet provides protection against moisture.
  2. Motors used in conjunction with low voltage control systems may have a voltage rating less than 115 volts.
- F. Single phase motors, greater than 1/20 horsepower and less than 1/2 horsepower shall be ball bearing; drip-proof, totally enclosed or explosion proof, as specified, with Class A or B insulation, as standard with the motor manufacturer; 115 or 120/208/240 volts as required; capacitor start-induction run, permanent split capacitor, or repulsion start-induction run type with minimum efficiency of 70 percent and a minimum full load power of 77 percent.
- G. Except as otherwise specified in the various specification sections, 3 phase motors 60 horsepower and smaller shall be NEMA design B squirrel cage induction type meeting the requirements of this paragraph. Motors shall be drip-proof, totally enclosed or explosion proof, as specified or indicated. Insulation shall be Class B or F, at 40 degrees C ambient temperature. Drip-proof motors shall have a 1.15 service factor and totally enclosed and explosion proof motors shall have a service factor of 1.00 or higher. Motors specified for operation at 480, 240, and 208 volts shall be nameplated 460, 230, 200 volts, respectively. Efficiencies and percent power factor at full load for three phase motors shall be not less than the values listed below for premium efficiency motors:

MOTOR NAMEPLATE	MINIMUM PERCENT EFFICIENCY AT NOMINAL SPEED AND RATED LOAD	MINIMUM PERCENT POWER FACTOR

MOTOR NAMEPLATE	MINIMUM PERCENT EFFICIENCY AT NOMINAL SPEED AND RATED LOAD	MINIMUM PERCENT POWER FACTOR
1HP and above to	85.5 percent	84 percent
1-½ HP	86.5 percent	85 percent
2HP	86.5 percent	85 percent
3HP	89.5 percent	86 percent
5HP	89.5 percent	87 percent
7½ HP	91 percent	86 percent
10HP	91.7 percent	85 percent
15HP	93.0 percent	85 percent
20HP	93.0 percent	86 percent
25HP	93.6 percent	85 percent
50HP and above	94.5 percent	88 percent
60 HP	95.0 percent	90 percent
75HP	95.0 percent	90 percent
100 HP	95.4 percent	90 percent
125 HP	95.8 percent	95 percent
150 HP and above	96.0 percent	95 percent

- H. For motors serving equipment being controlled by a variable speed drive, motor shall be premium efficiency inverter duty rated.
- I. Control of each motor shall be manual or automatic as specified for each in the various mechanical sections. In general, and unless otherwise specified for a particular item in the various mechanical sections of the specifications, motor starters and controls shall be specified and provided under the various electrical sections of these specifications.

2.3 MOTOR INSTALLATION

- A. Install in accordance with manufacturer’s instructions.
- B. Install securely on firm foundation. Mount ball bearing motors to support shaft regardless of shaft position.
- C. Check line voltage and phase and ensure agreement with nameplate. Check that proper thermal overloads have been installed prior to operating motors.

2.4 WIRING DIAGRAMS

- A. The Contractor is responsible for obtaining and submitting wiring diagrams for all major items of equipment.
- B. Wiring diagrams shall be provided with shop drawings for all equipment requiring electric power.
- C. Provide wiring diagrams for all major mechanical items of equipment to electrical contractor and ATC subcontractor for coordination.

### PART 3. EXECUTION

#### 3.1 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.
- B. Install equipment according to approved submittal data. Portions of the work are shown only in diagrammatic form. Refer conflicts to Engineer.
- C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- D. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- E. Install equipment giving right of way to piping installed at required slope.
- F. Install flexible connectors on equipment side of shutoff valves, horizontally and parallel to equipment shafts if possible.

#### 3.2 SUPPORTS, HANGERS AND FOUNDATIONS

- A. Provide supports, hangers, braces, attachments and foundations required for the work. Support and set the work in a thoroughly substantial and workmanlike manner without placing strains on materials, equipment, or building structure, submit shop drawings for approval. Coordinate all work with the requirements of the structural division.
- B. Supports, hangers, braces, and attachments shall be standard manufactured items or fabricated structural steel shapes. All interior hangers shall be galvanized or steel with rust inhibiting paint. For un-insulated copper piping provide copper hanger to prevent contact of dissimilar metals. All exterior hangers shall be constructed of stainless steel utilizing stainless steel rods, nuts, washers, bolts, etc.

#### 3.3 PAINTING AND FINISHES

- A. Provide protective finishes on all materials and equipment. Use coated or corrosion-resistant materials, hardware and fittings throughout the work. Paint bare, untreated ferrous surfaces with rust-inhibiting paint. All exterior components including supports,

hangers, nuts, bolts, washers, vibration isolators, etc. shall be stainless steel.

- B. Clean surfaces prior to application of insulation, adhesives, coatings, paint, or other finishes.
- C. Provide factory-applied finishes where specified. Unless otherwise indicated factory-applied paints shall be baked enamel with proper pretreatment.
- D. Protect all finishes and restore any finishes damaged as a result of work under Division 23 to their original condition.
- E. The preceding requirements apply to all work, whether exposed or concealed.
- F. Remove all construction marking and writing from exposed equipment, ductwork, piping and building surfaces. Do not paint manufacturer's labels or tags.
- G. All exposed piping, equipment, etc. shall be painted. Colors shall be as stated in this division or as selected by the Owner and conform to ANSI Standards.
- H. All exposed piping, equipment, etc., in Mechanical Rooms, Boiler Rooms, and Storage where PVC jacketed shall not require painting. Label and identify and color code as specified.

### 3.4 CLEANING OF SYSTEMS

- A. Thoroughly clean systems after satisfactory completion of pressure tests and before permanently connecting fixtures, equipment, traps, strainers, and other accessory items. Blow out and flush piping until interior surfaces are free of foreign matter.
- B. Flush piping in re-circulating water systems to remove cutting oil, excess pipe joint compound, solder slag and other foreign materials. Do not use system pumps until after cleaning and flushing has been accomplished to the satisfaction of the Engineer. Employ chemical cleaners, including a non-foaming detergent, not harmful to system components. After cleaning operation, final flushing and refilling, the residual alkalinity shall not exceed 300 parts per million. Submit a certificate of completion to Engineer stating name of service company used.
- C. Maintain strainers and dirt pockets in clean condition.
- D. Pay for labor and materials required to locate and remove obstructions from systems that are clogged with construction refuse after acceptance. Replace and repair work disturbed during removal of obstructions.
- E. Leave systems clean, and in complete running order.
- F. All HVAC piping/equipment strainers must be pulled and cleaned prior to substantial completion. In addition six (6) months after substantial completion all HVAC piping/equipment strainers must be pulled and cleaned a second time. Document and submit verification of strainer cleaning to Engineer, Owner, and Construction Manager.

### 3.5 COLOR SELECTION

- A. Color of finishes shall be as selected by the Engineer.
- B. Submit color of factory-finished equipment for acceptance prior to ordering.

### 3.6 PROTECTION OF WORK

- A. Protect work, material and equipment from weather and construction operations before and after installation. Properly store and handle all materials and equipment.
- B. Cover temporary openings in piping, ductwork, and equipment to prevent the entrance of water, dirt, debris, or other foreign matter. Deliver pipes and tubes with factory applied end caps.
- C. Cover or otherwise protect all finishes.
- D. Replace damaged materials, devices, finishes and equipment.
- E. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, where stored inside.

### 3.7 OPERATION OF EQUIPMENT

- A. Clean all systems and equipment prior to initial operation for testing, balancing, or other purposes. Lubricate, adjust, and test all equipment in accordance with manufacturer's instructions. Do not operate equipment unless all proper safety devices or controls are operational. Provide all maintenance and service for equipment that is authorized for operation during construction.
- B. Where specified, or otherwise required, provide the services of the manufacturer's factory-trained servicemen or technicians to start up the equipment. Where factory start-up of equipment is not specified, provide field start-up by qualified technician.
- C. Submit factory start-up sheets or field start-ups sheets for all equipment prior to the commencement of testing and balancing work. Testing and balancing work shall not commence until start-up reports have been completed, reviewed by Engineer and forwarded to Testing and Balancing Agency.
- D. Upon completion of work, clean and restore all equipment to new conditions; replace expendable items such as filters.

### 3.8 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a videographer to record demonstration and training video recordings. Record each training module separately.
  - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Video Recording Format: Provide high-quality color video recordings with menu navigation in format acceptable to Engineer

- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.
- D. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.
- E. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.

### 3.9 IDENTIFICATIONS, FLOW DIAGRAMS, ELECTRICAL DIAGRAMS AND OPERATING INSTRUCTIONS

- A. Contractor shall submit for approval schematic piping diagrams of each piping system installed in the building. Diagrams shall indicate the location and the identification number of each valve in the particular system. Following approval by all authorities, the diagrams shall be framed, mounted under safety glass and hung in each Mechanical Room where directed. Contractor shall deliver the tracing or sepia from which the diagrams were reproduced to the Owner.
- B. All valves shall be plainly tagged. For any bypass valves, install sign indicating valve position as “Normally Open” or “Normally Closed” as required.
- C. All items of equipment, including motor starters, disconnects and ATC panels shall be furnished with white on black plastic permanent identification cards. Lettering shall be a minimum of ¼ inch high. Identification plates shall be secured, affixed to each piece of equipment, starters, disconnects, panels by screw or adhesive (tuff bond #TB2 or as approved equal).
- D. Provide three (3) copies of operating and maintenance instructions for all principal items of equipment furnished. This material shall be bound as a volume of the *Record and Information Booklet* as hereinafter specified.
- E. All lines piping installed under this contract shall be stenciled with *direction of flow* arrows and with stenciled letters naming each pipe and service. Refer to Division 23 Section, “HVAC Piping, Fittings, Valves, Etc.”. Color-code all direction of flow arrows and labels. In finished spaces omit labeling and direction of flow arrows. Paint in color as selected by Engineer.
- F. Submit list of wording, symbols, letter size, and color coding for mechanical identification. Submit samples of equipment identification cards, piping labels, ductwork labels, and valve tags to Engineer for review prior to installation.
- G. Provide at least 8 hours of straight time instruction to the operating personnel. Time of instruction shall be designated by the Owner. Additional instruction time for the automatic temperature control (ATC) system is specified in Division 23 Section, “Instrumentation & Controls of HVAC & Plumbing Systems”.
- H. Contractor shall demonstrate Sequences of Operation of all equipment in presence of Owner’s representative, Engineer, and ATC subcontractor.

## 3.10 WALL AND FLOOR PENETRATION

- A. All penetrations of partitions, ceilings, roofs and floors by ducts, piping or conduit under Division 23 shall be sleeved, sealed, and caulked airtight for sound and air transfer control. Penetrations of mechanical room partitions, ceilings, and floors shall be as specified in Division 23 Section, "Vibration Control for HVAC, Plumbing and Fire Protection Equipment".
- B. All penetration of fire rated assemblies shall be sleeved, sealed, caulked and protected to maintain the rating of the wall, roof, or floor. Fire Marshal approved U.L. assemblies shall be utilized.
- C. Where piping extends through exterior walls or below grade, provide waterproof pipe penetration seals, as specified in another division of these specifications.
- D. Provide pipe escutcheons and duct flanges for sleeved pipes and ducts in finished areas.
- E. Piping sleeves:
  - 1. Galvanized steel pipe, standard weight where pipes are exposed and roofs and concrete and masonry walls. On exterior walls provide anchor flange welded to perimeter.
  - 2. Twenty-two (22) gauge galvanized steel elsewhere.

## 3.11 RECORD DRAWINGS

- A. Upon completion of the mechanical installations, the Contractor shall deliver to the Engineer one complete set of prints of the mechanical contract drawings which shall be legibly marked in red pencil to show all changes and departures of the installation as compared with the original design. They shall be suitable for use in preparation of Record Drawings.
- B. Contractor shall incorporate all sketches, addendums, value engineering, change orders, etc., into record drawings prior to delivering to Engineer.

## 3.12 WARRANTY

- A. Contractor's attention is directed to warranty obligations contained in the GENERAL CONDITIONS.
- B. The above shall not in any way void or abrogate equipment manufacturer's guarantee or warranty. Certificates of equipment manufacturer's warranties shall be included in the operations and maintenance manuals.
- C. The Contractor guarantees for a two year period from the time of final acceptance by the Owner.
  - 1. That the work contains no faulty or imperfect material or equipment or any imperfect, careless, or unskilled workmanship.

2. That all work, equipment, machines, devices, etc. shall be adequate for the use to which they are intended, and shall operate with ordinary care and attention in a satisfactory and efficient manner.
3. That the contractor will re-execute, correct, repair, or remove and replace with proper work, without cost to the Owner, any work found to be deficient. The contractor shall also make good all damages caused to their work or materials in the process of complying with this section.
4. That the entire work shall be water-tight and leak-proof.

### 3.13 LUBRICATION

- A. All bearings, motors, and all equipment requiring lubrication shall be provided with accessible fittings for same. Before turning over the equipment to the Owner, the Contractor shall fully lubricate each item of equipment, shall provide one year's supply of lubricant for each, and shall provide Owner with complete written lubricating instructions, together with diagram locating the points requiring lubrication. Include this information in the Record and Information Booklet.

### 3.14 OPERATIONS AND MAINTENANCE MANUALS

- A. The Contractor shall have prepared three (3) copies of the Record and Information Booklet and deliver these copies of the booklet to the Owner. The booklet shall be as specified herein. The booklet must be approved and will not be accepted as final until so stamped.
- B. The booklet shall be bound in a three-ring loose-leaf binder similar to National No. 3881 with the following title lettered on the front: *Operations and Maintenance Manuals – Sussex Tech High School Chiller Replacement - HVAC*. No sheets larger than 8-1/2 inches x 11 inches shall be used, except sheets that are neatly folded to 8-1/2 inches x 11 inches and used as a pull-out. Provide divider tabs and table of contents for organizing and separating information.
- C. Provide the following data in the booklet:
  1. As first entry, an approved letter indicating the starting/ending time of Contractor's warranty period.
  2. Maintenance operation and lubrication instructions on each piece of equipment furnished.
  3. Complete catalog data on each piece of heating and air conditioning equipment furnished including approved shop drawing.
  4. Manufacturer's extended limited warranties on equipment including but not limited to air conditioning compressors and chiller.
  5. Chart form indicating frequency and type of routine maintenance for all mechanical equipment. The chart shall also indicate model number of equipment, location and service.
  6. Provide sales and authorized service representatives names, address, and phone numbers of all equipment and subcontractors.
  7. Provide supplier and subcontractor's names, address, and phone number.
  8. Catalog data of all equipment, valves, etc. shall include wiring diagrams, parts

- list and assembly drawing.
  - 9. Provide and install in locations as directed by the Owner, valve charts including valve tag number, valve type, valve model number, valve manufacturer, style, service and location. Each valve chart shall be enclosed in a durable polymer based frame with a cover safety glass.
  - 10. Copy of the approved balancing report.
  - 11. ATC systems including as-built ATC drawings of systems including internal of all panels.
  - 12. Approved Pressure Vessel Inspection and Electrical Certificates.
  - 13. Start-up reports for equipment.
  - 14. Insert color graphic with embedded parameters for ATC system into record and information booklet.
  - 15. Documentation of strainer pulling and cleaning.
- D. Submit Record and Information Booklets prior to anticipated date of substantial completion for Engineer review and approval. Substantial completion requires that Record and Information booklets be reviewed and approved.

3.15 PIPING SYSTEMS TESTING

- A. The entire new HVAC piping systems shall be tested hydrostatically before insulation covering is applied and proven tight under the following gauge pressures for a duration of four (4) hours. Testing to be witnessed by Owner's representative and documented in writing.

SYSTEM	TEST PRESSURE
Condenser Water Supply & Return Piping	100 psi
Chilled Water Supply & Return Piping, Including Chemical Treatment Piping	100 psi

- B. Testing and acceptance thereof shall be in accordance with local requirements and shall meet approval of authority having jurisdiction. Submit certificates and approved permits and insert one (1) copy in the *Operations and Maintenance Manuals*.

3.16 STRAINER CLEANING

- A. All equipment strainers must be pulled and cleaned at substantial completion. Document in writing and via digital photographs that all strainers have been pulled and cleaned.
- B. One year after project substantial completion all strainers shall be pulled again and cleaned. Document in writing and via digital photographs that all strainers were pulled and clean at the one year after project substantial completion data.
- C. Insert documentation that the strainers have been pulled and cleaned in the Record and Information Books.
- D. Re-purge hydronic systems of all air after strainers are pulled and cleaned.

3.17 OUTAGES

- A. Provide a minimum of fourteen (14) days' notice to schedule outages. The Contractor shall include in their bid outages and/or work in occupied areas to occur on weekends, holidays, or at night. Coordinate and get approval of all outages with the Owner.
- B. Submit *Outage Request Form*, attached at end of this Section, to Owner for approval.

END OF SECTION

OUTAGE REQUEST

DATE APPLIED: \_\_\_\_\_ BY: \_\_\_\_\_

DATE FOR OUTAGE: \_\_\_\_\_ FIRM: \_\_\_\_\_

START OUTAGE-TIME: \_\_\_\_\_ DATE: \_\_\_\_\_

END OUTAGE -- TIME: \_\_\_\_\_ DATE: \_\_\_\_\_

AREAS AND ROOMS: \_\_\_\_\_

FLOOR(S): \_\_\_\_\_

AREA(S): \_\_\_\_\_

ROOM(S): \_\_\_\_\_

WORK TO BE PERFORMED: \_\_\_\_\_

SYSTEM(S): \_\_\_\_\_

REQUEST APPROVED BY: \_\_\_\_\_

(FOREMAN OR OTHER PERSON IN CHARGE)

**(FOR OWNER'S USE ONLY):**

APPROVED: \_\_\_\_\_

YES \_\_\_ NO \_\_\_ BY: \_\_\_\_\_ DATE: \_\_\_\_\_

DATE/TIME-AS REQUESTED: \_\_\_\_\_ OTHER : \_\_\_\_\_

OWNER'S PRESENCE REQUIRED: \_\_\_\_\_

YES: \_\_\_ NO: \_\_\_ NAME: \_\_\_\_\_

POINT OF CONTACT: \_\_\_\_\_ PHONE: \_\_\_\_\_

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HVAC PIPING, FITTINGS AND VALVES  
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## SECTION 230505 - HVAC PIPING, FITTINGS AND VALVES

## PART 1. GENERAL

## 1.1 SUMMARY

- A. The conditions of the contract and other general requirements apply to the work specified in this section. All work under this section shall also be subject to the requirements of Division 23 Section, *Common Work Results for HVAC* and Division 01, *General Requirements*.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SYSTEM DESCRIPTION CONDITIONS

- A. Provide all labor and materials necessary to furnish and install all piping systems on this project as herein specified and/or shown on the drawings. Final connections to equipment furnished in other sections of the specifications shall be included under this section.
- B. Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- C. Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.
- D. Use non-conducting dielectric connections whenever jointing dissimilar metals in open systems.
- E. Provide pipe hangers and supports in accordance with ASTM B31.9 and MSS SP69 unless indicated otherwise.
- F. Use 3/4 inch (20 mm) ball valves with cap and chain for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment. Pipe to nearest floor drain.
- G. At all runout piping serving equipment, use swing joints with elbows to prevent excessive movement of piping due to expansion.

## 1.3 QUALITY ASSURANCE

- A. Valves: Manufacturer's name and pressure rating marked on valve body.
- B. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulation. Provide certificate of compliance from authority having jurisdiction indicating approval of welders.
- C. Welders Certification: In accordance with ASME Section 9.
- D. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single

manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

1. All castings used for coupling housings, fittings, and valve bodies shall be date stamped for quality assurance and traceability.

E. Maintain one copy of each document on site.

#### 1.4 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, protect and handle products to site under as hereinbefore specified.
- B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary protective coating on cast iron and steel valves.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed systems.

#### 1.5 EXTRA MATERIALS

- A. Provide one (1) repacking kit for each size valve.

#### 1.6 ALTERNATES

- A. Refer to Division 01 Section, "Alternates" for description of work under this section affected by alternates.

### PART 2. PRODUCTS

#### 2.1 PIPE MATERIALS

- A. All materials, unless otherwise specified, shall be new and of the best quality of their respective kinds, and shall conform to the requirements and ordinances of local, state and insurance authorities having jurisdiction.
  1. Chilled Water Supply & Return Piping, Condenser Water Supply and Return Piping, Chemical Treatment Piping, (Inside of Building):
    - a). Pipe: Schedule 40 Black steel pipe, ASTM A53  
1-1/2 inch and smaller - Type F, ASTM A53 steel (CW) with threaded joints  
  
2 inch and larger - Grade B, Type E, ASTM A53 steel (ERW) with welded, flanged or grooved joints.
    - b). Fittings & Joints: 2-1/2 inches & larger, schedule 40 wrought steel ASTM A234 Grade WPB or Std. B16.9 long radius welding; factory-fabricated from ASTM A53 pipe; or ASTM A536 ductile iron; 2 inches & smaller 125

lb. std. cast iron screwed, ASTM Standard B16.4; or Vic-Press precision, cold drawn, stainless steel with elastomer O-ring seals. Joints shall be threaded or AWS D1.1 welded. Victaulic or approved equal grooved joints shall be acceptable.

- c). Flanges: Wrought steel Class 150 welding neck. ASTM Standard B16.5.
- d). Grooved Joint Couplings: MI or Two ductile iron housings, pressure responsive elastomer gasket, and ASTM A449 zinc electroplated steel bolts and nuts. Couplings shall comply with ASTM F1476 Standard Specification for the Performance of Gasketed Mechanical Couplings for Use in Piping Applications.
  - i. Rigid Type: Coupling housings shall be cast with offsetting, angle-pattern bolt pads to provide joint rigidity and support and hanging in accordance with ASNI B31.1 and B31.9.
    - a. Victaulic Style 107H, Installation-Ready or approved equal, for direct stab installation without field disassembly, with grade EHP gasket, suitable for water service to +250 degrees F.
    - b. Victaulic Style 07 "Zero-Flex" or approved equal.
  - ii. Flexible Type: For use in locations where vibration attenuation and stress relief are required, and for the elimination of flexible connectors. Victaulic Installation-Ready Style 177 or Style 77, or approved equal.
  - iii. 14" and Larger: AGS Series, with lead-in chamfer on housing key and wide width FlushSeal gasket. Victaulic Style W07 (rigid) and Style W77 (flexible), or approved equal.
  - iv. Flange adapters shall be suitable for direct connection to ANSI Class 125 or 150 flanged components. Victaulic Style 741/W741, or approved equal.
  - v. Rolled form grooves only. Cut grooves are prohibited.
  - vi. Verify gasket compatibility on Chemical Treatment piping.
- e). Gate Valves: 2-1/2 inches & larger - IBBM, 150 lb. OS&Y grooved end or flanged; 2 inches & smaller - 150 lb. Bronze body bronze trim. Basis of Design: Victaulic Series 771V or approved equal.

For valves 4 inch and larger located in mechanical equipment spaces 10 feet-0 inch or greater above finished floor, valve shall have chain wheel operators with chains extending to within 6 feet-0 inch above finished floor. Chain wheels and guides shall be galvanized.

- f). Ball Valves: Shut-off valves 2 inches and smaller shall be ball valves. Ball valves shall be 150 lbs, brass or bronze body, standard port, 2 piece body, TFE seats with bronze trim. Ball valves shall be VicPress end, threaded end or solder end as required to accommodate piping. Ball valves shall be as manufactured by Victaulic, Conbraco, Crane, Apollo, Nibco, Watts or

engineer approved equal.

- g). Globe Valves: 2-1/2 inches & larger – IBBM 125 lb.std. flanged, with No. 1 disc; 2 inches & smaller - bronze 150 lb.std. screw ends, with #1 disc.
- h). Check Valves: 2-1/2 inches & larger – IBBM or stainless steel trim, 125 lb.std. grooved end or flanged spring-assisted swing check suitable for vertical or horizontal installation, with metal disc; 2 inch & smaller - 125 lb. std. screwed. Provide "silent" spring loaded check valves at all pump discharges. Victaulic Series 716/W715 or approved equal.
- i). Balancing Valves: Victaulic Series 377/365, DeZurik Series 100, Fig. 118 or approved equal, ductile iron or cast iron construction, stainless steel bearings, nickel seats (3 inches and larger) non-lubricated, eccentric plug with EPDM, chlorobutyl rubber or Bunz-N resilient faced plugs suitable for 230 degrees F, semi-steel screwed with fig. 159, removable lever and open. nut for valves 3 inches and smaller. For valves 4-inch and larger, provide gear operators and grooved ends or flanged connections. Provide chain operated valves for sizes 4-inches and larger located 10 feet-0 inches or more above finished floor. Chains shall extend to within 6 inch-0 inches above finished floor. All valves shall have adjustable memory stop. Chain wheel and guide shall be galvanized.
- j). Butterfly Valves: Victaulic Vic300 MasterSeal/ AGS-Vic300, DeZurik, high performance or Keystone K-Loc, type with infinite position lever (for 3-inches and smaller) and pressure-responsive seat or double seat type and memory stop. Provide gear operator on valves 4-inches and larger.
  - i. Valve stem shall be stainless steel, and shall be offset from the disc centerline to provide complete 360 degree circumferential seating.
  - ii. Valve shall be rated to +250 deg F in sizes through 12-inches.
  - iii. Seat shall be elastomer, of a grade suitable for the intended service. The seat shall be pressure responsive in sizes through 12 inches.
  - iv. For valves 4 inches and larger located 10 feet-0 inches or more above finished floor shall be provided with chain operators with chains extending to within 6 feet-0 inches above finished floor. Chain wheel and guide shall be galvanized.
- k). Extended Valve Stems: Provide and install round collar type extended valve stems on all valves installed in insulated piping. Valve stem and collar shall be selected to suit insulation thickness and maintain valve handles outside of insulation.
- l). Alternate:
  - i. At contractors option all HVAC water supply and return lines may

be copper type L (ASTM Std. B88) with wrought copper fittings (ASTM Std. B 16.22) with brazed or 95-5 silver solder joints lead and antimony based solders are prohibited and all bronze valves may be used on piping 2 inches and less in size.

2. Refrigeration Piping: Including Refrigerant Relief Piping and Refrigerant Monitoring Piping
  - a). Concealed: Tube Size  $\frac{3}{4}$  -inch & Smaller:

ASTM B280, copper tube; Type ACR, soft annealed temper fittings; cast copper-alloy fittings for flared copper tubes; flared joints. Fittings shall be ASME B16.22, wrought copper. Joints shall be bronzed, AWS A5.8, BCUP silver/phosphorous/copper alloy with melting range 1190 to 1480 degrees F.
  - b). Concealed: Tube Size  $\frac{7}{8}$  inch through 4-1/8inches:

Copper tube, Type ACR, soft annealed temper; wrought-copper, solder-joint fittings; solder joints.
  - c). Exposed: Tube Size  $\frac{3}{4}$  Inch and Smaller:

Copper pipe, Type ASTM B88, Type K with brazed wrought-copper fittings conforming to ASME B16.22. Filler metal shall be brazing type conform to AWS A5.8.
  - d). Exposed: Tube Sizes  $\frac{7}{8}$  Inch and Larger:

Copper pipe, Type ASTM B88, Type K with brazed wrought-copper fittings conforming to ASME B16-22. Filler metal shall be brazing type conforming to AWS A5.8.
  - e). Soldered Joints: Solder joints using silver-lead solder, ASTM B 32, Grade 96 TS.
  - f). Brazed Joints: Braze joints using American Welding Society (AWS) classification BCuP-4 for brazing filler metal.
  - g). Flexible connectors: 500-psig (3450-kPa) minimum operating pressure; stainless-steel core and high-tensile stainless-steel-braid covering; dehydrated, pressure tested, minimum 7 inches (180 mm) long.
  - h). Pressure Relief Valves: Straight-through or angle pattern, brass body and disc, neoprene seat, and factory sealed and ASME labeled for standard pressure setting.
- B. Steel pipe shall be similar and equal to National Tube Company, Grinnell, Republic, or Bethlehem black or zinc-coated (galvanized) as hereinafter specified. Pipe shall be free from all defects which may affect the durability for the intended use. Each length of pipe shall be

stamped with the manufacturer's name.

- C. Copper pipe shall be Revere, Anaconda or Chase with approved solder fittings.
- D. Welding fittings for steel pipe shall meet the requirements of ASTM Standard A-23 and shall be standard catalog products. Fittings fabricated by metering and notching pipe will not be accepted.

2.2 PIPE HANGERS, ROLLER SUPPORTS, ANCHORS, GUIDES, AND SADDLES

- A. All hangers for metallic piping shall be adjustable, wrought clevis type, or adjustable malleable split ring swivel type, having rods with machine threads. Hangers shall be Grinnell Company's Figure 260 for pipe ¾-inch and larger, and Figure 65 for pipe 2-inches and smaller, or approved equal. Adjustable pipe stanchion with U-bolt shall be Grinnell Company's Figure 191. Pipe roller supports shall be Grinnell's Figure 181 or Figure 271. Exterior pipe hangers shall be galvanized or stainless steel construction. For copper piping in direct contact with the hanger, hanger construction shall be copper coated to prevent contact of dissimilar metals similar to Grinnell's Figure CT-65. Hanger spacing and rod sizes for steel and copper pipe shall not be less than the following:

NOMINAL PIPE SIZE IN	STD. STEEL PIPE	MAXIMUM SPAN FT. COPPER TUBE	MINIMUM ROD DIAMETER INCHES OF ASTM A36 STEEL THREADED RODS
¾ & 1	6	5	3/8
1 - ½	6	8	3/8
2	8	8	3/8
2 - ½	10	9	½
3	12	10	½
4	14	12	5/8
5	14	12	5/8
6	16	14	¾
8	18	16	7/8
10	20	18	7/8
12	20	18	7/8

- B. Anchors, guides, and roller supports shall be installed in accordance with the contract drawings and manufacturer's recommendations to provide pipe support and control pipe movement for all piping systems. Anchors and guides shall be securely attached to the pipe support structure. Submit shop drawing for proposed pipe support structure for guides and

anchors for approval of the Structural Engineer. Pipe alignment guides shall be Fig. 255 Grinnell, or as approved equal. Guides shall be sized to accommodate the pipe with insulation. Guides shall be steel factory, fabricated, with bolted two section outer cylinder and base for alignment of piping and two section guiding spider for bolting to pipe.

- C. Hangers for pipe sizes ½ to 1 ½ inch (13 to 38 mm): Carbon steel, adjustable swivel, split ring.
- D. Hangers for cold pipe sizes 2 inches (50 mm) and over: Carbon steel, adjustable, clevis.
- E. Hangers for cold pipe sizes 2 to 4 inches (50 to 100 mm): Carbon steel, adjustable, clevis.
- F. Hangers for cold pipe sizes 6 inches (150 mm) and over: adjustable steel yoke, cast iron roll, double hanger.
- G. Multiple or Trapeze hangers: Steel channels with welded spacers and hanger rods.
- H. Wall support for pipe sizes to 3 inches (76 mm): cast iron hook
- I. Wall support for pipe sizes 4 inches (100 mm) and over: Welded steel bracket and wrought steel clamp.
- J. Vertical Support: Steel riser clamp.
- K. Floor support for cold pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- L. Copper pipe support: Carbon steel ring, adjustable, copper plated.
- M. Hanger rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
- N. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

### 2.3 VALVES

- A. Provide parts list and assembly drawings (exploded view) for all valves in shop drawing submittals. Provide valves of the same type by the same manufacturer.

### 2.4 STRAINERS

- A. Strainers shall be of the basket or "Y" type and shall be heavy and durable, constructed of ductile iron to ASTM A536 or the best grade gray iron with the bottoms drilled and plugged. Bodies shall have arrows clearly cast on the sides to show flow direction. Strainers shall be equipped with easily removable covers and brass sediment baskets made of stainless steel or brass not less than #22 gauge in thickness. Total area of basket perforations shall be not less than four times the cross section of the entering pipe. Flow shall be into basket, and then out through the perforations. Strainers shall be suitable for water or the intended fluid. Strainers 2 inches and smaller shall have threaded or solder ends, 2 inches and larger shall have

flanged ends.

- B. Strainer screens shall be stainless steel with perforations and shall be 1/16-inch for pipe sizes 5 inches and less, 1/8-inch (40 percent open area) perforations for pipe sizes 6-inch and greater.
- C. Provide valved and capped (with chain) blowdowns in each strainer. Blowdown valves shall be Appolo 78-100/200 series or as approved equal.
- D. Strainers shall be manufactured by Victaulic Style 732/W732, Watts, Mueller, Armstrong, Yarway, Spirax/Sarco or as approved equal.

## 2.5 UNIONS, FLANGES, AND COUPLINGS

- A. Unions in steel pipe 2-inches and smaller shall be malleable iron with brass inserted seats designed for a working pressure of 150 psig.
- B. Unions in copper pipe 2-inches and smaller shall be sweat fittings with bronze seats designed for a working pressure of 125 psig.
- C. Unions in stainless steel pipe 2-inches and smaller shall be hexagonal threaded type stainless steel unions, with VicPress ends. Basis of Design: Victaulic Style P584.
- D. Flanges for steel pipe over 2 inches shall be 150 psig, forged steel, slip on. Gaskets shall be 1/16 inch thick pre-formed neoprene.
- E. Flanges for copper pipe over 2 inches shall be bronze. Gaskets shall be 1/16 inch thick preformed neoprene.

## 2.6 MANUAL AIR VENTS

- A. Manual air vents shall be similar to the hereinafter specified gauge valves. Provide 1/4-inch size on 3/4-inch pipe and smaller, 1/2 -inch size on 1-inch pipe and larger. Install at all high points of piping. Valves shall be Crane No. 88, or as approved equal, with threaded ends, bronze body, bronze or brass bonnet and bronze stem.

## 2.7 THERMOMETERS

- A. Unless otherwise indicated, thermometers shall be ASTM E1, in a glass type, organic filled, 9-inch scale size, corrosion-resistant metal case, with "any-angle" mounting with positive locking device. Trerice Industrial Thermometers, Weksler Instruments, Ernst Gage Co., Miljoco, or approved equal. Insertion stem length shall suite the pipe size and configuration. Thermometer wells shall be brass with brass union hubs in copper and in ferrous piping. Where piping is insulated or otherwise covered, use wells with lagging extension. Where wells are installed in pipe tees at turns, increase pipe size so that well does not restrict flow. Accuracy shall be 2 percent.
- B. Unless otherwise indicated, thermometer ranges shall be as follows:
  - 1. Chilled water, glycol, systems: 0 degrees F to 100 degrees Fahrenheit, 1 degrees

Fahrenheit Division

2. Condenser water: 30 degrees Fahrenheit to 240 degrees Fahrenheit, 2 degrees Fahrenheit Division.

- C. Provide heat conducting compound in wells.
- D. At Contractor's option, light powered thermometers may be utilized in lieu of organic filled thermometers.

## 2.8 PRESSURE GAUGES

- A. Unless otherwise indicated, pressure gauges shall be the bronze bourdon tube type, 4-1/2-inch dial, stem mounting, cast aluminum adjustable pointer, 1 percent accuracy over middle half of scale range, 1-1/2 percent over balance: Trerice Model 600C; Weksler Instruments, Ernst Gage Co., Miljoco, or as approved equal.
- B. Gauges shall have pressure, vacuum, compound, or retard ranges as required, select ranges so that the normal readings are at the approximate midpoint and maximum system pressures do not exceed full scale.
- C. Furnish and install a gauge valve at each pressure gauge. Gauge valves shall be Crane Model No. 88, Needle Valve, Ernst Gage Co. FLG 200, Wexler Instrument Corp. Type BBV4, or approved equal, rated for pressure intended.
- D. Gauge connections for pressure gauges, thermometers, or control instruments shall be made using tee fittings, except that gauge connections up to 1-inch size in steel may be using threaded extra heavy pipe couplings welded directly to the main, provided that the main is at least 2-inch size for 2-inch connections, 3-inch size for 3/4-inch connections, and 4-inch size for 1-inch connections. Minimum gauge connection shall be 2-inch ips.
- E. Provide snubbers on all gauges. Snubbers shall be No. 872 by Trerice, RS1/RS6 by Wexler Instruments, Miljoco or as approved equal.

## 2.9 FLOW METERS

- A. Griswold disturbed flow measurement quickset flow meters shall be utilized in lieu of sentinel type flow meters. Units shall consist of a spun steel venturi welded into the pipe. Disturbed fluid shall be channeled through the throat of the venturi with a multi-point Piezo Ring. Accuracy shall be  $\pm 1\%$  PSID with no straight pipe run required. Furnish differential pressure gauge supplied with carrying case and hoses.

## 2.10 PIPING SPECIALTIES

- A. Furnish and install flexible pipe connections, as specified and/or shown on the drawings, at connections to chillers, all vibrating equipment, and elsewhere as shown. Refer to Division 23 Section, *Vibration Controls for HVAC, Plumbing and Fire Protection Equipment* for specifications.
- B. Pressure relief valves shall be provided in the number and sizes required to relieve 110 percent of the full input to the systems. Valves shall be rated; and installed in accordance

with ASME, and CSD-1 including all amendments. Pipe discharge full size to floor drain, (with union) and support discharge pipe to prevent exerting any strain on relief valve body, piping to be Type-L copper. Water safety relief valves shall be Watts Series 740, Conbraco, Series 154A, Bell and Gossett, or approved equal. Provide pressure gauge adjacent to all safety relief valves.

#### 2.11 ESCUTCHEONS

- A. Provide chromium plated escutcheons properly fitted and secured with set screws on all exposed piping which passes through walls, floors or ceilings of finished spaces.
- B. All escutcheon plates shall be chrome plated spun brass of plain pattern, and shall be set tight on the pipe and to the building surface. Plastic escutcheon plates will not be accepted.

#### 2.12 DIELECTRIC CONNECTIONS:

- A. Furnish and install electrically insulated dielectric waterway fittings, unions or flanges, as manufactured by Victaulic Company Style 47, EPCO Sales, Inc., or approved equal at the following locations:
  - 1. Where steel piping systems join copper piping.
  - 2. Where copper tube connects to domestic water storage tanks, water heaters, heat exchangers, expansion tanks, and other steel vessels.
  - 3. Avoid the installation of steel nipples, cast iron or steel valves and specialties, or other ferrous components in predominately copper piping systems. Where such installation is necessary, isolate the component with dielectric connections. Do not mix steel pipe and copper tube in the same run of pipe or in the same section of a piping system.

#### 2.13 SLEEVES

- A. Sleeves shall be provided around all pipes through walls, floors, ceilings, partitions, roof structure members or other building parts. Sleeves shall be standard weight galvanized iron pipe two sizes larger than the pipe or insulation so that pipe or insulation shall pass through masonry or concrete walls or floors. Provide 20 gauge galvanized steel sheet or galvanized pipe sleeves for all piping passing through frame walls.
- B. Sleeves through floors shall be flush with the floor except for sleeves passing through Equipment Rooms which shall extend 3/4-inch above the floor. Refer to Division 23 Section, *Vibration Controls for HVAC, Plumbing and Fire Protection Equipment* for mechanical equipment room penetrations additional requirements. Space between the pipe and sleeve shall be caulked. Escutcheon plates shall be constructed to conceal the ends of sleeves. Each trade shall be responsible for drilling existing floors and walls for necessary sleeve holes. Drilling methods and tools shall be as hereinbefore specified.
- C. Sleeves through walls and floors shall be sealed with a waterproof caulking compound.
- D. Firestop at sleeves that penetrate smoke barriers smoke partitions and/or rated walls/floors.

## 2.14 WATER PROOF PIPE PENETRATION SEALS

- A. Provide and install waterproof pipe penetration seals at all pipes that enter the building below grade or through exterior wall.
- B. Link seals are to be Metraflex Metraseals, Model MS, Linkseal, or approved equal, black EPDM seal material, glass reinforced plastic pressure plates, zinc plated nuts and bolts, seals are to be resistant to sunlight and ozone, pressure rated to make a hydrostatic seal of up to 20 psig and up to 40 feet of head, temperature rated from -40 degrees F to 250 degrees Fahrenheit.

## 2.15 TEST PLUGS

- A. Description: Nickel-plated, brass-body test plug in NPS 2 (DN15) fitting. Test plugs shall be as manufactured by Trerice, Watts, Natural Meter or approved equal.
- B. Body: Length as required to extend beyond insulation.
- C. Pressure Rating: 500 psig minimum.
- D. Core Inserts: One or two self-sealing valves, suitable for inserting 1/8 inch OD probe from dial-type thermometer or pressure gage.
- E. Core Insert: Self-sealing valve, suitable for inserting 1/8 inch OD probe from dial-type thermometer or pressure gage.
- F. Core Material for Air, Water, Oil, and Gas: 20 to 300 degrees F chlorosulfonated polyethylene synthetic rubber.
- G. Test-Plug Cap: Gasketed and threaded cap, with retention chain or strap.
- H. Test Kit: Pressure gage and adapter with probe, two bimetal dial thermometers, and carrying case.
- I. Pressure Gage and Thermometer Ranges: approximately two times the system's operating conditions.

## PART 3. EXECUTION

### 3.1 GENERAL PIPING INSTALLATION REQUIREMENTS

- A. All pipes shall be cut accurately to measurements established at the building, and shall be worked into place without springing or forcing, properly clearing all windows, doors and other openings. Excessive cutting or other weakening of the building structure to facilitate piping installation will not be permitted. All pipes shall be so installed as to permit free expansion and contraction without causing damage. All horizontal mains shall pitch down in the direction of flow with a grade of not less than 1 inch in 40 feet. All open ends of pipe lines, equipment, etc., shall be properly capped or plugged during installation to keep dirt or other foreign material out of the system. All pipes shall be run parallel with the lines of the

building and as close to walls, columns and ceilings as may be practical, with proper pitch. All piping shall be arranged so as not to interfere with removal of other equipment on devices not to block access to doors, windows, manholes, or other access openings. Flanges or unions, as applicable for the type of piping specified, shall be provided in the piping at connections to all items of equipment, coils, etc., and installed so that there will be no interference with the installation of the equipment, ducts, etc. All valves and specialties shall be placed to permit easy operation and access and all valves shall be regulated, packed and glands adjusted at the completion of the work before final acceptance. All piping shall be installed so as to avoid air or liquid pockets throughout the work. Ends of pipe shall be reamed so as to remove all burrs.

- B. All piping shall be graded to convey entrained air to high points where automatic air vents shall be provided. The size of supply and return pipes for each piece of equipment shall in no case be smaller than the outlets in the equipment.
- C. All piping shall be run to provide a minimum clearance of 2-inches between finished covering on such piping and all adjacent work. Group piping wherever practical at common elevations.
- D. All valves, strainers, caps, and other fittings shall be readily accessible.
- E. Drain valves with hose connections shall be provided at low points for drainage of piping systems. Blow down valves shall be provided at the ends of all mains and branches so as to properly clean by blowing down the lines throughout in the direction of normal flow.
- F. All branches from water mains shall be taken from the top of the supply mains at an angle of forty-five (45) degrees above the horizontal, unless otherwise directed. Branches feeding down shall be taken from the side or bottom of the main on water mains only. All connections shall be carefully made to insure unrestricted circulation, eliminate air pockets or trapped condensate, and permit the complete drainage of the system.
- G. Cutoff valves shall be provided on each branch line from the mains on all heating/air conditioning lines.
- H. Balancing valves shall be installed in all heating/air conditioning water branches and at all pumps, and where indicated on the drawings.
- I. Unions shall be installed on all bypasses, ahead of all traps, at all connections to equipment, where shown on drawings or where required to facilitate removal of equipment whether shown or not.
- J. Spring clamp plates (escutcheons) shall be provided where pipes are exposed in the building and run through walls, floors, or ceilings. Plates shall be chrome plated spun brass of plain pattern, and shall be set tight on the pipe and to the building surface.
- K. If the size of any piping is not clearly evident in the drawings, the Contractor shall request instructions for the Engineer as to the proper sizing. Any changes resulting from the Contractor's failure to request clarification shall be at his expense. Where pipe size discrepancies or conflicts exist in the drawings, the larger pipe size shall govern.

- L. Install all valves with stem upright or horizontal, not inverted.
- M. Where pipe support members are welded to structural building framing, scrape, brush clean, weld and apply one coat of zinc rich primer.
- N. Provide clearance for installation of insulation and access to valves and fittings.
- O. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.
- P. All water containing pipes shall be routed clear of combustion air dampers and louvers to prevent freezing condition when dampers are open.
- Q. Provide manual air vents at top of piping systems.

### 3.2 THERMOMETER AND PRESSURE GAGE INSTALLATION REQUIREMENTS.

- A. Install thermometers and adjust vertical and tilted positions.
- B. Install separable sockets in vertical position in piping tees where fixed thermometers are indicated.
  - 1. Install with socket extending to one-third diameter of pipe.
  - 2. Fill sockets with oil or graphite and secure caps.
- C. Install pressure gages in piping tees with pressure-gage valve located on a pipe at most readable location.
- D. Adjust faces of thermometer and gages to proper angle for best visibility.
- E. Clean windows of thermometer and gages and clean factory-finished surfaces. Replace cracked and broken window, and repair scratched and marred surfaces with manufacturer's touch up paint.

### 3.3 VALVE INSTALLATION REQUIREMENTS

- A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance of valves. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- C. Operate valves from fully open to fully closed positions. Examine guides and seats made accessible by such operation.
- D. Examine threads on valve and mating pipe for form and cleanliness.

- E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.
- F. Do not attempt to repair defective valves; replace with new valves.
- G. Install valves as indicated, according to manufacturer's written instructions.
- H. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate the general arrangement of piping, fittings, and specialties.
- I. Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance, and equipment removal without system shutdown.
- J. Locate valves for easy access and provide separate support where necessary.
- K. Install valves in horizontal piping with stem at or above the center of the pipe.
- L. Install valves in a position to allow full stem movement.
- M. For chain-wheel operators, extend chains to 60 inches above finished floor elevation.
- N. Adjust or replace packing after piping systems have been tested and put into service, but before final adjusting and balancing. Replace valves if leak persists.

#### 3.4. REFRIGERANT PIPING AND ACCESSORIES INSTALLATION REQUIREMENTS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- B. Install refrigerant piping according to ASHRAE 15.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise. All exposed piping shall be hard copper tubing with brazed joints. Refer to Architectural Contract Documents to determine exposed areas.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping adjacent to units to allow service and maintenance.
- F. Install piping free of sags and bends. Install VEE clevis hangers and VEE troughs on pipes less than ¾" inch in diameter.
- G. Install fittings for changes in direction and branch connections.
- H. Select system components with pressure rating equal to or greater than system operating pressure.

- I. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- J. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified if valves or equipment requiring maintenance is concealed behind finished surfaces.
- K. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.
- L. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- M. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- N. Identify refrigerant piping and valves.
- O. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 23 Section, "Common Work Results for HVAC".
- P. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 23 Section, "Common Work Results for HVAC".
- Q. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 Section, "Common Work Results for HVAC".
- R. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet (6m) long.
  - 2. Roller hangers and spring hangers for individual horizontal runs 20 feet (6m) or longer.
  - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet (6m) or longer, supported on a trapeze.
  - 4. Spring hangers to support vertical runs.
  - 5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- S. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
  - 1. NPS ½ (DN 15): Maximum span, 60 inches (1500mm); minimum rod size, ¼ inch (6.4mm).

2. NPS 5/8 (DN 18): Maximum span, 60 inches (1500mm); minimum rod size, ¼ inch (6.4mm).
  3. NPS 1 (DN 25): Maximum span, 72 inches (1800mm); minimum rod size, ¼ inch (6.4mm).
  4. NPS 1-1/4 (DN 32): Maximum span, 96 inches (2400mm); minimum rod size, 3/8 inch (9.5mm).
  5. NPS 1-1/2 (DN 40): Maximum span, 96 inches (2400mm); minimum rod size, 3/8 inch (9.5mm).
  6. NPS 2 (DN 50): Maximum span, 96 inches (2400mm); minimum rod size, 3/8 inch (9.5mm).
  7. NPS 2-½ (DN 65): Maximum span, 108 inches (2700mm); minimum rod size, 3/8 inch (9.5mm).
  8. NPS 3 (DN 80): Maximum span, 10 feet (3m); minimum rod size, 3/8 inch (9.5mm).
  9. NPS 4 (DN 100): Maximum span, 12 feet (3.7m); minimum rod size, 1/2 inch (13mm).
- T. For all interior refrigerant pipe/tubing that is less than 3/4inch in diameter, utilize VEE type clevis hanger Model 200 V and VEE type trough Model 200 VT; as manufactured by Carpenter and Patterson or approved equal. VEE trough materials shall be carbon steel with pre-galvanized finish. Install as required to maintain maximum hanger spacing requirements.
- U. All accessories shall be ARI rated. Furnish required nitrogen and refrigerant to fully test and charge system. Flood piping system with nitrogen when brazing.
- V. Refrigerant piping shall be Type 1 hard temper (ACR) copper tubing with wrought copper solder fittings. Make joints with silver solder and non-corrosive flux.
- W. Refrigerant piping shall be cleaned, dehydrated and evacuated. Piping shall be evacuated and held to less than 2.5 mm Hg vacuum for a period of not less than 12 hours without appreciable pressure rise. Vacuum shall then be broken with refrigerant or dry nitrogen and re-evacuated to 2.5 mm Hg vacuum for an additional 12 hours. Piping test to be witnessed by Owner's representative and documented in writing. Submit results of tests to Architect/Engineer.
- X. Follow ASHRAE 15, latest edition procedures for charging and purging of systems and for disposal of refrigerant.
- Y. Fully charge completed system with refrigerant after tested.
- Z. Test and inspect refrigerant piping according to ASME B31.5, Chapter VI.
1. Test refrigerant piping, specialties and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure.
  2. Test high- and low-pressure side piping of each system at not less than the lower of the design pressure or the setting of pressure relief device protecting high and low side of system.
    - a). System shall maintain test pressure at the manifold gage throughout duration of test.
    - b). Test joints and fittings by brushing a small amount of soap and glycerin

- solution over joint.
- c). Fill system with nitrogen to raise a test pressure of 150 psig (1035 kPa) or higher as required by authorities having jurisdiction.
  - d). Remake leaking joints using new materials, and retest until satisfactory results are achieved.
- AA. Adjust set-point temperature of the chilled-water controllers to the system design temperature.
- BB. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
- 1. Open shutoff valves in condenser water circuit.
  - 2. Check compressor oil level above center of sight glass.
  - 3. Check compressor-motor alignment, and lubricate motors and bearings.
- CC. Before installing copper tubing other than Type ACR, clean tubing and fittings with trichloroethylene.
- DD. Replace core of filter-dryer after system has been adjusted and design flow rates and pressures are established.
- EE. Charge system using the following procedures:
- 1. Install core in filter-dryer after leak test but before evacuation.
  - 2. Evacuate entire refrigerant system with a vacuum pump to a vacuum of 500 micrometers (67 Pa). If vacuum holds for 12 hours, system is ready for charging.
  - 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig (14 kPa).
  - 4. Charge system with a new filter-dryer core in charging line. Provide full-operating charge.

### 3.5. PIPE JOINTS INSTALLATION REQUIREMENTS

- A. **Welded Joints:** Joints in piping 2-1/2-inches and larger shall be fusion welded. Welding shall be in accordance with recommendations of the American Welding Society. Welding fittings shall conform in physical and chemical properties to the latest revisions of the American Society for Testing Materials.
- B. **Qualify welding procedures, welders and operators** in accordance with ASME B31.1, or ASME B31.9 as applicable, for shop and project site welding of piping work. Certify welding of piping work using Standard Procedure Specifications by, and welders tested under supervision of, National Certified Pipe Welding Bureau (NCPWB). Submit welders qualifications for approval.
- C. **Grooved Joints:** Grooved joint shall be installed in accordance with the manufacturer's written recommendations. Grooved ends shall be clean and free from indentations,

projections, or roll marks. The gasket shall be molded and produced by the coupling manufacturer of an elastomer suitable for the intended service. 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.)

- D. Screwed Joints: All screwed joints shall be made with tapered threads properly cut. Screwed joints shall be made perfectly tight with a stiff mixture of graphite and oil, applied with a brush to the male threads on the fittings.
- E. Soldered Joints and Copper Piping: Joints in copper piping shall conform to the following minimum standards.
1. The pipes shall be cut to a length making certain that the ends are square, using a fins hacksaw blade or tube cutter. The ends of all pipes shall be reamed and all burrs removed.
  2. The outside end of the pipe and the cut end of the fitting shall be cleaned with steel wool, sand cloth, or steel wire brush. All dark spots shall be removed.
  3. The flux shall be applied evenly and sparingly to the outside end of the pipe and the inside of the outer end of the fitting until all surfaces to be jointed are completely covered. The piping and fitting shall be slipped together and reworked several times to insure an even distribution of the flux.
  4. The correct amount of solder per joint for each size pipe shall be used in accordance with the manufacturer's recommendations.
  5. Solder joints shall be made by using a direct flame from a torch.
  6. On pipe sizes larger than ¼-inch, the fittings and valves in the pipe shall be moved or tapped with a hammer when the solder starts to melt to insure an even distribution of the solder.
  7. The excess solder shall be removed while it is still in the plastic state leaving a fillet around the cup of the fitting.
  8. Solder joints shall be suitable for working pressure of 100 psig and for working temperature of not less than 250 degrees F. The type of solder and flux used will be submitted for approval. Type 95-5 shall be the minimum standard.
  9. Lead and antimony-based solders shall not be used for potable water systems. Brazing and silver solders are acceptable.
- F. Where copper piping joins steel piping, approved bronze adapters shall be used.
- G. Prohibited Connections: No direct weld, soldered, or brazed connections, without unions or flanges, shall be made to valves, strainers, apparatus, or related equipment. Right and left

couplings, long threads, or caulking of pipe threads or gasket joints will not be permitted.

### 3.6. HANGERS, SUPPORTS, ANCHORS, GUIDES INSTALLATION REQUIREMENTS

- A. General: All hangers shall be of an approved type arranged to maintain the required grading and pitching of lines to prevent vibration and to provide for expansion and contraction. Provide protection saddles between hangers and insulation on heating water insulated pipe. Saddles shall be Grinnells Figure 173/273 or approved equal. Provide approved spacers between saddles and pipe where flexible insulation is specified. Provide insulation protection shields for insulated piping without saddles. Shield shall be Grinnell Figure 167 or as approved equal.
- B. Spacing: Regardless of spacing, hangers shall be provided at or near all changes in direction, both vertical and horizontal, for all piping. For cast iron soil pipe, one hanger shall be placed at each hub or bell.
- C. Vertical Lines: Shall be supported at their bases, using either a suitable hanger placed in a horizontal line near the riser, or a base type fitting set on a pedestal, foundation or support.
- D. Racks and Brackets: All horizontal piping on vertical walls shall be properly supported by suitable racks securely anchored into the wall construction. Where not practical to obtain ceiling anchorage, all piping near walls shall be supported by approved brackets securely anchored into the wall construction. Washer plates (Fib. 60, 60L) and other miscellaneous attachments, fasteners, etc., shall be Grinnell or as approved equal.
- E. Pipe Hangers and supports shall be attached to the panel point at the top chord of bar joist.
- F. Select hangers and components for loads imposed. Secure rods with double nuts.
- G. Support of horizontal piping shall allow for vertical adjustment after installation of piping.
- H. Support overhead piping with clevis hangers.
- I. Do not support all parallel piping from the same joist.

### 3.7. AIR VENTING INSTALLATION

- A. The top of each hydronic water supply and return piping and other points as indicated or where necessary for the removal of air from the system or equipment, shall be vented using an approved type of manual air vent.
- B. In addition to manual air vents at high points of system, each item of water heat transfer equipment shall be manually vented using an approved type manual air vent. All air vents shall be accessible.

### 3.8. EXPANSION LOOPS AND SWING CONNECTION INSTALLATION REQUIREMENTS

- A. Install pipe bends and loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

- B. Connect risers and branch connections to mains with at least five pipe fittings, including tee in main.
- C. Connect risers and branch connections to terminal units with at least four pipe fittings, including tee in riser.
- D. Connect mains and branch connections to terminal units with at least four pipe fittings, including tee in main.

3.9. PIPING IDENTIFICATION INSTALLATION

- A. All piping shall be identified with painted background marked with the name of the service with arrows to indicate flow direction. Color code and system identification shall comply with ANSI Standards and piping identification system shall comply with ASME A13.1-81., scheme for the identification of piping systems and ASHRAE Fundamentals Handbook, latest edition.
- B. Markings shall be plain block letters, stenciled on pipes, and shall be located near each branch connection, near each valve, and at least every 10 feet on straight runs of pipe. Where pipes are adjacent to each other, markings shall be neatly lined up. All markings shall be located in such manner as to be easily legible from the floor. Pipe identification schedule shall be as follows:

OUTSIDE DIAMETER OF PIPE OR COVERING (INCHES)	LENGTH OF COLOR FIELD (INCHES)	SIZE OF LETTERS (INCHES)
½ to 1 ¼	8	½
1-½ to 2	8	¾
2 ½ to 6	12	1 ¼
8 to 10	24	2 ½
Over 10	32	3 ½

3.10. VALVE IDENTIFICATION REQUIREMENTS

- A. All valves shall be tagged with a numbered tag.
- B. The tags shall be made of 1-inch diameter brass tags fastened to the valve by means of brass chains. Numbers shall agree with valve numbers on diagrammatic herein before specified.
- C. Provide a minimum of three (3) valve charts with valve numbers indicating valve type, size, manufacturer and service.
- D. Additional valve charts shall be mounted behind glazed wooden frames and be hung in each mechanical equipment room including each air handling unit mechanical equipment room. Additional copies shall be provided in each copy of the O&M manuals.

3.11. CLEANING PIPING AND EQUIPMENT

- A. All chilled water, condenser water, HVAC systems shall be cleaned by filling with a solution of one (1) pound of trisodium phosphate to each 50 gallons of water and circulating this solution for a period of six (6) hours during which time the system shall reach operating temperature. The systems shall then be flushed with fresh water and refilled with fresh water and/or where indicated antifreeze solution and purged of all air.
- B. All condenser water, chilled water, HVAC, piping system shall be flushed clean with fresh water. See Division 22 Sections, *Plumbing Fixtures* and *Plumbing Equipment* for domestic potable water cleaning and sterilization. Where indicated, hydronic systems shall be filled with 25 percent by volume antifreeze.
- C. Any equipment, such as coils that have small tubing, shall be bypassed to prevent deposition of debris from the piping. Water balancing shall not be scheduled until the completion of the cleaning and treatment process.
- D. All strainers shall be inspected and cleaned prior to testing and balancing. In addition, prior to substantial completion, contractor must inspect and clean all strainers.

END OF SECTION

DIVISION 23 SECTION 230548  
VIBRATION CONTROLS FOR HVAC, PLUMBING AND FIRE PROTECTION EQUIPMENT

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## SECTION 230548 - VIBRATION CONTROLS FOR HVAC, PLUMBING AND FIRE PROTECTION EQUIPMENT

## PART 1 RELATED DOCUMENTS

## 1.1 GENERAL

- A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections apply to work of this section.
- B. All work under this section shall also be subject to the requirements of Division 23 Section, *Common Work Results for HVAC*.

## 1.2 SUMMARY

- A. Provide all labor and materials necessary to furnish and install vibration control systems on this project as herein specified and/or shown on the drawings.
- B. Mount all mechanical equipment on suitable vibration isolators so as to prevent transmission of vibration into or through the building structure. Isolators shall be as manufactured by Mason Industries, Inc., Korfund, Inc., Amber Booth, or approved equal, and shall be selected by the isolator manufacturer for each item of equipment in accordance with requirements hereinafter specified.
- C. The equipment manufacturer shall supply all pump and motor bases, fan and motor bases, cradles, isolation pipe/duct hangers, spring and/or neoprene isolators, neoprene pads, flexible connectors, etc. as a coordinated package by a single manufacturer.
- D. Select isolators for uniform static deflections according to distribution of weight; and for not less than the indicated isolation efficiency with the lowest rotational speed of equipment as the disturbing frequency.
- E. Isolators and bases shall be stable during stopping and starting of equipment without transverse or eccentric movement of equipment, and shall be designed to resist horizontal forces of equipment which may operate unbalanced.
- F. In general, select isolators on the basis of criteria as specified in the ASHRAE Applications Handbook, Latest Edition.

## 1.3 SUBMITTALS

- A. Shop Drawings: Indicate inertia bases and locate vibration isolators, with static and dynamic load on each.
- B. Product Data: Provide schedule of vibration isolator type with location and load on each.
- C. Manufacturer's Installation Instructions: Indicate special procedures and setting dimensions.
- D. Manufacturer's Certificate: Certify that isolators are properly installed and adjusted to meet or exceed specified requirements.

#### 1.4 PROJECT RECORD DOCUMENTS

- A. Record actual locations of hangers including attachment points.

#### 1.5 COLOR CODING

- A. All springs shall be color coded for load carrying capacity.

#### 1.6 ALTERNATES

- A. Refer to Division 01 Section, *Alternates* - Alternates for description of work under this section affected by alternates.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURER

- A. Isolators shall be the equivalent of the following types by Mason Industries, Inc., Korfund, Inc. or approved equal.

#### 2.2 CORROSION PROTECTION FOR STEEL PARTS

- A. Where steel parts are exposed to weather or humid environments provide hot-dipped galvanized coating of at least 2 ounces of zinc per square foot of surface. Coat springs with neoprene.

#### 2.3 SPRINGS

- A. All springs shall have minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between .3 and .6 of maximum deflection.

#### 2.4 NEOPRENE

- A. Grade durometer 40, 50 OR 60 AND OIL RESISTANT.

#### 2.5 SPRING ISOLATORS

- A. Restrained Spring Isolator: Equipment with operating weight different from the installed weight such as chillers, boilers, etc., shall be mounted on spring mountings as described above, but a housing shall be used that includes vertical limit stops to prevent spring extension when weight is removed. The housing shall serve as blocking during erection and mounts shall be located between the supporting steel and roof or the grillage and dunnage as shown on the drawings. The installed and operating heights shall be the same. A minimum clearance of ½" shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring action. Limit stops shall be out of contact during normal operations. Mounting shall be type SLR.

#### 2.6 SUSPENSION ISOLATORS

- A. General: Provide hangers with suspension isolators encased in open steel brackets. Isolate

hanger rods from isolator steel brackets with neoprene-lined opening.

- B. Suspension Spring Isolators: Vibration hangers shall contain a steel spring and 0.3" deflection neoprene element in series. The neoprene element shall be molded with a rod isolation bushing that passes through the hanger box. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing thru a 30° arc before contacting the hole and short circuiting the spring. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Submittals shall include a scale drawing of the hanger showing the 30° capability. Hangers shall be type 30N.
- C. Precompressed Suspension Spring Isolators: Vibration hangers shall be as described in "C" above, but they shall be precompressed to the rated deflection so as to keep the piping or equipment at a fixed elevation during installation. The hangers shall be designed with a release mechanism to free the spring after the installation is complete and the hanger is subjected to its full load. Deflection shall be clearly indicated by means of a scale. Submittals shall include a scale drawing of the hanger showing the 30° capability. Hangers shall be type PC30N.

2.7 FLEXIBLE CONNECTORS FOR PIPING

- A. General: Straight or elbow flexible connectors rated for temperatures, pressures, and fluids to be conveyed. Provide flexible connectors with the strength 4 times operating pressure at highest system operating temperature. Provide elbow flexible connectors with a permanently set angle.
- B. Elastomeric Flexible Connectors: Flexible neoprene connectors shall be manufactured of multiple plies of nylon tire cord fabric and neoprene both molded and cured in hydraulic rubber presses. No steel wire or rings shall be used as pressure reinforcement. Straight connectors shall have two spheres. Connectors up to and including 1 ½ " diameter may have threaded ends. Connectors 2" and larger shall be manufactured with floating galvanized flanges recessed to lock the connector's raised face neoprene flanges. Hoses shall be installed on the equipment side of the shut-off valves. Connectors shall be rated a minimum of 150 psi at 220°F. Flanged equipment shall be directly connected to neoprene elbows in the size range 2 ½ " through 12" if the piping makes a 90° turn at the equipment. All straight through connections shall be made with twin-spheres properly pre-extended as recommended by the manufacturer to prevent additional elongation under pressure. 12" and larger sizes operating above 100 psi shall employ control cables with end fittings isolated by means of ½ " thick bridge bearing neoprene washer bushings designed for a maximum of 1000 psi.

Submittals shall include two test reports by independent consultants showing minimum reductions of 20 DB in vibration accelerations and 10 DB in sound pressure levels at typical blade passage frequencies.

Elbows shall be Mason-Flex type MFNEC, straight connectors Mason-Flex type MFTFU or MFTNC, and control cable assemblies type ACC.

- C. Metal Flexible Connectors: Fabricated of Grade E phosphor bronze, monel or corrugated stainless steel tube covered with comparable bronze or stainless steel braid restraining and pressure cover. Sizes 3" and larger shall be flanged. Sizes 2 ½ " and smaller shall have male nipples. Lengths shall be as indicated:



Nominal Diameter (Inches)	Length (Inches)
1/2 "	12"
3/4"	12"
1 1/2 "	12"
1 1/2 "	12"
2"	12"
2 1/2 "	12"
3"	18"
4"	18"
5"	24"
6"	24"
8"	24"
10"	24"

Hoses shall be installed on the equipment side of the shut-off valves horizontally and parallel to the equipment shafts wherever possible. Hoses shall be type BSS.

PART 3 EXECUTION

3.1 GENERAL PROVISIONS

- A. Install vibration-and-noise isolation materials and equipment as indicated and in accordance with machinery manufacturer's instructions.
- B. A minimum of 6" thick reinforced concrete housekeeping pads shall be provided under all chillers. Rest subbases on structural floor and reinforce with steel rods interconnected with floor reinforcing bars by tie bars hooked at both ends. Provide at least one (1) inch clearance between subbases and inertia bases, steel bases, and steel saddles with machinery in operation.
- C. All vibration isolators exposed to weather or humid environment shall be hot dipped galvanized with springs coated with neoprene in accordance with paragraph hereinbefore described.
- D. Anchor Bolts and Grout: Secure machinery to foundations and inertia bases with anchor bolts. Grout equipment with baseplates, the full area under baseplates with premixed non-shrinking grout. After grout has set, remove wedges, shims, and jack bolts and fill spaces with grout.
- E. Vertical Stops: For machinery affected by wind pressure or having an operational weight different from installed weight, provide resilient vertical limit stops which prevent spring extension when weight is removed. Provide vertical stops for machinery containing liquid, such as water chillers. Spring isolated or protected spring isolated machinery must rock and move

freely within limits of stops or seismic restraint devices.

- F. Machinery: Provide vibration isolators, flexible connectors and seismic snubbers in accordance with manufacturer's recommendations. Machinery with spring isolators or protected spring isolators shall rock or move freely within limits of stops or seismic snubber restraints.
- G. Stability: Isolators shall be stable during starting and stopping of machinery without traverse and eccentric movement of machinery that would damage or adversely affect the machinery or attachments.
- H. Lateral Motion: The installed vibration isolation systems for each piece of floor or ceiling mounted machinery shall have a maximum lateral motion under machinery start up and shut down conditions of not more than ¼ -inch. Restrain motions in excess by approved spring mountings.
- I. Electrical Connections: Provide flexible conduit or multiple conductor cable connections for machinery with sufficient extra length to permit 2 inch minimum displacement in any direction without damage.
- J. Systems Not To Be Vibration Isolated: Do not provide vibration isolation for electrical raceways and conduits or for fire protection, storm, sanitary, and domestic water piping systems which do not include pumps or other vibrating, rotating, or pulsating equipment including control and pressure reducing valves.
- K. Install in accordance with manufacturer's instructions.
- L. Install isolation for motor driven equipment.
- M. Install spring hangers without binding.
- N. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.
- O. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.
- P. Connect wiring to isolated equipment with flexible hanging loop.

### 3.2 PIPE ISOLATION

- A. Horizontal Pipe Isolation:
  - 1. Precompressed Suspension Spring Isolators:
    - a. For the first three pipe hangers in the main lines near the mechanical equipment provide precompressed suspension spring isolators. Floor supported piping shall rest on trained spring isolators. All precompressed suspension spring isolators hangers or the first three trained spring isolators mounts as noted above, will have the same static deflection as specified for the mountings under the connected equipment. If piping is connected to equipment located in basements and hangs

from ceiling under occupied spaces, the first three hangers shall have 0.75" deflection for pipe sizes up to and including 3", 1.5" deflection for pipe sizes up to and including 6" and 2.5" deflection thereafter. All other hangers and mounts will have a minimum steel spring deflection of 0.75". Hangers shall be located as close to the overhead supports as practical.

2. Combination Spring and Neoprene Suspension Hanger:
  - a. For horizontal runs in other than those hereinbefore specified provide suspension spring hangers (combination spring and neoprene) with .75" minimum steel spring deflection.
  - b. Chilled Water Supply/Return Piping:
    - 1). For the first 20 feet of the branch connection of the main supply and return piping at each floor.
    - 2). For all piping over 2" diameter.
- B. Floor-Supported Piping:
  1. Floor supports for piping in equipment rooms and adjacent to isolated equipment shall use vibration isolators as described hereinbefore and selected to the guidelines of hangers.
  2. The first three adjacent floor supports shall be the restrained spring type with a blocking feature that prevents load transfer to equipment flanges as the piping is filled and drained.
  3. Where piping is subject to larger thermal movement a slide plate shall be installed on the top of the isolator. Slide plate shall be teflon, graphite or steel.
  4. Provide a thermal barrier where neoprene products are installed directly beneath steam or hot water lines.
- C. Supports at Base of Pipe Risers: Piping isolation supports at the base of risers shall be two layers of ½" thick heavy-duty neoprene pad separated by ¼" thick steel plate. Use bearing plates sized to provide a pad loading of not more than 500 psi. Weld the stanchion between the pipe and isolation support to the pipe and weld or bolt to the isolation support. Bolt isolation support to the floor slab with resilient sleeves and washers. Where supplementary steel is required to support piping, provide a maximum deflection of 0.08 inches at the mid-span of this steel under the load. Rigidly support piping from the supplementary steel with the supplementary steel isolated from the building structure with isolators.

### 3.3 FLEXIBLE PIPE CONNECTORS

- A. Provide flexible connectors in accordance with manufacturers instructions where piping systems serving vibration isolated equipment and as shown on the drawings. Flexible connectors shall be installed near the connection to the equipment. Where liquid pulsation dampening is required, flexible connectors with spherical configuration may be used. Provide restraints for pipe connectors at pumps to prevent connector failure upon pump start-up.

- B. Provide flexible connectors at connections of air compressors to piping systems.

3.4 ISOLATION FOR SPECIFIC EQUIPMENT

- A. The vibration isolator manufacture shall provide isolators for all pieces of equipment provided for the job. Isolator shall be selected by the isolator manufacturer on the basis of criteria as specified in the ASHRAE Applications Handbook, latest edition, unless a more stringent requirement is indicated on the drawings.
- B. Chillers: Chillers shall be mounted on restrained spring isolator with vertical limit stops for not less than 1 inch static deflection under full operating load. Isolators shall be Mason Industries Type SLR or as approved equal. All exterior isolators for chillers shall be hot dipped galvanized including all hardware. Provide neoprene coated springs.

3.5 MANUFACTURER'S FIELD SERVICES

- A. Inspect isolated equipment after installation and submit report. Include static deflections.

END OF SECTION

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TESTING, ADJUSTING, AND BALANCING FOR HVAC AND PLUMBING  
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## SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC AND PLUMBING

## PART 1. GENERAL

## 1.1. GENERAL

- A. This section covers performance testing, adjusting and balancing of heating, ventilating, air conditioning and domestic re-circulating systems as specified in Division 23 Section, *Heating, Ventilating, and Air Conditioning Equipment* and in Division 22 Section, *Plumbing Fixtures and Plumbing Equipment*.
- B. For *Common Work Results of HVAC*, See Division 23. See Division 01 for *General Requirements*.
- C. The mechanical contractor shall select and employ an impartial, independent balancing agency to provide testing and balancing services for the heating, ventilating and air conditioning (HVAC) systems and other specified systems of this project.
- D. The work included in this section consists of furnishing labor, instruments, and tools required in testing, adjusting and balancing the HVAC systems, as described in these specifications or shown on accompanying drawings. Services shall include checking equipment performance, taking the specified measurements, and recording and reporting the results.
- E. The items requiring testing, adjusting, and balancing include, but are not limited to, the following:

Hydronic Systems:

Chiller  
Existing Cooling Tower  
Flow Measuring Stations  
Existing Chilled Water Pumps  
Existing Condenser Water Pumps  
System Mains and Branches  
Flow Meter Fittings

In addition, any existing pumps or equipment specified to be re-used under this project shall be tested and balanced, similar to new pumps or equipment.

## 1.2. EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
  - 1. Systems are started and operating in a safe and normal condition.
  - 2. Temperature control systems are installed complete and operable.
  - 3. Proper thermal overload protection is in place for electrical equipment.
  - 4. Hydronic systems are flushed, filled, and vented.

5. Pumps are rotating correctly.
  6. Proper strainer baskets are clean and in place.
  7. Service and balance valves are open.
- B. Submit field reports. Report defects and deficiencies noted during performance of services which prevent system balance.
- C. Beginning of work means acceptance of exiting conditions.

### 1.3. QUALIFICATIONS OF THE BALANCE AGENCY

- A. The balancing agency shall be a member of the Associated Air Balance Council (AABC) and have an engineer certified by the National Examining Board.
- B. The certified test and balance engineer shall be responsible for supervision and certification for the total work herein specified.
- C. All final reports shall be signed and officially stamped by the certified test and balance engineer.

### 1.4. PRE-BALANCING CONFERENCE

- A. Convene a conference one week prior to commencing work of this Section with all appropriate individuals.

### 1.5. STANDARDS

- A. The balancing agency shall perform the services specified herein in accordance with the Associated Air Balance Council's National Standards, including revisions, to the date of the contract.
- B. All terms in this specification shall have their meaning defined as stated in the National Standards.
- C. ASHRAE III: Practice for measurement, testing, adjusting and balancing of building heating, ventilation, air conditioning, and refrigeration systems.
- D. NEBB: Procedure standards for testing, adjusting, and balancing of environmental systems.
- E. AABC: Associated Air Balance Council

### 1.6. COORDINATION

- A. It will be necessary for the balancing agency to perform its services in close coordination with the mechanical contractor.
- B. The plans and specifications have indicated meters, valves, dampers, and other devices

for the purpose of adjusting the system to obtain optimum operating conditions. It will be the responsibility of the mechanical contractor to install these devices in a manner that will leave them accessible and readily adjustable. The balancing agency shall provide guidance if there is a questionable arrangement of a control or balancing device.

- C. The general contractor, mechanical contractor, temperature control contractor and suppliers of the HVAC equipment shall all cooperate with the balancing agency to provide all necessary data on the design and proper application of the system components.

#### 1.7. INSTALLATION TOLERANCE

- A. Unless otherwise indicated, all air devices shall be adjusted to within plus or minus 10 percent of design. All fans shall be adjusted to within plus or minus 5 percent of design. All pumps and Hydronic equipment shall be adjusted to within plus or minus 5 percent of design.

#### 1.8. RESPONSIBILITIES OF THE MECHANICAL CONTRACTOR

- A. The mechanical contractor shall sufficiently complete the installation and start all HVAC systems to insure they are working properly and shall perform all other items as described hereinafter to assist the balancing agency in performing the testing and balancing of the HVAC system.
- B. Record equipment manufacturer's standard start-up information and submit to Engineer for review. Testing and balancing work shall not commence on any equipment until start-up reports have been completed, reviewed by Engineer, and forwarded to Testing and Balancing Agency.
- C. Water Circulating Systems
  1. Verify installation for conformity to design.
  2. Check all pumps to verify pump alignment and rotation.
  3. Ensure that systems are clean, with the proper strainer screens installed for normal operation.
  4. Check all pump motors for current and voltage, to ensure that motors do not exceed nameplate rating.
  5. Provide thermal overload protection of proper size and rating. Record thermal overload ratings for all motors. Insert data in Test and Balance Report.
  6. Ensure that all water circulating systems shall be full and free of air; that expansion tanks are set for proper water level; and that all air vents were installed at high points of systems and are operating.

#### 1.9. RESPONSIBILITIES OF THE TEMPERATURE CONTROL CONTRACTOR

- A. The temperature control contractor shall complete the installation of the temperature

control system, and operate and test all control systems to ensure they are functioning properly as designed. The temperature control contractor shall assist the balancing agency in testing and balancing the HVAC systems, as described hereinafter.

1. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks.
  2. Verify that all controlling instruments are calibrated and set for design operating conditions.
  3. Calibrate temperature sensors after installation, and before the temperature sensors control verification tests are performed. The balancing agency shall prove the accuracy of final settings by taking temperature readings. The readings shall be in a typical conditional space for each separately controlled zone.
  4. The temperature control contractor shall allow sufficient time in the project to provide assistance and instruction to the balancing agency in the proper use and setting of control components such as, but not limited to, computers, static pressure controllers, or any other device that may need set points changed so that the testing and balancing work can be performed.
- B. All control sequences, software, equipment, and components shall be started-up by a qualified technician. Start-up report shall be submitted to Engineer prior to the commencement of testing and balancing work. Testing and balancing shall not commence until start-up reports are completed, reviewed by Engineer and forwarded to Testing and Balancing Agency.

#### 1.10. NOTIFICATION FOR TESTING AND BALANCING WORK TO BEGIN

- A. The mechanical contractor shall notify the balancing agency in writing when all heating, ventilating, and air conditioning systems are complete and ready for testing and balancing. The mechanical contractor shall attest that he has completed all items as herein described.
- B. The following must be completed prior to start of system balancing:
1. Piping systems completed, flushed and filled.
  2. Equipment properly started by qualified personnel or start-up technicians.
  3. Automation system (temperature controls) installed and completed for both air and water systems.
  4. All equipment controlled in automatic (“Auto”) mode.
  5. Access granted to the balancing contractor to the automation/controls system provided.

#### 1.11. DEFICIENCIES

- A. Any deficiencies in the installation or performance of a system or component observed

by the TAB agency shall be brought to the attention of the appropriate responsible person.

- B. The work necessary to correct items on the deficiency listing shall be performed and verified by the affected Contractor before the TAB Agency returns to retest. Unresolved deficiencies shall be noted in the final report.

#### 1.12. ADJUSTING

- A. Ensure recorded data represents actual measured observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring all sensors to specified settings.
- E. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.
- F. Check and adjust systems approximately six months after final acceptance and submit report.

#### 1.13. ALTERNATES

- A. Refer to Division 01 Section, *Alternates* for description of work under this section affected by alternates.

### PART 2. PRODUCTS (NOT APPLICABLE)

### PART 3. EXECUTION

#### 3.1. GENERAL

- A. Perform all testing and balancing in complete accordance with AABC National Standards for Field Measurements and Instrumentation.
- B. Furnish all test instruments and equipment. All instruments must have been calibrated within six (6) months prior to use and shall be checked for accuracy prior to and during the work.
- C. Review all systems designs and equipment, manufacturers' data, and be completely familiar with the work before proceeding.
- D. Report all malfunctions or deficiencies to the contractor so that corrective action can be taken. Test and Balance Report shall not be submitted for review until all malfunctions or deficiencies are corrected. Repeat tests where required until design conditions are

achieved.

- E. Where systems or equipment cannot be balanced or adjusted to design conditions, determine the cause and submit a complete report to the Engineer.
- F. Retest or rebalance the system as required during the warranty period.
- G. Test and balance all systems under adequate load condition. If, in the opinion of the Engineer, there is insufficient load to properly test and balance the systems, perform sufficient preliminary balancing and adjustment to permit operation of the systems until such time as final testing and balancing can be done. Provide in writing the future date when systems shall be tested under sufficient load.

### 3.2. EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine equipment performance data including pump curves.
  - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- F. Examine system and equipment installations and verify that field quality-control testing, cleaning and adjusting specified in individual Sections have been performed.
- G. Examine test reports specified in individual system and equipment Sections.
- H. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- I. Examine strainers. Verify that startup screens are replaced by permanent screens and indicated perforations.
- J. Examine system pumps to ensure absence of entrained air in the suction piping.
- K. Examine operating safety interlocks and controls on HVAC equipment.
- L. Report deficiencies discovered before and during performance of TAB procedures.

Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

### 3.3. WATER SYSTEM PROCEDURES

- A. The various water circulating systems shall be filled, purged of air, and put into operation before hydronic balancing by the mechanical contractor.
- B. The flow of water through all coils shall be adjusted by manipulating balancing valves until the rated pressure drop through the coil or metering device is obtained. Perform balancing by measurement of temperature differential in conjunction with air balancing.
- C. The balancing agency shall perform the following testing and balancing functions in accordance with the AABC National Standards.
- D. All Hydronic equipment and HVAC pumps shall be Tested and Balanced as described below:
  - 1. Water Treatment - Examine the water in the system and determine if the water has been treated and cleaned. If it has not, request the mechanical contractor to clean and treat the water prior to TAB work
  - 2. Strainers - Request that the mechanical contractor clean all strainers.
  - 3. Air Vents - Check all air vents at the high points of the water system and determine if they are installed and operating.
  - 4. Valves - Set all balancing valves to the full-open position for balancing.
  - 5. Pumps - Adjust all pumps and domestic hot water re-circulating water pumps to meet design GPM requirements. Check pumps for proper operation. Pumps shall be free of vibration and cavitation. Measure and record operating current and voltage. Check and record thermal overloads installed on all pumps. Record in Test and Balance Report.
  - 6. Tolerances - Proceed to balance all coils, pumps, balance valves chillers, to within 5 percent of design requirements.
  - 7. Marking - Mark all settings and record all data after completing the flow readings and coil adjustments.
  - 8. Where available pump capacity (due to diversity) is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.
- E. Chillers:
  - 1. Verify that chillers have been started by others and are in operation. Test and adjust chiller water flows to achieve maximum or design GPM.
  - 2. Current and Voltage - Test and record motor voltage and amperage, and compare

data with the nameplate limits to ensure compressor motor is not in or above the service factor.

3. Test and record temperature profiles of chillers.
4. Description of liquid sufficient to obtain physical properties.
5. Power input to controls and auxiliary components in KW.
6. Condenser water flow rate, temperature and pressure drop.

F. Cooling Towers:

1. Verify that cooling towers have been filled and started by others, and are in operation. Test cooling tower fans for proper RPM and airflow.
2. Test and adjust water flows to balance tower cells and flows between towers.
3. Test and record temperature profiles for water and air side operation.
4. Current and Voltage: Test and record motor voltage and amperage, and compare with nameplate limits to ensure fan motor is not in or above service factor.

3.4. TESTING AND BALANCING OF EXISTING SYSTEMS

- A. The balancing agency shall perform testing and balancing of existing air handling, fan and pump systems to the extent indicated. Existing air devices and terminals shall be re-tested and balanced where effected by new ductwork modifications.
- B. Test and Balance Agency shall assist the mechanical contractor in selection of new sheaves and belts, if required. Re-sheaving of existing air handling units or fans shall be done at no additional cost to owner. Where required, new sheave and belt size calculations shall be forwarded to the Engineer for review and approval.
- C. The Test and Balance Agency shall perform water system procedures (here-in before specified) on the following hydronic systems.
  1. Existing cooling tower.
  2. Existing chilled water pumps.
  3. Existing condenser water pumps

3.5. VERIFICATION OF TEMPERATURE CONTROL

- A. The balancing agency shall be assisted by the temperature control contractor in verifying the operation and calibration of all temperature control systems. The following tests shall be conducted:
  1. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, damper sequences, air and water reset.

2. Verify that all controlling instruments are calibrated and set for design operating conditions.
3. Verify the accuracy of the final settings by taking temperature readings. The readings shall be in a typical conditioned space for each separately controlled zone.

### 3.6. TEST AND BALANCE REPORTS

- A. The test and balance report shall be complete with logs, data, and records as required herein. All logs, data, and records shall be typed on white bond paper and bound. The report shall be certified accurate and complete by the balancing agency's certified test and balance engineer.
- B. Three (3) copies of the test and balance report are required and shall be submitted to the Engineer. If, in the opinion of the Engineer, test results or portions thereof are incomplete or inconclusive, repeat necessary portions of the work to the satisfaction of the Engineer.
- C. The report shall contain the following general data in a format selected by the balancing agency:
  1. Project Number
  2. Contract Number
  3. Project Title
  4. Project Location
  5. Project Mechanical Engineer
  6. Test & Balance Agency
  7. Test & Balance Engineer
  8. Construction Manager
  9. Mechanical Subcontractor
  10. Dates tests were performed
  11. Certification
  12. Phone Numbers of all Individuals Listed Above
- D. The test and balance report shall be recorded on report forms conforming to the recommended forms in the AABC National Standards.

### 3.7. TEST REPORT FORMS

- A. Pump Test Forms - Submit pump curve showing design, operating, and no-flow points of operation. Also, record the following items on each pump test form:
1. Manufacturer, size, model, service and serial number.
  2. All design and manufacturer's rated data.
  3. Pump operating suction and discharge pressure and final total dynamic head.
  4. No flow (pump discharge valve closed) suction and discharge pressure and corresponding total dynamic head. This procedure is to determine actual impeller size. Record impeller size.
  5. Rated and actual operating current, voltage, and brake horsepower of each pump motor.
  6. Total operating head pressure.
  7. Shutoff, discharge and suction pressures.
  8. Shutoff, total head pressure.
- B. Chiller Test Forms - Record the following items on each chiller test form:
1. Manufacturer model number, serial numbers.
  2. All design and manufacturer's rated data.
  3. Service and location.
  4. Actual pressure drop and related GPM primary side.
  5. Actual pressure drop and related GPM, secondary side.
  6. Primary side entering and leaving temperatures.
  7. Secondary side entering and leaving temperatures.
  8. Temperature control settings.
  9. Electrical characteristics.
- C. Flow Measuring Station Test Forms:
1. Identification/location.
  2. Manufacturer.
  3. Size and Model Number.
  4. Design and Actual Flow Rate.

5. Design and Actual Pressure Drop.
- D. Electric Motors Test Forms: (Applies to all motors, including pumps, fans and HVAC equipment)
1. Manufacturer.
  2. Model/Frame.
  3. HP/BHP.
  4. Phase, voltage, amperage; nameplate, actual, no load.
  5. RPM.
  6. Service factor.
  7. Starter size, rating, heater elements.
  8. Sheave Make/Size/Bore.
  9. Thermal overload settings
- E. V-Belt Drive Test Forms:
1. Identification/location.
  2. Required driven RPM.
  3. Driven sheave, diameter and RPM.
  4. Belt, size and quantity.
  5. Motor sheave diameter and RPM.
  6. Center to center distance, maximum, minimum, and actual.
- F. Cooling Tower Test Forms:
1. Tower identification/number.
  2. Manufacturer.
  3. Model number.
  4. Serial number.
  5. Rated Capacity.
  6. Entering air WB temperature, specified and actual.

7. Leaving air WB temperature, specified and actual.
8. Ambient Air DB temperature, specified and actual.
9. Condenser water entering temperature, specified and actual.
10. Condenser water leaving temperature, specified and actual.
11. Condenser water flow rate, specified and actual.
12. Fan RPM, specified and actual.

END OF SECTION

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HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT  
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## SECTION 230600 - HEATING, VENTILATING, AND AIR CONDITIONING EQUIPMENT

## PART 1 GENERAL

## 1.1 GENERAL

- A. The Conditions of the Contract and other General Requirements apply to the work specified in this section. All work under this section shall also be subject to the requirements of Division 23 Section, *Common Work Results for HVAC* and Division 01 Section *General Requirements*.

## 1.2 DESCRIPTION

- A. The work to be performed shall include all labor, materials and equipment necessary to furnish and install complete, all mechanical equipment as shown on drawings, hereinafter specified or reasonably implied, and leaving the same in satisfactory operation condition. It is the intent that systems be installed complete with all items necessary to accomplish this purpose.

## 1.3 SUBMITTALS

- A. Shop Drawings: Indicate assembly, equipment dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.
- B. Product Data:
1. Provide literature which indicates dimensions, weights, capacities, ratings, performance, gages and finishes of materials, and electrical characteristics and connection requirements.
  2. Submit electrical requirements for power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

## 1.4 OPERATION AND MAINTENANCE DATA

- A. Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of General Requirements.
- B. Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.
- C. Store all equipment in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.
- D. Comply with manufacturer's installation instructions for rigging, unloading and

transporting equipment.

- E. Protect all motors, shafts, and bearings from weather and construction dust.

#### 1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not operate any equipment for any purpose, temporary or permanent, until piping is clean, strainers are in place, bearings lubricated, and equipment has been test run under observation.

#### 1.7 ALTERNATES

- A. Refer to Division 01 Section, "Alternates" for description of work under this section affected by alternates.

### PART 2 PRODUCTS

#### 2.1 WATER COOLED MAGNETIC BEARING CHILLERS (VARIABLE SPEED COMPRESSORS)

- A. Section includes design, performance criteria, refrigerants, controls, and installation requirements for water-cooled magnetic bearing two stage centrifugal chillers. Chillers shall be suitable for operation with glycol. Provide packaged water cooled chiller of the size, capacity, and electrical characteristics as shown on the Contract Drawings.
- B. Comply with applicable Standards/Codes of ARI 550/590, ANSI/ASHRAE 15, ASHRAE 90.1 current version requirements, NEC/NFPA 70, and ASME Section VIII.
- C. Submit shop drawings and product data in accordance with specification requirements.
- D. All scheduled chilled water capacities are based on 25% propylene glycol solution by volume.
- E. Submittals shall include the following:
  - 1. Dimensioned plan and elevation view drawings, required clearances, and location of all field connections,
  - 2. 1/3 octave band sound ratings per ARI Standard 370.
  - 3. Single line schematic drawing of the field power hookup requirements, indicating all items that are furnished.
  - 4. Certification of factory run test.
  - 5. Installation manuals.
  - 6. Manufacturer's certified performance data at full load plus IPLV or NPLV.
- F. Qualifications: Equipment manufacturer must specialize in the manufacture of the products specified and have five years experience with the equipment and refrigerant offered.

- G. Regulatory Requirements: Comply with the codes and standards specified.
- H. Chiller must be manufactured in an ISO certified facility.
- I. Chillers shall be delivered to the job site completely assembled and charged with refrigerant and oil by the manufacturer.
- J. Comply with the manufacturer's instructions for rigging and handling.
- K. If unit is to be stored, comply with manufacturer instructions for storage.
- L. Warranty: The refrigeration equipment manufacturer's warranty shall be for a period of two (2) years from date of equipment start up. It shall cover replacement parts (and the labor to replace them) having proven defective within the above period.
- M. Extended Compressor Warranty: Three (3) years
- N. During the first 12 months of operation, the manufacturer shall perform quarterly remote or on-site operating inspections to confirm the chiller's operational performance. Resulting from each inspection, the manufacturer shall provide the owner with a report describing the condition of the equipment and each of its major components, a log of its current operating data, any issues needing to be addressed, and any recommended corrective actions.
  - 1. Basis of Design – Daikin McQuay Magnitude™ Chiller Model WMC, including the standard product features and all special features required per the plans and specifications.
  - 2. Equal Products - Equipment manufactured by Arctic Cool, or by York International may be acceptable as an equal. Naming these products as equal does not imply that their standard construction or configuration is acceptable or meets the specifications. Equipment proposed “as equal”, must meet the specifications including all architectural, mechanical, electrical, and structural details, all scheduled performance and the job design, plans and specifications.
- O. General: In general, unit shall consist of two or more magnetic bearing, completely oil-free centrifugal compressors, refrigerant, condenser and evaporator, and control systems including integrated variable frequency drive, operating controls and equipment protection controls. Chillers shall be charged with refrigerant HFC-134a. The entire chiller system, including all pressure vessels, shall remain above atmospheric pressure during all operating conditions and during shut down to ensure that non-condensables and moisture do not contaminate the refrigerant and chiller system.
- P. Each chiller shall be factory run-tested under load conditions for a minimum of one hour on an AHRI certified test stand with evaporator and condenser waterflow at job conditions (excluding glycol applications). Operating controls shall be adjusted and checked. The refrigerant charge shall be adjusted for optimum operation and recorded on the unit nameplate. Any deviation in performance or operation shall be remedied prior to shipment and the unit retested if necessary to confirm repairs or adjustments. Manufacturer shall supply a certificate of completion of a successful run-test upon request.

- Q. Chiller shall be equipped for single-point power connection, unless otherwise specified.
- R. Each compressor shall be 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, and allowing the chiller to remain in operation with the other compressor(s) on-line.
- S. Compressors:
1. Compressors shall be of semi-hermetic centrifugal design and operate oil-free with two-stages of compression, magnetic bearings, movable inlet guide vanes and integrated variable frequency drive system.
  2. Automatically positioned and controlled inlet guide vanes shall operate with compressor speed controls.
  3. The compressor shall be capable of coming to a controlled stop in the event of a power failure. The unit shall be capable of initializing an automatic restart in the case of a power failure.
  4. Each compressor shall have integrated microprocessor control capable of capacity and safety control.
  5. Each compressor shall be installed with individual suction, discharge and motor cooling refrigerant line isolation valves. Chillers without discharge line isolation valves that rely on non-return valves in the discharge line for compressor removal shall not be accepted.
  6. Each compressor shall have an individual disconnect switch. The compressor shall have mechanical and electrical isolation to allow the chiller to operate when a compressor is removed from the machine, on chillers that are provided with more than one compressor.
  7. Optional:
    - a. EMI filters installed for each compressor.
    - b. Vibration isolation pads.
- T. The evaporator and condenser shall be separate vessels of the shell-and-tube type, designed, constructed, tested and stamped according to the requirements of the ASME Code, Section VIII. Regardless of the operating pressure, the refrigerant side of each vessel will bear the ASME stamp indicating compliance with the code and indicating a test pressure of 1.1 times the working pressure, but not less than 100 psig. The tubes shall be individually replaceable and secured to the intermediate supports without rolling or expanding to facilitate replacement if required. Provide factory-mounted and wired, thermal-dispersion water flow switches on each vessel to prevent unit operation with no or low water flow. Paddle and pressure differential type switches are not acceptable due to high rates of failure and false indications from these types of flow indicators.
- U. Provide factory installed 1 ½" insulation on evaporator.
- V. Evaporator:

1. The evaporator shall be provided with spring loaded reseating-type pressure relief valves according to ASHRAE-15. Rupture disks are not acceptable.
2. To ensure effective liquid droplet removal, prevent liquid damage to compressors, and equalize suction pressure across evaporators with multiple compressors, a perforated plate designed for vapor disengagement shall be installed inside the evaporator above the tubing.

W. Condenser:

1. The condenser shall be provided with dual relief valve equipped with a transfer valve so one valve can be removed for testing or replacement without loss of refrigerant or removal of refrigerant from the vessel. Rupture disks are not acceptable.

X. Performance: Refer to the schedule of performance on the drawings. The chiller shall be capable of stable operation to a minimum of 20% percent of full load without hot gas bypass.

1. The unit shall provide ventilation in the controller to provide operation above 105°F up to 125°F ambient air temperatures.

Y. Manufacturer must provide both sound power and sound pressure data in decibels. Sound pressure data per AHRI 575. In addition, A-weighted sound pressure at 30 feet should be provided at 100%, 75%, 50% and 25% load points to identify the full operational noise envelope. If manufacturer cannot meet the noise levels (per the attached chart), sound attenuation devices and/or compressor sound blankets must be installed to meet this performance level.

<b>Sound Pressure:</b>									
Load	A Weighted Overall	63Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz
100%	83.5	46.0	55.5	65.5	70.5	74.5	76.0	80.0	74.5
75%	82.5	45.5	55.5	65.5	69.5	73.5	76.5	79.0	72.5
50%	81.0	45.0	54.5	64.0	69.0	71.0	74.5	77.5	70.0
25%	77.0	44.5	51.5	61.0	64.5	67.5	73.0	73.0	62.0

Sound Pressure (dB) measured in accordance with ANSI/AHRI Standard 575-2008 (A-weighted)

Z. Liquid Level Controls:

1. Control of refrigerant flow shall utilize a single or multiple 6,000 step electronic expansion valve (EXV), to operate within the full range from full load to the lowest loading capacity for the chiller. Fixed orifice metering devices or float controls using hot gas bypass are not acceptable. The EXV liquid line shall have a sight glass with moisture indicator and temperature sensor connected to the control system for validation of sub-cooling.
2. Load balancing valves shall be provided for capacity control and additional temperature stability.
3. The chiller shall be equipped with a backup valve to channel discharge gas from the outlet of the compressor to the evaporator, in order for the ramp up during a high pressure

ratio application.

AA. Prime Mover:

1. A permanent-magnet, synchronous hermetically sealed motor of sufficient size shall be provided to effectively meet compressor horsepower requirements. The motor shall include soft-start capabilities with an in-rush current of no more than 2 amps (TT300 models) and 4 amps (TT400 models). The motor shall be liquid refrigerant cooled with internal thermal overload protection devices embedded in the winding of each phase.
2. Compressor motor and chiller unit shall include variable-frequency speed controls to match cooling load demand to compressor speed and inlet guide vane position.
3. Each compressor shall be equipped with an AC line reactor and individual disconnect.

BB. Chiller Controls:

1. The controller fitted to the oil-free centrifugal chiller package shall be an embedded real-time microprocessor device that utilizes control software written specifically for chiller applications. User operation shall be accomplished using a panel mounted color touch-screen interface. The status of the compressors and all system parameters including compressor alarms and temperature trends shall be viewable.
2. Controller features must include the following:
  - a. Operator interface.
  - b. Chiller documentation shall be viewable via panel in pdf format.
  - c. Operator interface shall be capable of connecting directly to compressors via serial communication protocol, and displaying compressor information.
  - d. All control functionality shall be carried out on a dedicated real time processor, and data shall be served to a remote graphical user interface via an open Ethernet protocol.
  - e. Chiller controls shall be BacNet capable via MSTP or IP.
  - f. Complete configuration or native BAS communications via Modbus RTU, Modbus TCP/IP, BacNet MSTP and BacNet IP shall be made via standard chiller controller graphical user interface.
  - g. Chiller control shall be capable of controlling all compressors on all individual refrigerant circuits serving the same chilled water stream.
  - h. Chiller control panel user interface shall be capable of remote control via an internet connection, without the use of any third party gateway device or additional hardware or software.
  - i. Real time chiller control processor shall be capable e-mailing a predefined list of recipients, should a fault occur. E-mail shall include details of fault, possible reason for fault, attachment of a monthly data log of 195 or more compressor and chiller variables at a minimum of 30 second intervals, and indication of fault severity.
  - j. Ability to place all outputs in a manual station (hand, off, auto) via graphical user interface.
  - k. Alarm screen shall be capable of filtering faults into specific categories such as compressor, chiller and system faults in order to provide rapid diagnosis, and separation of failure modes.

- l. Built-in stepper motor controls for EXVs.
- m. Controls lockup protection.
- n. Three levels of alarm safety for minimum chiller down time.
- o. Chiller control software shall employ an active fault avoidance algorithm to reduce chiller capacity and/or power level in the case of the chiller approaching within 10% of any trip limit value such as suction pressure, discharge pressure, chiller amp limit, leaving chilled water temperature limit, etc...
- p. Real time data trending viewable via panel.
- q. Controls shall identify within 60 seconds, a compressor that is not starting or ramping-up properly. Upon this identification, the compressor shall be disabled, the remaining compressors shall be operated in an optimized manner, and an alarm shall be sent to alert the operator.
- r. Optional:
  - i. BMS interface module for the interface with BacNET MSTP, BacNET IP, or LonTalk FT10.

## 2.2 INDUSTRIAL INHIBITED PROPYLENE GLYCOL

- A. Provide a 25 percent by volume (as installed) industrial grade inhibited propylene glycol heat transfer fluid as manufactured by the Dow Chemical Company (Dowfrost HD), Houghton, Interstate Chemical (Intercool P-300) or approved equal. The 25 percent solution shall provide freeze protection to 15 degrees F and burst protection to 0 degrees F. The propylene glycol solution as supplied by the manufacturer shall contain corrosion inhibitors specially formulated for cool storage services to keep internal surfaces free from corrosion and fouling and shall include buffers, reserve alkalinity agents, antifoaming additives, and a fluorescent dye to aid in leak detection. The solution shall be easily re-inhibited using specially formulated inhibitor readily available from the field manufacturer. The manufacturer shall provide free propylene glycol yearly solution laboratory analysis for two (2) years. The analysis shall accurately report propylene glycol concentration, freeze point temperature, inhibitor level, alkalinity, particulate and recommended additions of glycol, inhibitor and buffers to ensure twenty-year minimum life. The fluid shall pass the ASTM D-1384 test with less than 0.5 mils penetration per year.
- B. Automotive antifreeze or any solutions containing silicates shall not be acceptable.
- C. Propylene glycol shall be supplied preduilted with deionized water and installed in the specified piping systems.
- D. Provide a Misco Products calibrated hand held refractor meter.
- E. Entire system shall conform to EPRI Standard propylene glycol systems 15751.

## 2.3 WATER TREATMENT SERVICES:

- A. Complete chemical water treatment service shall be provided by an organization regularly engaged in water treatment, ARC, Inc., RCCO Corp., Aquatel Ind., Inc., Mogul Corp., Oilin, Inc., HVAC Services, Inc., Feedwater Treatment Systems, Inc., Eco-Lab, or approved equal. The service shall provide all equipment, chemicals and labor necessary to prevent corrosion, inhibit scale build-up and minimize organic growth for a period of 2 years starting from building acceptance. Service visits for the purpose of

adding chemicals to feeding equipment, regulating bleed-off, inspecting and adjusting water treatment equipment, and obtaining samples of laboratory analysis shall be performed at monthly intervals for closed systems and every two weeks for open systems during the entire guarantee period. Chemicals shall not be injurious to water side equipment and construction materials. Records of all injurious to water side equipment and construction materials. Records of all service visits, chemical additions, laboratory tests, etc., shall be maintained and shall be provided to owner after each visit during guarantee period. Instruct mechanical contractor in field on piping and wiring of chemical feeding equipment.

- B. Systems to be protected shall include condenser water systems and chilled water system. Services shall include flushing and cleaning of piping systems specified under Division 23 Section, "HVAC Piping, Fittings, and Valves" section, furnishing and installing all chemical treatment equipment and accessories to perform the water treatment specified below. Maintain complete records of the treatment program for each system.
- C. Contractor shall perform an analysis of the building water supply as a basis of the chemical treatment. Contractor shall provide the Owner with written instructions for chemical feeding bleed-off, blowdown control and testing procedures, provide all required chemicals during the guarantee period, and provide all required test kits.
- D. Contractor shall maintain the following conditions in each system:

SYSTEMS	Chiller Water System
ph	8.0 to 10.5
Inhibitor for Scale & Corrosion Cycles	---
Cycles*	---
Organic	---
Buffered Nitrate	550 ppm
Chromate (Low)	
Molybdate	30 to 50 ppm
Sulfite	---
Sodium Nitrite	500 to 1000 PPM
Corrosion Inhibitor	100 to 150 PPM (as Molybdate) or 1000 to 1500 PPM sodium Nitrite
*Actual cycles of concentration to be determined from analysis of make-up water.	
* Use Inhibited Glycol supplied by Manufacturer	

- E. Chemical Feeding Equipment: Provide chemical feeding equipment, as specified below, to introduce chemicals into each system only when the system is operating.
  - 1. Closed Recirculating Systems

Five (5) gallon steel by-pass feeder installed across circulating pump suction and discharge lines, with tank and piping insulated using the same thickness and type of insulation as provided for the piping system. Provide filter. Unit shall contain quick opening cap and shall be suitable for working pressure of 175 psig. Tank shall be primed and finished in baked enamel paint.

2. Replace bypass feeder filter monthly during the entire 2-year warranty period.
- F. Closed Recirculating 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 the PH of the make-up water, flushing shall be resumed.
- G. Where glycol is specified or used, additional corrosion inhibitors should not be added without consulting the glycol manufacturer.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify all dimensions by field measurements. Verify that all equipment may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.
- B. Verify structure, mounting supports and membrane installations are completed to the proper point to allow installation of roof mounted equipment, where applicable.
- C. Examine rough-in requirements for all piping systems to verify actual locations of piping connections prior to installation.
- D. Verify that electrical work installation is in accordance with manufacture's submittal and installation requirements of Division 26 sections. Do not proceed with equipment start-up until electrical work is acceptable to equipment installer. Coordinate sizes of all thermal overloads with Division 26.
- E. Do not proceed until unsatisfactory conditions have been corrected.
- F. Provide wiring diagrams of all equipment as specified in Division 23 Section, *Common Work Results for HVAC*.

#### 3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install all equipment in accordance with manufacturer's installation instructions, in accordance with state and local code requirements, and in accordance with the contract drawings. Install all equipment plumb and level, to tolerances as required by the manufacturer of each item of equipment. Maintain manufacturer recommended clearances around and over all equipment.

- B. Coordinate vibration isolation requirements with all equipment in accordance with Division 23 Section, *Vibration Controls for HVAC, Plumbing and Fire Protection Equipment*.
- C. Coordinate all electrical requirements with Division 26.
- D. Coordinate all equipment pad locations and sizes with approved shop drawing submittals. Coordinate equipment pad locations and sizes with the Concrete Contractor or General Contractor. Furnish anchor bolts which are to be inserted in concrete pads to concrete installer.
- E. Verify piping arrangements of all equipment with the contract drawings. Piping details shall be strictly adhered to concerning valves, fittings, components, etc. At coils, where a rebuildable and repairable autoflow valve is installed in the line without the need for draining or shutting of the water, the same may be utilized as the isolation valve and additional shut-off valve is not required.
- F. Connect all equipment, devices and components to wiring systems and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening requirements specified in UL 486A.
- G. Testing: After installing HVAC equipment, devices and components and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
- H. Remove and replace malfunctioning units with new units and retest.
- I. All mechanical penetrations or terminations in exterior walls shall be flashed and caulked watertight.
- J. Arrange for equipment such as chiller to be shipped to project in modules where space constraints require the same. Field erect components as required.
- K. Installation of all equipment containing refrigerant shall be compliant with ASHRAE 15 requirements.

### 3.3 FIELD QUALITY CONTROL

- A. Where indicated provide the services of a factory authorized service representative to examine the field assembly of components, installation, piping, electrical connections, controls, and clearances. Submit factory start-up check list to Engineer for information purposes. Testing and balancing work shall not commence until start-up reports have been completed, reviewed by Engineer, and forwarded to Testing and Balancing Agency.
- B. Where factory start-up of equipment is not specified, provide field start-up by qualified technician to examine the field assembly of components, installation, piping, electrical connections, controls and clearances. Record equipment manufacturers standard start-up

information and submit to Engineer for review. Testing and balancing work shall not commence until start-up reports have been completed, reviewed by Engineer, and forwarded to Testing and Balancing Agency.

- C. Charge all refrigerant systems with refrigerant and oil and test for leaks. Repair leaks and replace lost refrigerant and oil.
- D. Fill all hydronic systems with water and/or antifreeze (when required after flushing and test for leaks. Repair leaks and replace lost water and/or antifreeze. Coordinate with water treatment contractor.
- E. Verify proper motor sizes, voltages, thermal overloads, nameplate data, etc. All equipment voltages and current shall be recorded to insure that motors are operating below their service factors. Test and Balance Engineer shall record electrical data before continuous or permanent operation.

### 3.4 DEMONSTRATION

- A. Where indicated, provide the services of a factory authorized service representative to provide start-up and to demonstrate and train the Owner's maintenance personnel.
- B. Place equipment into operation and adjust controls and safeties. Replace damaged or malfunctioning components and controls.
- C. Training:
  - 1. Train the Owner's maintenance personnel on start-up and shut-down procedures, trouble shooting procedures, lubrication, servicing procedures and preventative maintenance schedules/procedures. Review with the Owner's personnel, the contents of the operation and maintenance data specified in Division 23 Section, *Common Work Results for HVAC*.
  - 2. Submit operation and maintenance data as soon as possible prior to project close-out. Operations and maintenance data shall be submitted to the Owner for review and comment prior to submission to the Engineer.
  - 3. Schedule training with the Owner through the Architect and/or Engineer with at least seven (7) days prior notice.
- D. Contractor shall demonstrate removal and replacement of filters at all pieces of equipment with filters in the presence of the Owners representative.

### 3.5 CLEANING

- A. After completing installation, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes including chips, scratches, and abrasions.

### 3.6 CHILLER INSTALLATION REQUIREMENTS

- A. Align chiller package on steel or concrete foundations as indicated.

- B. Arrange chiller piping for easy dismantling to permit tube cleaning.
- C. Supply initial charge of refrigerant and oil as required.
- D. Comb out fins on air cooled chillers where deformed or bent. Replace or repair broken fins.
- E. Install chillers according to manufacturer's written instructions.
- F. Install chillers plumb and level, and anchor. Anchor housekeeping pads to building floor. Anchor chiller and vibration isolators to housekeeping pad.
- G. Install vibration isolators according to isolator manufacturer's written instructions.
- H. Maintain manufacturer's recommended clearances for service and maintenance.
- I. Install piping connections maintaining clearances for service and maintenance of chillers.
- J. Manufacturer's Field Service: Provide services of a factory-authorized service representative to supervise field assembly of components and installation of chillers, including piping and electrical connections, and to report results in writing.
  - 1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- K. Touch up scratches in unfinished surfaces to restore corrosion resistance.
- L. Touch up scratches in finished surfaces to restore finish.
- M. Provide services of a factory trained service technician to start chiller and train Owner on the chiller operation.
- N. Interlock chiller with automatic temperature control system. Coordinate requirements with automatic temperature control contactor.
- O. Install, wire, and interlock fluid flow switches. Interface with automatic temperature control system.
- P. Install flexible connectors, valves, fittings, thermostats, gauges, balance valves, etc... as indicated on flow diagram.

### 3.7 HYDRONIC EQUIPMENT AND SPECIALITIES INSTALLATION REQUIREMENTS

- A. Where large air quantities can accumulate, provide enlarged air collection standpipes.
- B. Provide manual air vents at system high points and as indicated.
- C. For automatic air vents provide vent tubing to nearest drain.
- D. Provide valved drain and hose connection on strainer blow down connection.

- E. Perform test determining strength of antifreeze and water solution and submit written test results.

### 3.8 WATER TREATMENT INSTALLATION REQUIREMENTS

- A. Systems shall be operational, filled, started, and vented prior to cleaning. Use water meter to record capacity in each system.
- B. Place terminal control valves in open position during cleaning. Open bypass valves on coils and close isolation valves on coils during initial flushing.
- C. Verify that electric power is available and of the correct characteristics.
- D. Use neutralizer agents on recommendation of system cleaner supplier and approval of Engineer.
- E. Flush open systems and closed systems with clean water for one hour minimum. Drain completely and refill.
- F. Remove, clean, and replace strainer screens.
- G. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.
- H. Test and submit antifreeze concentration where the same is utilized.

### 3.9 HEAT REJECTION EQUIPMENT INSTALLATION REQUIREMENTS

- A. Manufacturers 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.
- B. Adjust water-level control for proper operating level.
- C. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt and construction debris, and repair damaged finishes including chips, scratches and abrasions.
- D. Obtain wet-bulb, condenser-size, and performance selection tables from manufacturer.
- E. Lubricate bearings on fans and shaft as recommended by manufacturer.
- F. Ensure fan wheels rotate in correct direction without vibration or binding.
- G. Adjust belts to proper alignment and tension.
- H. Start existing cooling tower. Follow manufacturers written starting procedures.
- I. Check water level in existing cooling tower basin.

- J. Check operation of existing cooling tower basin, make-up line, solenoid valve, dampers, end switches, and low water cut-off controlling device.
- K. Pipe all drain pipes and bleed-off valves to floor drains with suitable air gaps.

END OF SECTION

DIVISION 23 SECTION 230701  
HVAC INSULATION

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## SECTION 230701 - HVAC INSULATION

## PART 1 GENERAL

## 1.1 REFERENCE

- A. The Conditions of the Contract and other General Requirements apply to the work specified in this Section. All work under this Section shall be subject to the requirements of Division 23 Section, *Common Work Results for HVAC*.
- B. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section

## 1.2 DESCRIPTION

- A. All piping and equipment installed under this Contract shall be covered as specified.

## 1.3 SCOPE

- A. The work covered by this specification consists of furnishing all labor, equipment, materials and accessories, and performing all operations required, for the correct fabrication and installation of thermal insulation applied to all piping, equipment, and duct systems, in accordance with applicable project specifications and drawings, subject to the terms and conditions of the contract.

## 1.4 STANDARDS

- A. Thermal insulation materials shall meet the property requirements of one or more of the following specifications as applicable to the specific product or use:
  - 1. American Society for Testing of Materials Specifications:
    - a). ASTM C 547, "Standard Specification for Mineral Fiber Preformed Pipe Insulation".
    - b). ASTM C 55, "Standard Specification for Mineral Fiber Blanket and Felt Insulation".
    - c). ASTM E 96, "Standard Test Methods for Water Vapor Transmission of Material".
    - d). ASTM C 585, "Recommended Practice for Inner and Outer Diameters of Rigid Pipe Insulation for Nominal Sizes of Pipe and Tubing (NPS System)".
    - e). ASTM C 612, "Standard Specification for Mineral Fiber Block and Board Thermal Insulation".
    - f). ASTM C 1136, "Standard Specification for Barrier Material, Vapor, "Type 1 or 2 (Jacket only)".

- g). ASHRAE 90.1 "Energy efficient design of new buildings except low-rise residential buildings", latest edition.
- B. Insulation materials, including all weather and vapor barrier materials, closures, hangers, supports, fitting covers, and other accessories, shall be furnished and installed in strict accordance with project drawings, plans, and specifications.

#### 1.5 SYSTEM PERFORMANCE

- A. Insulation materials furnished and installed hereunder should meet the minimum economic insulation thickness requirements of the North American Insulation Manufacturers' Association (NAIMA) (formerly known as TIMA), to ensure cost-effective energy conservation performance. Alternatively, materials should meet the minimum thickness requirements of National Voluntary Consensus Standard 90.1, (latest edition) and "Energy Efficient Design of New Buildings," of the American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE), latest edition. However, if other factors such as condensation control or personnel protection are to be considered, the selection of the thickness of insulation should satisfy the controlling factor. As minimum, all insulation thicknesses shall be as hereinafter specified.
- B. Insulation materials furnished and installed hereunder shall meet the fire hazard requirements of any one of the following specifications:
  - 1. American Society for Testing of Materials      ASTM E 84
  - 2. Underwriters' Laboratories, Inc.                      UL 723
  - 3. National Fire Protection Association                      NFPA 255
  - 4. ASTM E 96, "Standard Test Methods for Water Vapor Transmission of Materials".

#### 1.6 QUALITY ASSURANCE

- A. Insulation materials and accessories furnished and installed hereunder shall, where required, be accompanied by manufacturers' current submittal or data sheets showing compliance with applicable specifications listed in Section 1.4 above.
- B. Insulation materials and accessories shall be installed in a workmanlike manner by skilled and experienced workers who are regularly engaged in commercial insulation work.

#### 1.7 DELIVERY AND STORAGE OF MATERIALS

- A. All of the insulation materials and accessories covered by this specification shall be delivered to the job site and stored in a safe, dry place with appropriate labels and/or other product identification.
- B. The Contractor shall use whatever means are necessary to protect the insulation materials and accessories before, during, and after installation. No insulation material shall be

installed that has become damaged in any way. The Contractor shall also use all means necessary to protect work and materials installed by other trades.

- C. If any insulation material has become wet because of transit or job site exposure to moisture or water, the Contractor shall not install such material, and shall remove it from the job site. An exception may be allowed in cases where the Contractor is able to demonstrate that wet insulation when fully dried out (either before installation, or afterward following exposure to system operating temperatures) will provide installed performance that is equivalent in all respects to new, completely dry insulation. In such cases, consult the insulation manufacturer in writing for technical assistance.
- D. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements. Protect all insulation from water, construction traffic, dirt, chemical and mechanical damage.

## 1.8 ALTERNATES

- A. Refer to Division 01 Section, *Alternates* for description of work under this section affected by alternates.

## PART 2 PRODUCTS

### 2.1 GENERAL

- A. All materials to be insulated shall be thoroughly cleaned, after completion of successful tests, and shall be covered as specified below. Fiberglass insulation shall be Owens-Corning, Manville, Armstrong, or P.P.G, or as approved equal.

### 2.2 PIPE INSULATION MATERIALS

- A. Unless otherwise noted, insulation shall be one piece or half sectional molded fibrous glass with "K" rating of .23 at 75 degrees Fahrenheit mean temperature, for service temperatures between -60 degrees Fahrenheit and +450 degrees Fahrenheit with all service jacket. Pipe insulation shall be fiberglass SSL II with double closure system as manufactured by Owens Corning, Johns Manville, Knauf or approved equal.
- B. Unless otherwise noted, pipe insulation jacket shall be factory-applied vinyl coated, embossed and reinforced vapor barrier laminate, with a perm rating of not more than 0.02 perms. All hot and cold, concealed and exposed butt strips shall be of the same material as the jacket. Jacket and butt strips shall be sealed with field-applied Foster 85-20/85-60 or Childers CP-82 (5 gal cans only) adhesive. Jacket and butt strips shall be off-white color and shall be equivalent to Owens-Corning Fiberglass 25-ASJ.
- C. For fittings on all piping, valves and flanges, apply fiberglass molded or segmented insulation equal in thickness to the adjoining insulation and securely fasten in place using wire. Cold piping: Apply a tack coat of vapor barrier coating and reinforcing mesh. After ½ hour, apply second coat of same vapor barrier coating, UL labeled, Type C, for cold water piping, Hot piping Type H for hot water piping: Apply tack of breather mastic. Wrap fitting with fiberglass reinforcing cloth overlapping adjoining sections of pipe insulation by 2-

inches. Apply a second coat of breather mastic over the reinforcing cloth, working it to a smooth finish.

1. Vapor Barrier Coating: Foster 30-65; Childers CP-34 or Vimasco 749. Permeance shall be 0.03 perms or less at 45 mils dry as test by ASTM E96.
  2. Breather mastic: Foster 46-50; Childers CP-10/11 or Vimasco WC-5
  3. Reinforcing Mesh: Foster Mast a Fab; Childers Chil Glas #10 or Vimasco Elastafab
- D. All pipe insulation, jackets, or facings, and adhesives used to adhere jacket or facing to the insulation, including fittings and butt strips, shall have non-combustible fire and smoke hazard system rating and label as tested by ASTM E-84, NFPA 225, and UL 73, not exceeding Flame Spread 25, Fuel Contributed 50, Smoke Developed 50. Accessories such as adhesives, mastic cements, tapes and cloth for fittings shall have the same ratings as listed above. All products or their shipping cartons shall bear the Underwriter's label indicating that flame and smoke ratings do not exceed the above criteria.
- E. For piping having a vapor barrier insulation and for all insulated piping requiring supports, hangers and supports shall be installed outside the insulation. Wherever hangers and supports are installed outside the insulation, pipe insulation protecting shields shall be provided. Where insulation is a load bearing material, of sufficient strength to support the weight of the piping, pipe shields one-third the circumference of the insulation and of a length not less than three times the diameter of the insulation (maximum length 24-inches) shall be provided. Insulation of 7-1/4 pound or greater density will be considered as load bearing for pipe sizes up to and including 2-inches. Where insulation is not of sufficient strength to support the weight of the piping, a half section of high density fiberglass or foam inserts, shall be provided. Vapor barrier and finish shall be applied as required to match adjoining insulation. In addition, shields shall be furnished as specified above.
- F. All disturbed piping insulation in existing areas shall be re-insulated with insulation type, density, and thickness as specified for new piping. Insulation damaged due to new work and demolition only shall be replaced unless otherwise noted.
- G. On cold systems such as chilled water piping, vapor barrier performance is extremely important. All penetrations and seams of the ASJ and exposed ends of insulation must be sealed with vapor barrier coating. The ASJ must be protected with either a coating or a suitable vapor retarding outer jacket. Vapor seals at butt joints shall be applied at every fourth pipe section joint and at each fitting to provide isolation of water incursion. Vapor Barrier Coating: Foster 30-65; Childers CP-34 or Vimasco 749. Permeance shall be 0.03 perms or less at 45 mils dry as test by ASTM E96.
- H. Fittings and valves shall be insulated with pre-formed fiberglass fittings, fabricated sections of fiberglass pipe insulation, Fiberglass pipe and tank insulation, Fiberglass blanket insulation, or insulating cement. Thickness shall be equal to adjacent pipe insulation. Finish shall be with pre-formed PVC fitting covers or as otherwise specified on contract drawings. Where applicable, Victaulic PVC fitting valve and coupling covers shall be utilized. Victaulic PVC covers shall be installed with matching pipe insulation jacketing material, vinyl tape solvent weld adhesive and appropriate fasteners.
1. Flanges, couplings and valve bonnets shall be covered with an oversized pipe insulation section sized to provide the same insulation thickness as on the main pipe

section. An oversized insulation section shall be used to form a collar between the two insulation sections with low density blanket insulation being used to fill gaps. Jacketing shall match that used on straight pipe sections. Rough cut ends shall be coated with a suitable weather or vapor-resistant mastic as dictated by the system location and service. Finish valve installation with a Tyvac jacket with ends that secure to adjacent piping.

2. On cold systems, particular care must be given to vapor sealing the fitting cover or finish to the pipe insulation vapor barrier. All valve stems must be sealed with caulking which allows free movement of the stem but provides a seal against moisture incursion. All gauge and thermometer penetrations and extensions shall be correctly sealed and insulated to prevent surface condensation. Install oversized hangers to prevent penetrations of pipe insulation vapor barrier.
- I. All piping shall be supported in such a manner that neither the insulation or the vapor/weather barrier is compromised by the hanger or the effects of the hanger. In all cases, hanger spacing must be such that the circumferential joint may be made outside the hanger. On cold systems, vapor barrier must be continuous, including material covered by the hanger saddle.
1. Piping systems 3-inches (7.5cm) in diameter or less, insulated with Fiberglass insulation, may be supported by placing saddles of the proper length and spacing, as designated in Owens-Corning Pub. 1-IN-12534, under the insulation. Hangers saddles shall be minimum 16 gauge with a saddle arc of 120 degrees minimum.
  2. For hot or cold piping systems larger than 3-inches (7.5 cm) in diameter, operating at temperatures less than +200 degrees F (93 degrees C) and insulated with fiber glass, high density inserts such as foam or wood blocks with sufficient compressive strength shall be used to support the weight of the piping system.
  3. Where pipe shoes and roller supports are required, insulation shall be inserted in the pipe shoe to minimize pipe heat loss. Where possible, the pipe shoe shall be sized to be flush with the outer pipe insulation diameter.
  4. Thermal expansion and contraction of the piping and insulation system shall generally be taken care of by utilizing double layers of insulation and staggering both longitudinal and circumferential joints. Where long runs are encountered, expansion joints may be required where single layers of insulation are being used and should be so noted on the contract drawings.
  5. On vertical runs, insulation support rings shall be used.

2.3 PIPING INSULATION THICKNESSES SCHEDULE

A. All piping shall be insulated with pipe insulation of the thicknesses indicted below:

PIPING INSULATION THICKNESS SCHEDULE SERVICES	THICKNESS
Chilled Water Piping 2 ½-inches & Larger	2-inch thickness

PIPING INSULATION THICKNESS SCHEDULE SERVICES	THICKNESS
Chilled Water Piping 2-inches & Smaller	2-inch thickness

2.4 ACCESSORY MATERIALS

- A. Accessory materials installed as part of insulation work under this section shall include, but not be limited to:
  - 1. Closure Materials - Butt strips, bands, wires, staples, mastics, adhesives; pressure-sensitive tapes.
  - 2. Field-applied jacketing materials - sheet metal, plastic, canvas, fiber glass cloth, insulating cement; PVC fitting covers, PVC jacketing.
  - 3. Support Materials - Hanger straps, hanger rods, saddles.
  - 4. Fasteners, weld pins/studs, speed clips, insulation washers.
  - 5. Metal mesh or expanded metal lagging.
- B. All accessory materials shall be installed in accordance with project drawings and specifications, manufacturer's instructions, and/or in conformance with the current edition of the Midwest Insulation Contractors Association (MICA) "Commercial & Industrial Insulation Standards."

2.5 FIELD-APPLIED JACKET

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a). Johns Manville; Zeston.
    - b). P.I.C. Plastics, Inc.; FG Series.
    - c). Proto PVC Corporation; LoSmoke.
    - d). Speedline Corporation; SmokeSafe.
  - 2. Adhesive: As recommended by jacket material manufacturer.
  - 3. Color: High gloss white.
  - 4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

- a). Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

## 2.6 HANGER BLOCKS

- A. For all pipes larger than 3 inches in diameter the hanger blocks shall be high compressive strength foam or wood blocks. Wood blocks shall be precision cut thickness to match specified insulation and shall include flared edge hanger saddle as manufactured by Buckaroo.
- B. The wood blocks shall be suitable for temperatures from -120 degrees Fahrenheit to 200 degrees Fahrenheit. Do not utilize the wood blocks for piping systems operating outside of the indicated temperature range.

## PART 3 EXECUTION

### 3.1 WORKMANSHIP

- A. The Contractor shall take special care to prevent soiling equipment below or adjacent to areas being insulated. He shall be completely responsible for removing insulation cement splashes and smears and all surfaces that he mars or otherwise soils or defaces, and he will be totally responsible for restoring these damaged surfaces to their like-new condition when delivered to the site.

### 3.2 SITE INSPECTION

- A. Before starting work under this section, carefully inspect the site and installed work of other trades and verify that such work is complete to the point where installation of materials and accessories under this section can begin.
- B. Verify that all materials and accessories can be installed in accordance with project drawings and specifications and material manufacturers' recommendations.
- C. Verify, by inspecting product labeling, submittal data, and/or certifications which may accompany the shipments, that all materials and accessories to be installed on the project comply with applicable specifications and standards and meet specified thermal and physical properties.

### 3.3 PREPARATION

- A. Ensure that all pipe and equipment surfaces over which insulation is to be installed are clean and dry.
- B. Ensure that insulation is clean, dry, and in good mechanical condition with all factory-applied vapor or weather barriers intact and undamaged. Wet, dirty, or damaged insulation shall not be acceptable for installation.
- C. Ensure that pressure testing of piping or duct systems has been completed prior to installing insulation.

### 3.4 INSTALLATION

#### A. Piping Systems

##### 1. General:

- a). Install all insulation materials and accessories in accordance with manufacturer's published instructions and recognized industry practices to ensure that it will serve its intended purpose.
- b). Install insulation on piping subsequent to painting, testing, and acceptance tests.
- c). Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other. Butt insulation joints firmly to ensure complete, tight fit over all piping surfaces.
- d). Maintain the integrity of factory-applied vapor barrier jacketing on all pipe insulation, protecting it against puncture, tear or other damage. Seal all tears, punctures and other penetrations of the pipe insulation vapor barrier coating.
- e). On exposed piping, locate insulation and cover seams in least visible location.

##### 2. Fittings: Cover valves, fittings, unions, flanges, strainers, flexible connections, expansion joints, pump bodies, strainers, blowdowns, and similar items in each piping system using one of the following:

- a). Mitered sections of insulation equivalent in thickness and composition to that installed on straight pipe runs.
- b). Cold pipe fittings: Apply a tack coat of vapor barrier coating and reinforcing mesh to produce a smooth surface. After ½ hour, apply a second coat of same vapor barrier coating, UL labeled, Type C, for cold water piping.
- c). Insulation cement equal in thickness to the adjoining insulation.
- d). PVC fitting covers insulated with material equal in thickness and composition to adjoining insulation.

##### 3. Penetrations: Extend piping insulation without interruption through walls, floors, and similar piping penetrations, except where otherwise specified.

##### 4. Joints:

- a). Butt pipe insulation against hanger inserts. For cold piping, apply wet coat of vapor barrier lap cement on butt joints, and seal joints with 3-inch (7.5cm) wide vapor barrier tape or band.
- b). All pipe insulation ends shall be tapered and sealed, regardless of service.

### 3.5 FIELD QUALITY ASSURANCE

- A. Upon completion of all insulation work covered by this specification, visually inspect the work and verify that it has been correctly installed. This may be done while work is in progress, to assure compliance with requirements herein to cover and protect insulation materials during installation.

### 3.6 PROTECTION

- A. Replace damaged insulation which cannot be satisfactorily repaired, including insulation with vapor barrier damage and moisture-saturated insulation.
- B. The insulation contractor shall advise the general and/or the mechanical contractor as to requirements for protection of the insulation work during the remainder of the construction period, to avoid damage and deterioration of the finished insulation work.

### 3.7 SAFETY PRECAUTIONS

- A. Insulation contractor's employees shall be properly protected during installation of all insulation. Protection shall include proper attire when handling and applying insulation materials, and shall include (but not be limited to) disposable dust respirators, gloves, hard hats, and eye protection.
- B. The insulation contractor shall conduct all job site operations in compliance with applicable provisions of the Occupational Safety and Health Act, as well as with all state and/or local safety and health codes and regulations that may apply to the work.

### 3.8 INSULATION COVERING

- A. Unless otherwise noted, all exposed equipment insulation shall have a field applied PVC jacket cover neatly cut and pasted over equipment insulation. PVC shall be high gloss white and shall be 20 mils thick.
- B. Unless otherwise noted, all exposed pipe insulation required to be insulated shall be jacketed with a PVC Jacketing with fitting covers. PVC jacket shall be color fade resistant, white high gloss, U.S.D.A. authorized as manufactured by Proto Corporation or approved equal. PVC jacketing shall be high impact, ultraviolet resistant PVC. Minimum thickness shall be 20 mils, roll stock ready for shop or field cutting and forming.
- C. Exposed areas include, but are not limited to, all mechanical equipment rooms/fan rooms, boiler rooms, chiller rooms, exposed in an occupied space.

- D. Where PVC jackets are indicated, install with 1 inch overlap at longitudinal seams and end joints, for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturers recommended adhesive.
  - 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

END OF SECTION

DIVISION 23 SECTION 230900  
INSTRUMENTATION AND CONTROLS OF HVAC AND PLUMBING SYSTEMS (DDC SYSTEM)

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## SECTION 230900 - INSTRUMENTATION AND CONTROLS OF HVAC AND PLUMBING SYSTEMS

## PART 1. GENERAL

## 1.1 SUMMARY

- A. For General Mechanical Requirements, see Division 23 Section, *Common Work Results for HVAC*, and Division 01 Sections.
- B. Comply with all code requirements and fire safety requirements as specified in Division 23 Section, *Common Work Results for HVAC*.
- C. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- D. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory wired controls.
- E. The automatic temperature control system ATC and central control and monitoring system (CCMS) shall be electric/electronic direct digital control (DDC), Johnson Controls (Metasys), Honeywell, Trend Controls: a division of Honeywell by HavTech Solutions, Siemens, Automated Logic Corporation, Reliable Controls, Schneider Electric, Advanced Power, and ASI Controls. All work associated with the automatic temperature control system shall be performed by personnel regularly and directly employed by the Automatic Temperature Controls Contractor. Control System shall be web based, allowing the client access via a standard web browser. Refer to Division 01 section "Alternates".
- F. Coordinate controls with controlled equipment. Upon completion of the work, calibrate and adjust all controls for proper function. Electric wiring, including interlock wiring for equipment such as pumps, etc., shall be furnished and installed under this section. All electrical work shall conform to the applicable requirements of Division 26.
- G. All automatic temperature control dampers, valves and separable wells for immersion elements furnished by the Control Manufacturer shall be installed by the Mechanical Contractor or his sheet metal subcontractor under the Control Manufacturer's supervision.
- H. Reference is hereby made for this contractor to become familiar with Division 26 of these specifications. Familiarization is for coordination purposes only. The control contractor shall provide all necessary relays, contacts, interlock wiring etc. not provided under Division 26 for the automation of the ATC and CCMS systems as required by the sequence of operation and input/output schedule. The control contractor shall coordinate all requirements with the building Fire Alarm System. The control contractor shall provide all additional devices and interlock wiring required for the automation of the ATC system and monitoring of the CCMS system.
- I. Furnish all labor, materials, software, equipment and services necessary for and incidental to furnishing and installing a complete direct digital control, automatic temperature control system to meet the requirements of the sequence of operation

described in Part 4.

- J. Unless the necessary items are specified to be provided with mechanical equipment by Division 23, the ATC contractor shall coordinate with Division 23, Mechanical, and shall furnish and install all items necessary to meet the requirements of the Sequence of Operation and the Central Control and Monitoring System (CCMS) indicated on the drawings and as required in this specification.
- K. The control system shall include all necessary and specified control equipment properly installed in accordance with the specifications and drawings and shall include, but not be limited to the automatic temperature control and energy management system of the following:
  - 1. Chilled Water System
  - 2. Existing Pumps (Chilled Water/Condenser Water)
  - 3. Variable Speed Drives
  - 4. Interlocks
  - 5. Existing Cooling Tower Interlock
- L. All labor, material, equipment and software to meet the functional intent of the system, as specified herein and as shown on the drawings, shall be included. Drawings are diagrammatic only. Equipment and labor not specifically referred to herein or on the plans, that are required to meet the functional intent, shall be provided without additional cost to the owner.
- M. Where equipment is specified to be provided by equipment manufacturer or where packaged controls are specified map out all points provided by the manufacturer so the same can be viewed by ATC system. As a minimum all points indicated in the point list and control diagram must be viewable and adjustable from the ATC system. Coordinate with equipment manufacturer.

## 1.2 DEFINITIONS

- A. DDC: Direct digital control.
- B. I/O: Input/output.
- C. LonWorks: A control network technology platform for designing and implementing interoperable control devices and networks.
- D. MS/TP: Master slave/token passing.
- E. PC: Personal computer.
- F. PID: Proportional plus integral plus derivative.
- G. RTD: Resistance temperature detector.
- H. UPS: Uninterruptible Power Supply.
- I. NAE: Network Automated Engine.

### 1.3 SYSTEM PERFORMANCE

- A. Comply with the following performance requirements:
1. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
  2. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
  3. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.
  4. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.
  5. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.
  6. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.
  7. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:
    - a). Water Temperature: Plus or minus 1 deg F (0.5 deg C).
    - b). Water Flow: Plus or minus 5 percent of full scale.
    - c). Water Pressure: Plus or minus 2 percent of full scale.
    - d). Temperature Differential: Plus or minus 0.25 deg F (0.15 deg C).
    - e). Electrical: Plus or minus 5 percent of reading.

### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.
- B. System Software: Update to latest version of software at Project completion.

### 1.5 COORDINATION

- A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.
- B. Coordinate supply of conditioned electrical branch circuits for control units and operator workstation.
- C. Coordinate equipment with Division 26 Section, *Panelboards* to achieve compatibility with starter coils and annunciation devices.
- D. Coordinate equipment with Division 26 Section, *Motor-Controllers* to achieve compatibility with motor starters and annunciation devices.

### 1.6 WORK BY OTHERS

- A. Automatic temperature control valves, pipe taps, flow meters, and separable wells for immersion elements furnished by the control manufacturer shall be installed by the

mechanical contractor under the control manufacturer's supervision. The control contractor shall deliver to the mechanical contractor valves and wells for installation within the various systems.

#### 1.7 QUALITY ASSURANCE

- A. The automatic temperature control (ATC) system and the central control and monitoring system (CCMS) shall be as manufactured by Johnson Controls, Honeywell, Trend Controls: a division of Honeywell by HavTech Solutions, Siemens, Reliable Controls, or Trane.
- B. Supplier shall have an in-place support facility with technical staff, spare parts inventory and all necessary test and diagnostic equipment. The fully staffed and equipped office shall be within a 60 mile radius of the job site.
- C. The systems shall be complete in all respects, and shall be installed by skilled personnel. The Control Contractor shall have a successful history in the installation and maintenance of automatic temperature control systems similar in size and performance to that specified herein. Acceptable installers are Johnson Controls, Siebe, Alerton, Invensys, Automated Logic Corporation, Schneider Electric, Advanced Power, Control Technologies, and ASI Controls.
- D. All electrical wiring in connection with the Automatic Temperature Control System shall be furnished and installed by the ATC Contractor. This shall include all interlock wiring between the fans, pumps, chillers, condensing units, and cooling tower.
- E. Bids by wholesalers, contractors or franchised dealers or any other firm whose principal business is not that of manufacturing or installing automatic temperature control systems, shall not be acceptable. Bid documents that are not complete in their response to these documents or take exception to any of the capabilities defined within these documents shall not be acceptable.
- F. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.
- G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- H. Comply with ASHRAE 135 for DDC system components.

#### 1.8 GUARANTEE AND INSTRUCTION

- A. The control system including all components, system software, parts and assemblies herein specified shall be free from defects in workmanship and materials under normal use and service. After completion of the installation, the Control Manufacturer shall regulate and adjust all thermostats, control valves, control motors, and other equipment provided under this contract. If within two (2) years from the date of acceptance by Owner any of the equipment herein described is proved to be defective in workmanship or materials, it will be replaced or repaired at no additional cost to the Owner. The

Control Manufacturer shall, after completion, provide any service incidental to the proper performance of the Control System under guarantees outlined above for a period of two (2) years. Normal maintenance of the system is not to be considered part of the guarantee. All corrective modifications made during warranty service periods shall be updated on all user documentation including "as-built" shop drawings and on user and manufacturer archived software disks.

- B. The control contractor shall completely check out, calibrate and test all connected hardware to insure that the system performs in accordance with the approved specifications and sequences of operation submitted.
- C. Upon completion of the work, the control drawings encased in heavy plastic shall be provided where directed. Layout shall show all control equipment and the function of each item indicated.
- D. The temperature control contractor's office shall be within a 100 mile radius of the job site.
- E. The contractor shall respond to the job site with qualified technicians within a 4 hour period for any emergency relating to the control system or energy management systems.
- F. This agreement shall include emergency service during normal working hours.

#### 1.9 SUBMITTALS

- A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
  - 1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
  - 2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
  - 3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
  - 2. Schematic flow diagrams showing equipment, fans, pumps, coils, dampers,

- valves, and control devices.
3. Wiring Diagrams: Power, signal, and control wiring.
  4. Details of control panel faces, including controls, instruments, and labeling.
  5. Written description of sequence of operation.
  6. Schedule of dampers including size, leakage, and flow characteristics.
  7. Schedule of valves including flow characteristics.
  8. DDC System Hardware:
    - a). Wiring diagrams for control units with termination numbers.
    - b). Schematic diagrams and floor plans for field sensors and control hardware.
    - c). Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
  9. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
  10. Controlled Systems:
    - a). Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
    - b). Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
    - c). Written description of sequence of operation including schematic diagram.
    - d). Points list.
- C. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with LonWorks or Bacnet.
- D. Software and Firmware Operational Documentation: Include the following:
1. Software operating and upgrade manuals.
  2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
  3. Device address list.
  4. Printout of software application and graphic screens.
  5. Software license required by and installed for DDC workstations and control systems.
- E. Software Upgrade Kit: For Owner to use in modifying software to suit future systems

revisions or monitoring and control revisions.

- F. Qualification Data: For Installer and manufacturer.
- G. Field quality-control test reports.
- H. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section, *Operation and Maintenance Data*, and Division 23 Section, *Common Work Results for HVAC* include the following:
  - 1. Maintenance instructions and lists of spare parts for each type of control device.
  - 2. Interconnection wiring diagrams with identified and numbered system components and devices.
  - 3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
  - 4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
  - 5. Calibration records and list of set points.
- I. Upon completion of the work, provide a complete set of "as-built" drawings and application software on magnetic floppy disk media. Drawings shall be provided in format as acceptable to the Owner's files. Submit as-built drawings and specification to Owner's representative for review and approval prior to final project closeout.

#### 1.10 SOFTWARE LICENSE AGREEMENT

- A. The owner shall sign a copy of the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software.
- B. Software license agreement shall not apply on projects where existing ATC system is being extended.

#### 1.11 ELECTRICAL SURGE PROTECTION

- A. It is the responsibility of the ATC/FMS contractor to provide adequate surge protection for all wall mounted control panels required for this project.
  - 1. Devices under surge protection shall be of design that loss of memory will not occur in the event of the surge protection device being activated due to surge/spike conditions.
  - 2. Surge protection devices will be required to be hard wired, with the exception of peripheral devices that use standard 110VAC plugs for connections (i.e. Modems).

3. Surge protection devices are to be rated for 120 VAC single phase, 20 (or greater) amps capacity.
4. Surge Protection devices to internal fuse protection, audible surge alarm & LED indicators.
5. Surge protectors to have clamping voltage of 480V peak, maximum surge current rating of 50,000 amps. Unit to have NEMA 12 enclosure with wall mounting bracket and conduit connection.

#### 1.12 TRAINING

- A. The Automatic Temperature Controls (ATC) Contractor shall include in his bid, provisions for additional computer training at the company's regular school or training center. The ATC contractor shall include in his bid all costs associated with sending one (1) individual to the ATC contractors school for a period of not less than two (2) weeks. This training is in addition to the aforementioned training required under the General Provisions.
- B. The training time period shall be coordinated with the school system's facility Engineer. The schedule training period shall be arranged at the owner's convenience.
- C. Cost shall include all training material, instruction books, and two copies of video tape with sound DVD of training session.
- D. Upon completion of the work, the Control Contractor shall have completely adjusted the entire control system. He shall arrange to instruct the Owner's representative on the operation of the control system for a period of not less than eight hours. All training shall be by the control contractor and shall utilize specified manuals and as-built documentation.
- E. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain control systems and components.
  1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
  2. Provide operator training on data display, alarm and status descriptors, requesting data, executing commands, calibrating and adjusting devices, resetting default values, and requesting logs. Include a minimum of 40 hours' dedicated instructor time on-site.
  3. Review data in maintenance manuals. Refer to Division 01 Section, *Contract Closeout*.
  4. Review data in maintenance manuals. Refer to Division 01 Section, *Operation and Maintenance Data*.
  5. Schedule training with Owner, through Architect, with at least seven days' advance notice.

#### 1.13 ALTERNATES

- A. Refer to Division 01 Section, *Alternates* for description of work under this section affected by alternates.

#### 1.14 SUSSEX TECHNICAL SCHOOL DISTRICT SPECIFIC REQUIREMENTS

- A. The ATC Subcontractor shall include in his bid all costs associated with incorporating the following specific requirements:
  - 1. All holiday schedules shall incorporate a 12 month block. Coordinate exact holidays, schedules, calendars, occupied, unoccupied periods with Owner prior to writing software. All schedules shall be reviewed and approved by the Owner.
  - 2. The ATC Computer Graphics shall indicate for each item of equipment the “on” or “off” status and command shall be “run” or “stop”.
  - 3. All Temperature Sensors, equipment, current sensors, differential pressure sensors, etc indicated on ATC Control Diagrams and point list shall be displayed on the ATC Computer Graphic. Measured value or status shall be displayed.
  - 4. Provide a graphic of all floor plans indicating location of all equipment interlocked with ATC System including all control panels.

#### 1.15 GLOBAL SENSORS

- A. General
  - 1. Furnish and install global sensors and report the same on the automatic temperature control system.
  - 2. Global sensors shall monitor and trend the following conditions:
    - a). Outside air temperature.
    - b). Outside air humidity.
    - c). Chilled water supply temperature.
    - d). Chilled water return temperature.
    - e). All equipment interlocked with ATC system shall be able to be turned on/off via ATC system as specified. Changing temperature set point alone is not acceptable method for turning equipment on/off.
    - f). Condenser water supply temperature.
    - g). Condenser water return temperature.

#### PART 2. PRODUCTS

## 2.1 BUILDING MANAGEMENT SYSTEM

- A. The Building Management System (BMS) shall use an open architecture and fully support a multi-vendor environment. To accomplish this effectively, the BMS shall support open communication protocol standards and integrate a wide variety of third-party devices and applications. The system shall be designed for use on the Internet, or intranets using off the shelf, industry standard technology compatible with other owner provided networks.
- B. The Building Management System shall consist of the following:
1. Standalone Network Automation Engine(s)
  2. Field Equipment Controller(s)
  3. Input/Output Module(s)
  4. Local Display Device(s)
  5. Portable Operator's Terminal(s)
  6. Distributed User Interface(s)
  7. Network processing, data storage and communications equipment
  8. Other components required for a complete and working BMS
- C. The system shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, controllers and operator devices, while re-using existing controls equipment.
- D. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.
- E. Acceptable Manufacturers
1. Johnson Controls, Reliable Controls, Siemens, or Honeywell.
- F. Automation Network
1. The automation network shall be based on a PC industry standard of Ethernet TCP/IP. Where used, LAN controller cards shall be standard "off the shelf" products available through normal PC vendor channels.
  2. The automation network shall be capable of operating at a communication speed of 100 Mbps, with full peer-to-peer network communication.
  3. Network Automation Engines (NAE) shall reside on the automation network.

4. The automation network will be compatible with other enterprise-wide networks. Where indicated, the automation network shall be connected to the enterprise network and share resources with it by way of standard networking devices and practices.

#### G. Control Network

1. Network Automation Engines shall provide supervisory control over the control network and shall support all three (3) of the following communication protocols:
  - a). BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9.
  - b). LonWorks enabled devices using the Free Topology Transceiver (FTT-10a).
  - c). The Johnson Controls N2 Field Bus or equivalent.
  - d). Tridium FX-40
  - e). Honeywell Webs
  - f). Trend Controls: A division of Honeywell by HavTech Solutions – IQ3
2. Control networks shall provide either “Peer-to-Peer,” Master-Slave, or Supervised Token Passing communications, and shall operate at a minimum communication speed of 9600 baud.
3. DDC Controllers shall reside on the control network.
4. Control network communication protocol shall be BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135.
5. A BACnet Protocol Implementation Conformance Statement shall be provided for each controller device (master or slave) that will communicate on the BACnet MS/TP Bus.
6. The Conformance Statements shall be submitted 10 day prior to bidding.

#### H. Integration

1. Hardwired
  - a). Analog and digital signal values shall be passed from one system to another via hardwired connections.
  - b). There will be one separate physical point on each system for each point to be integrated between the systems.
2. BACnet Protocol Integration – BACnet
  - a). The neutral protocol used between systems will be BACnet over Ethernet and comply with the ASHRAE BACnet standard 135-2003.
  - b). A complete Protocol Implementation Conformance Statement (PICS) shall be provided for all BACnet system devices.
  - c). The ability to command, share point object data, change of state (COS) data and schedules between the host and BACnet systems shall be

provided.

I. Dedicated Web Based User Interface

1. Where required by the Owner, the BMS Contractor shall provide and install a personal computer for command entry, information management, network alarm management, and database management functions. All real-time control functions, including scheduling, history collection and alarming, shall be resident in the BMS Network Automation Engines to facilitate greater fault tolerance and reliability. Coordinate with Owner to determine computer type (i.e. PC (Windows based) or Macintosh (Apple)).
2. Dedicated User Interface Architecture – The architecture of the computer shall be implemented to conform to industry standards, so that it can accommodate applications provided by the BMS Contractor and by other third party applications suppliers, including but not limited to Microsoft Office Applications. Specifically it must be implemented to conform to the following interface standards.
  - a). Microsoft Internet Explorer for user interface functions
  - b). Microsoft Office Professional for creation, modification and maintenance of reports, sequences other necessary building management functions
  - c). Microsoft Outlook or other e-mail program for supplemental alarm functionality and communication of system events, and reports
  - d). Required network operating system for exchange of data and network functions such as printing of reports, trends and specific system summaries.
3. Computer Hardware – The personal computer(s) shall be configured as follows:
  - a). Memory – 1 GB (512 MB Minimum)
  - b). CPU– Pentium 4 processor. 2.8 Hz Clock Speed (2.0 GHz minimum)
  - c). Hard Drive – 80 GB free hard drive space (40GB minimum)
  - d). Hard drive backup system – CD/RW, DVD/RW or network backup software provided by IT department
  - e). CD ROM Drive – 32X performance
  - f). Ports – (2) Serial and (1) parallel, (2) USB ports
  - g). Keyboard – 101 Keyboard and 2 Button Mouse
  - h). CRT configuration – 1-2 CRTs as follows:
    - 1). Each Display – 17” Flat Panel Monitor 1280 x 1024 resolution minimum.
    - 2). 16 bit or higher color resolution
    - 3). Display card with multiple monitor support
  - i). LAN communications – Ethernet communications board; 3Comm or equal.
4. Operating System Software
  - a). Latest version of Windows.

- b). Where user interface is not provided via browser, provide complete operator workstation software package, including any hardware or software keys. Include the original installation disks and licenses for all included software, device drivers, and peripherals.
- c). Provide software registration cards to the Owner for all included software.

5. Peripheral Hardware

- a). Reports printer:
  - 1). Printer Make – Hewlett Packard DeskJet
  - 2). Print Speed – 600 DPI Black, 300 DPI Color
  - 3). Buffer – 64 K Input Print Buffer
  - 4). Color Printing – Include Color Kit

J. Distributed Web Based User Interface

- 1. All features and functions of the dedicated user interface previously defined in this document shall be available on any computer connected directly or via a wide area or virtual private network (WAN/VPN) to the automation network and conforming to the following specifications.
- 2. The software shall run on the Microsoft Internet Explorer (6.0 or higher) browser.
- 3. Minimum hardware requirements:
  - a). 256 MB RAM
  - b). 2.0 GHz Clock Speed Pentium 4 Microprocessor.
  - c). 40.0 GB Hard Drive.
  - d). 1 Keyboard with 83 keys (minimum).
  - e). SVGA 1024x768 resolution display with 64K colors and 16 bit color depth.
  - f). Mouse or other pointing device

K. User Interface Application Components

- 1. Operator Interface
  - a). An integrated browser based client application shall be used as the user operator interface program.
  - b). All Inputs, Outputs, Setpoints, and all other parameters as defined within Part 3 or Part 4, shown on the design drawings, or required as part of the system software, shall be displayed for operator viewing and modification from the operator interface software.
  - c). The user interface software shall provide help menus and instructions for each operation and/or application.
  - d). All controller software operating parameters shall be displayed for the operator to view/modify from the user interface. These include: setpoints, alarm limits, time delays, PID tuning constants, run-times,

- point statistics, schedules, and so forth.
- e). The Operator Interface shall incorporate comprehensive support for functions including, but not necessarily limited to, the following:
    - 1). User access for selective information retrieval and control command execution
    - 2). Monitoring and reporting
    - 3). Alarm, non-normal, and return to normal condition annunciation
    - 4). Selective operator override and other control actions
    - 5). Information archiving, manipulation, formatting, display and reporting
    - 6). FMS internal performance supervision and diagnostics
    - 7). On-line access to user HELP menus
    - 8). On-line access to current FMS as-built records and documentation
    - 9). Means for the controlled re-programming, re-configuration of FMS operation and for the manipulation of FMS database information in compliance with the prevailing codes, approvals and regulations for individual FMS applications.
    - 10). The operation of the control system shall be independent of the user interface, which shall be used for operator communications only. Systems that rely on an operator workstation to provide supervisory control over controller execution of the sequences of operations or system communications shall not be acceptable.

## 2. Navigation Trees

- a). The system will have the capability to display multiple navigation trees that will aid the operator in navigating throughout all systems and points connected. At minimum provide a tree that identifies all systems on the networks.
- b). Provide the ability for the operator to add custom trees. The operator will be able to define any logical grouping of systems or points and arrange them on the tree in any order. It shall be possible to nest groups within other groups. Provide at minimum 5 levels of nesting.
- c). The navigation trees shall be “dockable” to other displays in the user interface such as graphics. This means that the trees will appear as part of the display, but can be detached and then minimized to the Windows task bar or closed altogether. A simple keystroke will reattach the navigation to the primary display of the user interface.

## 3. Alarms

- a). Alarms shall be routed directly from Network Automation Engines to PCs and servers. It shall be possible for specific alarms from specific points to be routed to specific PCs and servers. The alarm management portion of the user interface shall, at the minimum, provide the following functions:
  - 1). Log date and time of alarm occurrence.
  - 2). Generate a “Pop-Up” window, with audible alarm, informing a

- user that an alarm has been received.
- 3). Allow a user, with the appropriate security level, to acknowledge, temporarily silence, or discard an alarm.
  - 4). Provide an audit trail on hard drive for alarms by recording user acknowledgment, deletion, or disabling of an alarm. The audit trail shall include the name of the user, the alarm, the action taken on the alarm, and a time/date stamp.
  - 5). Provide the ability to direct alarms to an e-mail address or alphanumeric pager. This must be provided in addition to the pop up window described above. Systems that use e-mail and pagers as the exclusive means of annunciating alarms are not acceptable.
  - 6). Any attribute of any object in the system may be designated to report an alarm.
- b). The FMS shall annunciate diagnostic alarms indicating system failures and non-normal operating conditions
  - c). The FMS shall annunciate application alarms as required.
4. Reports and Summaries
- a). Reports and Summaries shall be generated and directed to the user interface displays, with subsequent assignment to printers, or disk. As a minimum, the system shall provide the following reports:
    - 1). All points in the BMS
    - 2). All points in each BMS application
    - 3). All points in a specific controller
    - 4). All points in a user-defined group of points
    - 5). All points currently in alarm
    - 6). All points locked out
    - 7). All BMS schedules
    - 8). All user defined and adjustable variables, schedules, interlocks and the like.
  - b). Summaries and Reports shall be accessible via standard UI functions and not dependent upon custom programming or user defined HTML pages.
  - c). Selection of a single menu item, tool bar item, or tool bar button shall print any displayed report or summary on the system printer for use as a building management and diagnostics tool.
  - d). The system shall allow for the creation of custom reports and queries via a standard web services XML interface and commercial off-the-shelf software such as Microsoft Access, Microsoft Excel, or Crystal Reports.
5. Schedules
- a). A graphical display for time-of-day scheduling and override scheduling of building operations shall be provided. At a minimum, the following functions shall be provided:
    - 1). Weekly schedules

- 2). Exception Schedules
  - 3). Monthly calendars
- b). Weekly schedules shall be provided for each group of equipment with a specific time use schedule.
  - c). It shall be possible to define one or more exception schedules for each schedule including references to calendars
  - d). Monthly calendars shall be provided that allow for simplified scheduling of holidays and special days for a minimum of five years in advance. Holidays and special days shall be user-selected with the pointing device or keyboard, and shall automatically reschedule equipment operation as previously defined on the exception schedules.
  - e). Changes to schedules made from the User Interface shall directly modify the Network Automation Engine schedule database.
  - f). Schedules and Calendars shall comply with ASHRAE SP135/2003 BACnet Standard.
  - g). Selection of a single menu item or tool bar button shall print any displayed schedule on the system printer for use as a building management and diagnostics tool.
6. Password
- a). Multiple-level password access protection shall be provided to allow the user/manager to user interface control, display, and database manipulation capabilities deemed appropriate for each user, based on an assigned password.
  - b). Each user shall have the following: a user name (24 characters minimum), a password (12 characters minimum), and access levels.
  - c). The system shall allow each user to change his or her password at will.
  - d). When entering or editing passwords, the system shall not echo the actual characters for display on the monitor.
  - e). A minimum of five levels of access shall be supported individually or in any combination as follows:
    - 1). Level 1 = View Data
    - 2). Level 2 = Command
    - 3). Level 3 = Operator Overrides
    - 4). Level 4 = Database Modification
    - 5). Level 5 = Database Configuration
    - 6). Level 6 = All privileges, including Password Add/Modify
  - f). A minimum of 100 unique passwords shall be supported.
  - g). Operators shall be able to perform only those commands available for their respective passwords. Display of menu selections shall be limited to only those items defined for the access level of the password used to log-on.
  - h). The system shall automatically generate a report of log-on/log-off and system activity for each user. Any action that results in a change in the operation or configuration of the control system shall be recorded, including: modification of point values, schedules or history collection parameters, and all changes to the alarm management system, including the acknowledgment and deletion of alarms.

7. Screen Manager - The User Interface shall be provided with screen management capabilities that allow the user to activate, close, and simultaneously manipulate a minimum of 4 active display windows plus a network or user defined navigation tree.
8. Dynamic Color Graphics
  - a). The graphics application program shall be supplied as an integral part of the User Interface. Browser or Workstation applications that rely only upon HTML pages shall not be acceptable.
  - b). The graphics applications shall include a create/edit function and a runtime function. The system architecture shall support an unlimited number of graphics documents (graphic definition files) to be generated and executed.
  - c). The graphics shall be able to display and provide animation based on real-time data that is acquired, derived, or entered.
  - d). Graphics runtime functions – A maximum of 16 graphic applications shall be able to execute at any one time on a user interface or workstation with 4 visible to the user. Each graphic application shall be capable of the following functions:
    - 1). All graphics shall be fully scalable
    - 2). The graphics shall support a maintained aspect ratio.
    - 3). Multiple fonts shall be supported.
    - 4). Unique background shall be assignable on a per graphic basis.
    - 5). The color of all animations and values on displays shall indicate if the status of the object attribute.
  - e). Operation from graphics – It shall be possible to change values (setpoints) and states in system controlled equipment by using drop-down windows accessible via the pointing device
  - f). Graphic editing tool – A graphic editing tool shall be provided that allows for the creation and editing of graphic files. The graphic editor shall be capable of performing/defining all animations, and defining all runtime binding.
    - 1). The graphic editing tool shall in general provide for the creation and positioning of point objects by dragging from tool bars or drop-downs and positioning where required.
    - 2). In addition, the graphic editing tool shall be able to add additional content to any graphic by importing backgrounds in the SVG, BMP or JPG file formats.
  - g). Aliasing – Many graphic displays representing part of a building and various building components are exact duplicates, with the exception that the various variables are bound to different field values. Consequently, it shall be possible to bind the value of a graphic display to aliases, as opposed to the physical field tags.
9. Historical trending and data collection

- a). Each Automation Engine shall store trend and point history data for all analog and digital inputs and outputs, as follows:
  - 1). Any point, physical or calculated, may be designated for trending. Three methods of collection shall be allowed:
    - i Defined time interval
    - ii Upon a change of value.
  - 2). Each Automation Engine shall have the capability to store multiple samples for each physical point and software variable based upon available memory, including an individual sample time/date stamp. Points may be assigned to multiple history trends with different collection parameters.
- b). Trend and change of value data shall be stored within the engine and uploaded to a dedicated trend database or exported in a selectable data format via a provided data export utility. Uploads to a dedicated database shall occur based upon one of the following: user-defined interval, manual command, or when the trend buffers are full. Exports shall be as requested by the user or on a time scheduled basis.

10. Trend data viewing and analysis

- a). Provide a trend viewing utility that shall have access to all database points.
- b). It shall be possible to retrieve any historical database point for use in displays and reports by specifying the point name and associated trend name.
- c). The trend viewing utility shall have the capability to define trend study displays to include multiple trends
- d). Displays shall be able to be single or stacked graphs with on-line selectable display characteristics, such as ranging, color, and plot style.
- e). Display magnitude and units shall both be selectable by the operator at any time without reconfiguring the processing or collection of data. This is a zoom capability.
- f). Display magnitude shall automatically be scaled to show full graphic resolution of the data being displayed.
- g). Trend studies shall be capable of calculating and displaying calculated variables including highest value, lowest value and time based accumulation.

L. Portable Operator Terminal

1. For systems that do not provide full access to systems configuration and definition via the Browser Based user interface the BMS Contractor shall provide a portable operator terminal for programming purposes. The terminal shall be configured as follows:
  - a). Personal Laptop Computer Manufacturer – Dell, Compaq or HP
  - b). 1 GB RAM (256 MB minimum) – Windows 2000 or XP Professional.
  - c). 1.8 GHz Clock Speed Pentium 4 Microprocessor (800 MHz minimum).

- d). 40 GB Hard Drive. (40 GB minimum)
- e). (1) CD-ROM Drive, 32x speed.
- f). (1) Serial (1) Parallel (2) USB ports
- g). 1 Keyboard with 83 keys (minimum).
- h). Integral 2 button Track Point or Track Ball.
- i). 10" SVGA 1024x768 resolution color display
- j). Two PCMCIA Type II or one Type III card slot.
- k). Complete operator workstation software package, including any hardware or software.
- l). Original printed manuals for all software and peripherals.
- m). Original installation disks or CD for all software, device drivers, and peripherals.
- n). Software registration cards for all included software shall be provided to the Owner.
- o). Carrying case.
- p). Spare battery.
- q). External power supply/battery charger.

2. Proprietary Portable Terminal

- a). Manufacturers providing proprietary portable terminals shall submit technical data sheets for the terminal and all associated software and hardware.
- b). The proprietary terminal shall meet the same operator interface software requirements as specified above.

3. Software

- a). Portable operator terminals shall support all controllers within the system on a direct-connect communications basis.
- b). When used to access First or Second Tier controllers, the portable operator terminal shall utilize the standard operator workstation software, as previously defined.
- c). When used to access Application Specific Controllers, the portable operator terminal shall utilize either the standard operator workstation software, as previously defined, or controller-specific utility software.

2.2 WIRING

- A. The multi-conductor cable for field wiring of electronic analog sensors shall be minimum No. 22 AWG, 300 volt, thermoplastic with stranded copper wire and 100 percent shield coverage. The number of conductors in each sensor cable shall be as determined by the Contractor. 2/c #22 shielded cables shall be Belden Cat. #8451 3/c #20 shielded cables shall be Belden Cat. #9770.
- B. Conductors for digital sensors or contact control shall be the same as for the analog sensors, except the grounded shield is not required.
- C. Individual conductors shall be color coded and in addition shall be numbered in the field to identify the particular terminal to which attached. Field numbering shall be performed with Brady markers wrapped around the wire near the terminal connection. All wires

shall be terminated with pressure type connectors suitable for wire size, material and terminal connection.

- D. All exposed wiring shall be installed in a designated conduit raceway. The conduit shall conform to Division 26 of the specification. Concealed wiring shall be plenum rated cable.
- E. All junction boxes shall have covers painted *safety green*, and be rigid steel.

### 2.3 CONTROLLERS

- A. Temperature sensor covers shall be stainless steel wire guard type with vandal proof screws. All room temperature sensors shall be mounted 5'-3 inches above the finished floor, except in stairways, corridors and toilets, which shall be 7'-0 inches. Provide insulating bases where temperature sensors are located on exterior or unconditioned walls. Each temperature sensor shall have adjustable limit stops and adjustable sensitivity. User adjustment shall be 2 degrees F above and below set points or as determined by the Owner. Room temperature sensors shall include range of 55 degrees F to 85 degrees F set point adjustment. Temperature sensors shall include set-point adjusters, U.L. approved for mounting base in air plenums, and RJ-11 jack for communications.

### 2.4 CONTROL PANELS

- A. Furnish and install local panels for ATC devices. Control panels shall be fully enclosed cabinets, all steel construction and shall meet the requirements of NEMA 1 enclosures. Cabinet shall have piano hinged door with a locking latch. All cabinet locks shall use common key. Provide means of storing control system instructions and drawings inside cabinet for future reference. Panel shall be wall mounted or free standing and located where directed by the Contract Drawings or Engineer.
  - 1. Each panel shall have all internal devices factory wired to a numbered terminal strip. Controllers and associated devices shall be mounted within the panel, accessible through a hinged door.
  - 2. All ATC panels shall be provided with integral disconnect, wiring, and control transformers.
  - 3. Any ATC control panel that is serving equipment on the emergency generator must be powered by an emergency generator fed circuit/electrical panel. Refer to electrical contract documents for all emergency powered equipment.

### 2.5 MISCELLANEOUS ELECTRICAL DEVICES

- A. Electric Actuators. All automatically controlled devices, unless specified otherwise elsewhere, shall be provided with electric actuators which shall be sized to operate their appropriate loads with sufficient reserve power to provide smooth modulating action or two-position action and tight close off as specified.

### 2.6 UNINTERRUPTIBLE POWER SUPPLY

- A. Furnish, size and install uninterruptible power supplies at all ATC panels served by emergency power circuits.
- B. Provide all interlock and power wiring from U.P.S. to control panels as required.
- C. UPS's shall be sized for the ATC panel load and shall provide at least 2 minutes of full load power in the event of a power outage.
- D. UPS shall be furnished with plug and cord and shall be powered from emergency power receptacles as indicated under Division 26.
- E. Refer to electrical Contract Documents for all equipment served by the generator. All ATC panels for such equipment must be provided with a UPS.

2.7 CENTRAL CONTROL AND MONITORING SYSTEM (CCMS) (HARDWARE DESCRIPTION)

A. General

- 1. The Facilities Management Control System (FMCS) shall be comprised of a network of various independent, Stand-alone Digital Controllers (SDC'S), Mechanical System Digital Controllers (MSDC'S); together with Centralized Control Stations (CCS), and Centralized Host Stations (CHS) as specified, to provide centralized access and facility wide control functions. The SDC's, MSDC's, AHDC's, and UDC's shall be interconnected in a communicating network to provide facility wide access and sharing of information. A Gateway Digital Controller (GDC's) shall be provided to allow interface with third party microprocessor based control systems that are specified for integration within specification. A Local Area Network (LAN) shall be provided to interconnect SDC's for high-speed data transmission.

2. Specification Nomenclature

FMCS	Facility Management Control System
SDC	Stand-alone Digital Controller
MSDC	Mechanical System Digital Controller
HHOT	Hand Held Operator Terminal
GDC	Gateway Digital Controller
GP	Graphical Programmer
CHS	Central Host Station
CCS	Central Control Station
RPTR	Communications Repeater

B. Centralized Host Stations (CHS)

- 1. The FMCS shall include Centralized Host Stations. CHS's shall, in conjunction with the full compliment of Digital Controllers, provide the performance requirements within this specification. Each CHS shall include all hardware and software components to serve as a centralized facility operator station, providing color graphics, facility wide access, operator initiation of global control strategies, and centralized documentation.

The CHS shall be capable of simultaneously interfacing with the following:

- mouse pointing device
- two parallel printers
- high resolution VGA color graphics monitor
- seven auto answer/auto dial modems
- color inkjet printer
- two serial printers
- three FMCS LAN interface
- Alarm Graphic and Report FAX dial out service interface
- Mass storage tape system

As a minimum, the temperature control contractor shall provide the types and quantities of CHS, CCS, SDC, and MSDC as required.

2. Computer

- a). The existing FMS computer located in the Maintenance Office shall be utilized with the new CCMS System if compatible with the same. If the selected ATC contractor cannot tie into the existing computer, then a new stand-alone computer shall be furnished.
- b). Coordinate IP address with Owners' I.T. Department for network connection. The CCMS must be fully networkable.
- c). Provide fiber optic cable as required.

3. Operator Workstation: One PC-based microcomputer with minimum configuration as follows:

- a). Motherboard: With 8 integrated USB 2.0 ports, integrated Intel Pro 10/100 (Ethernet), integrated audio, bios, and hardware monitoring.
- b). Processor: Intel Pentium 4, 733 MHz.
- c). Random-Access Memory: 2GB.
- d). Graphics: Video adapter, minimum 1600 x 1200 pixels, 64-MB video memory, with TV out.
- e). Monitor: 19 inches (480 mm), LCD color.
- f). Keyboard: QWERTY, 105 keys in ergonomic shape.
- g). Floppy-Disk Drive: 1.44 MB.
- h). Hard-Disk Drive: 80 GB.
- i). CD-ROM Read/Write Drive: 48x24x48.
- j). Mouse: Three button, optical.
- k). Uninterruptible Power Supply: 2 kVa.
- l). Operating System: Microsoft Windows XP Professional with high-speed Internet access.
  - 1). ASHRAE 135 Compliance: Workstation shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
  - 2). LonWorks Compliance: Control units shall use LonTalk protocol and communicate using EIA/CEA 709.1

- datalink/physical layer protocol.
- m). Printer: Color, ink-jet type as follows:
    - 1). Print Head: 4800 x 1200 dpi optimized color resolution.
    - 2). Paper Handling: Minimum of 100 sheets.
    - 3). Print Speed: Minimum of 17 ppm in black and 12 ppm in color.
  - n). Application Software:
    - 1). I/O capability from operator station.
    - 2). System security for each operator via software password and access levels.
    - 3). Automatic system diagnostics; monitor system and report failures.
    - 4). Database creation and support.
    - 5). Automatic and manual database save and restore.
    - 6). Dynamic color graphic displays with up to 10 screen displays at once.
    - 7). Custom graphics generation and graphics library of HVAC equipment and symbols.
    - 8). Alarm processing, messages, and reactions.
    - 9). Trend logs retrievable in spreadsheets and database programs.
    - 10). Alarm and event processing.
    - 11). Object and property status and control.
    - 12). Automatic restart of field equipment on restoration of power.
    - 13). Data collection, reports, and logs. Include standard reports for the following:
      - i Current values of all objects.
      - ii Current alarm summary.
      - iii Disabled objects.
      - iv Alarm lockout objects.
      - v Logs.
    - 14). Custom report development.
    - 15). Utility and weather reports.
    - 16). Workstation application editors for controllers and schedules.
    - 17). Maintenance management.
  - o). Custom Application Software:
    - 1). English language oriented.
    - 2). Full-screen character editor/programming environment.
    - 3). Allow development of independently executing program modules with debugging/simulation capability.
    - 4). Support conditional statements.
    - 5). Support floating-point arithmetic with mathematic functions.
    - 6). Contains predefined time variables.
  - p). P.C. shall be the latest technology at the time of installation of the front end.

### C. Centralized Control Stations (CCS)

The FMCS shall include Centralized Control Stations, as required. CCS's shall, in conjunction with the network of SDC's and additional CCS components as required, provide the performance requirements within this section of the specification. Each CCS shall include all hardware and software components to serve as a centralized facility operator station, providing facility wide access, for review and modification of global

control strategies, real time system monitoring, controller database editing or creation, and centralized documentation.

D. Local Area Networks

1. The LAN shall utilize packetized transmissions, CRC 16 error checking, and distributed error recovery. Single or multiple SDC failures shall not cause loss of communication between other LAN-connected SDC's.
2. LAN connected SDC's shall be provided with a communications watchdog to assure that an individual SDC cannot permanently occupy the LAN. If an SDC is determined to be monopolizing communications, it shall be automatically shut down and an exception reported to annunciate this fact.
3. The LAN shall employ a token passing, peer-to-peer convention, same as or similar to the industry standard format IEEE 802.4. The content of messages shall be the manufacturer's standard. The Local Area Network components shall be manufacturer's standard or available from third party vendors which utilize the same chip implementation as used by the manufacturer.
4. Industry standard ANSI, RS-485 Network Communication System, Lon, or Bacnet, or Equivalent shall be utilized.
  - a). Trunk Wiring Practices - General  
The distributed communication network system shall consist of a multi-drop RS-485 bus architecture connecting SDC's, and MSDC's. The trunk shall consist of:
    - 1). A twisted pair of wires (24 awg) completely encased in continuous metallic conduit.
    - 2). A twisted shielded pair of wires (24awg) with the shield grounded in accordance with the manufacturer's wiring practices.
    - 3). Or a dual channel, 62.5 micron fiber cabling system with ST type connectors.

There shall be no power wiring, in excess of 30 VAC rms voltage, run in conduit with communications trunk wiring. In cases where power or signal wiring is run in conduit with trunk wiring, all communications trunk wiring and power wiring shall be run using separate twisted shielded pairs (24awg) with the shields grounded in accordance with the manufacturer's wiring practices.

b). Communication Transient Protection

- 1). The manufacturer's catalog data sheet shall provide evidence that all FMCS products offered by the manufacturer are tested and comply with the standard for Transient Surge withstand capabilities for electrical

devices ANSI C62.41, IEEE-587-1980, Categories A and B. Such testing shall have included power and communication trunk wiring. Compliance with IEEE-587 shall imply conformance with IEEE-472 transient standards based on the stated position of ANSI and IEEE regarding applicability of the rated standards.

- 2). In addition, at each building entry and exit point, the wire communications trunk wiring shall be protected with a transient surge protection device providing the minimal protection specifications of the General semiconductor, Model #422E device. Transient surge protection is not necessary if the communication trunk, external to the building, is fiber optic in nature.
  - 3). The communications circuitry and input/output circuitry, of the SDC's and MSDC's shall provide protection against a 1000 volt, 3 amp transient signal, directly applied to the communication or input/output terminations. The manufacturer's catalog data sheet shall provide evidence of conformance with this requirement. Systems not complying with this requirement shall provide equivalent protection external to the FMCS controller. Protection shall be provided for the individual communications and input/output terminations for each FMCS controller. Submittal documentation shall clearly define how this requirement will be met and how the external protection will not affect the performance of the controllers.
- c). **RS-485 Trunk Distance and Topology**  
The manufacturer's RS-485 trunk shall provide operation over end to end linear distances of 4000 feet for wire connections and 6,500 feet for fiber optic connections, without repeaters, at communication data rates of up to 64 kbps. The trunk may be extended up to 20,000 feet through the use of wire repeaters or 80,000 feet through the use of fiber optic repeaters.

At data rates of up to 19.2 kbps, the trunk distance shall be extendible to distances of up to 20,000 feet using RS-485 communication wire or fiber optic repeaters. A repeater shall be used each 4,000 feet of linear distance for wire or every 6,500 feet for fiber optics. Repeating devices shall contain separate LED indication for each communication interface trunk to indicate proper operation of the repeater as well as the communications trunks.

Contractors shall provide devices which are of FMCS control system manufacturer's design.

It shall be possible for the trunk to be "T" eed or "starred", at any location using a repeater, to facilitate the installation. Systems which do not provide this capability shall provide a trunk riser diagram showing

end to end distances and locations of system topology necessary to meet the trunk diagram shown on the plans.

d). Fiber Optic Communication Trunk

The temperature control contractor shall provide a dual channel fiber optic data link, as required, to minimize the effects of transient surges caused by lightning or external EMI generating equipment. The data link shall be comprised of a single duplex cable containing two fibers (transmit and receive), of 62.5 micron construction, to accommodate data rates of up to 64 kbps.

The fiber optic trunk shall be connected to SDC devices using manufacturer's standard RS-485 to fiber optic data link modem. Repeating devices shall contain separate LED indication for each communication interface and the fiber modem, to indicate proper operation of all aspects of the device. Fiber modem devices shall be tested and conform with transient surge withstand tests for electrical devices, ANSI C62.41 IEEE-587 Categories A and B. Manufacturer's data sheet shall provide evidence of compliance with this requirement. Manufacturer's products which do not meet this minimum performance requirement shall not be acceptable.

Systems which require a special gateway controller to accommodate the fiber optic trunks, shall provide such a controller per point where the fiber optic cable enters and leaves the building. Gateway controllers shall not inhibit transfer of point data values between SDC controllers throughout the LAN. Such inhibitive systems shall not be acceptable.

In lieu of the above two options, the contractor may provide a fiber optic link to each SDC controller within the LAN. All controllers shall have access to the fiber optic link for LAN.

Fiber optic cable shall be fully tested and terminated by the temperature control contractor.

E. Standalone Digital Controllers (SDC)

1. General

Standalone Digital Controllers (SDC) shall be 16 bit microcomputer based, utilizing a multi-tasking, multi-user operating system.

The SDC controllers shall permit the simultaneous operation of all control, communication facilities management and operator interface software, as programmed by the Contractor or User. Modification of the on-board SDC controller database shall be performed on-line using the built-in or HHOT interface. Systems which require the SDC to be removed from service while DDC control sequences are modified shall not be acceptable.

SDC controllers shall utilize true floating point arithmetic capabilities. To accommodate

totalization of large totalized values, SDC's with reporting capability shall support the calculation, accumulation and display of values within the range of +/-10 to the 10th power.

## 2. Database and Memory Back-up

All programming defining the functions to be performed by the SDC, including but not limited to application programs and point database within each SDC, shall be protected from loss due to power failure for a minimum of six months. Systems providing non-volatile memory for these functions are preferred. Systems not providing non-volatile memory shall provide a system rechargeable battery backup system sufficient to provide protection for the specified 6 month period. Systems not in compliance shall provide for uninterrupted power to each SDC.

## 3. Service Ports

SDC controllers shall be equipped with a minimum of one operator service port for the connection of a HHOT. The service port shall be either a built-in RS-232 data terminal port or an RJ-11 type jack which connects to the manufacturer's standard HHOT.

Connection of a service device, to a service port, shall not cause the SDC controller to lose communications with its peers or other networked device controllers.

The service port shall allow utilization of the same HHOT from any location. The same HHOT shall be utilized for any SDC or MSDC Systems which utilize more than one variety of HHOT shall not be acceptable.

## 4. Display and Readout Capability

The SDC controller shall provide manufacturer's standard display and readout capability.

## 5. Manual/Auto Control and Notification

The SDC controller shall provide commanded override capability from the HHOT or the built-in operator interface. Such overrides shall be annunciated to the CHS's. Such overrides shall be valid as long as power is applied to the controller.

Manual service overrides, such as Hand/Off/Auto switches, shall be provided as indicated on the drawings. Such overrides shall be located at the controlled device location and conform with OSHA Manual lockout regulations, as appropriate, for safety reasons. SDC indication of such manual override actions shall be provided as feedback status indication points shown on the drawings, in conjunction with the application programs within the SDC. Systems which provide built-in H/O/A switching devices with integral feedback shall provide external manual service overrides, as indicated, to comply with OSHA manual lockout regulations. H/O/A switches remotely located at the SDC controller are not acceptable.

## 6. Adjustments

Every control panel shall provide adjustments for the functions specified. In general, adjustments shall be provided for all set points used by controllers within each control

panel. In addition, adjustments shall be provided for throttling ranges, mixed air damper minimum positions, or other items as specified. Adjustments shall be integral to each individual SDC. The built-in operator interfaces shall allow the easy execution of the adjustment through named identifiers within the SDC. From a single SDC user interface, any other SDC shall be accessible and full adjustment capabilities shall be provided.

7. Sensing and Control Outputs Requirements

a). Sensing

All sensing inputs shall be provided via industry standard signals. Temperatures, humidities, differential pressure signals, and other signal inputs shall be one of the following types:

0-20 mA

4-20 mA

0-5 VDC

0-12 VDC

1000 ohm platinum (at 0{SYMBOL 176\f"Symbol"}C, 2.62 ohms/C)

1000 ohm Balco (2.2 ohms/{SYMBOL 176\f"Symbol"}F)

10 k ohm Thermistor (at 25{SYMBOL 176\f"Symbol"}C/77{SYMBOL 176\f"SYMBOL"}F)

Custom, definable input signals (accept sensor inputs from RTD devices, other than those of the manufacturer).

All signal inputs shall be compatible with the controllers used, and with the requirements for readout of variables in true scaled engineering units as specified.

b). Control Outputs

1). On/Off Outputs

Control panel shall internally provide test points for the circuit driving the equipment contactor, for the purpose of troubleshooting the 120 VAC or 240 VAC circuit to the contactor. All such relays or digital output modules shall provide a pilot light or LED display of the same status. On/Off output modules shall be of the modular construction that can be easily and quickly replaced, on an individual basis, if the module were to be damaged.

2). Modulating Outputs

Modulating outputs shall be industry standard 0-5 VDC, or 0-12 VDC with definable output spans, to adapt to industry available control products. Milliamp outputs of 0-20 mA or 4-20 mA are also acceptable. Drive open/Drive closed type modulating outputs are acceptable provided that they also comply with the following requirements.

All modulating outputs shall provide within the control panel, a meter

gauge, or display indication via on board display or HHOT, the commanded position signal for the actuating device. This meter, gauge, or display must provide either a 0-100 percent position indication, or read out directly in the engineering unit of the signal being used. Drive open/Drive closed type controllers shall include sufficient components and control algorithms to comply with this requirement. In the case of Drive open/closed technology, position feedback shall be provided to insure positive indication that the control device is at the commanded position.

F. Mechanical System Digital Controllers (Msdc's)

1. General

- a). Controls shall be microprocessor based, Mechanical System Direct Digital Controllers (MSDC's). MSDC's shall be provided for air handling units, central pump systems and other applications as required. MSDC's shall be based on a minimum 16 bit microprocessor working from software program memory which is physically located in the MSDC. The application control program shall be resident within the same enclosure as the input/output circuitry which translates sensor signals. All input/output signal conversion shall be performed through a minimum of a 12 Bit A to D converter. All input/output points shall be universal in nature allowing their individual function definition to be assigned through the application software. All unused input/output points must be available as universally definable at the owner discretion. If input/output points are not fully universal in nature, unused points must be equal in quantity between Analog Input, Digital Input, Analog Output, Digital Output.

Contractor shall provide a minimum of one MSDC controller per mechanical system, as shown on the drawings.

The BAS contractor shall provide and field install all MSDC's specified under this section. Mechanical Equipment manufacturers desiring to provide MSDC type controls as factory mounted equipment, shall provide a separate bid for their product less all controls, BAS/Temperature Control Contractor.

- b). All input/output signals shall be directly hardwired to the MSDC. Trouble shooting of input/output signals shall be easily executed with a volt-ohm meter (VOM). As a result of this intent, it is specified that power line carrier systems, or other systems which command multiple outputs over a single pair of wires, shall not be used.
- c). MSDC shall be in continuous direct communication with the network which forms the facility-wide Building Automation System (BAS). The MSDC's shall communicate with the SDC at a baud rate of not less than 19,200 baud.

2. Non-Volatile Memory

- a). All control sequences programmed into the MSDC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery to be retained. Power failures shall not cause the MSDC memory to be lost, nor shall there be any need for batteries to be recharged or replaced to maintain the integrity of the controller database. The MSDC shall allow for the creation of unique application control strategies. Systems that allow selection of sequences from the library or table are not acceptable.
- b). All control sequences shall be fully field programmable at the MSDC controller, allowing for the creation or editing of an application sequence of operations.
- c). Each MSDC shall be provided with manufacturer's standard built-in Operator Interface.
- d). The MSDC shall allow for internal processing and reporting of user defined Time of Day Schedules, Alarms, Trend Reports, Run Time Totalization, Energy Utilization Reports, Application Program Documentation and interface with a peripheral device such as an autodial/autoanswer modem, a VT-100 Display Terminal, or a serial printer.

Systems not providing the above functionality at the MSDC are not acceptable and shall utilize an SDC in place of the MSDC.

- e). The MSDC shall provide LED indication of transmit/receive communications performance as well as for the proper/improper operation of the controller itself.
  - f). The MSDC shall be provided with a battery backed time clock that is capable of maintaining the time of day and calendar for up to thirty days without loss of setting. The battery for the time clock shall be field replaceable by the customer. Integral daily, weekly, holiday and special event scheduling shall be provided, such that all schedules can be custom tailored to the facility. Predefined schedules, with set quantities of on/off cycles are not acceptable.
3. Controller Location

- a). To simplify controls, mechanical service and troubleshooting, the MSDC shall be mounted directly in or on the control compartment of the mechanical system. The MSDC shall be provided in a NEMA 1 enclosure to accommodate direct mounting on the equipment to be controlled. The MSDC shall be constructed in a modular orientation such that service of the failed components can be performed quickly and easily. The modular construction should limit the quantities of printed circuit boards to a maximum of three. When required to replace a printed circuit board, it shall not be necessary to disconnect any field wiring. The MSDC shall allow for the creation of, unique, application

control strategies. Systems that allow selection of sequences from a library or table are not acceptable. This shall allow all controls maintenance and troubleshooting to be made while at the unit location. MSDC shall be directly wired to sensory devices, staging relays or modulating valves for heating and cooling.

- b). For compatibility to the environment of the mechanical systems, MSDC shall have wide ambient ratings. MSDC shall be rated for service from -40 Deg F (Degrees Fahrenheit) to 140 Deg F.
- c). Contractor shall submit description of location for the MSDC's on all mechanical equipment.

## 2.8 SYSTEM SOFTWARE DESCRIPTION

### A. General

- 1. Contractor shall provide all software for a complete and operational system as described herein. Software shall include manufacturer's standard multi-tasking, multi-user operating system for operator consoles and controllers, network communication software for dial-up and hard trunk applications, operator man-machine interface software, control application software and all other software necessary to provide the functions specified herein.
- 2. System software shall be as manufactured by Siebe Environmental Controls, Johnson Controls, Honeywell, Trend Controls: a division of Honeywell by HavTech Solutions, Siemens, Alerton, Reliable Controls, Schneider Electric, Advanced Power, Trane, or approved equal.

## 2.9 EXCEPTION REPORTING SEQUENCES

### A. Alarm/COS Reports

- 1. For those digital points indicated on the drawings, the Contractor shall provide a unique change-of-state alarm message of up to 70 characters. The message shall report to all devices assigned to the alarm class.
- 2. For those points indicated on the drawings which are designated as interrupt priority, the Contractor shall provide an interrupting process display at the CHS location which displays the current conditions for the operator.

In addition, the CHS computer shall automatically send a picture of the process graphic display to the remote locations specified on the drawings as receiving facsimile copies of interrupting alarms.

- 3. For those points designated in paragraph 3 above, the FMCS shall also send a history log to the system report printer of the immediate prior history of the points causing the interrupt priority. This log shall contain 1 minutes samples of the previous 15 minutes of operation.
- 4. For those points on the drawings designed as Hard Facts points, the Contractor

shall provide an alarm message to a remote facsimile location designated by the Owner. The FMCS system shall provide at the remote location, a facsimile printout showing location, time/date of alarm and alarm message of the point. For interrupt priority fax alarms, the remote facsimile machine shall receive a hard copy of the interrupt process screen showing on-line dynamic data values of the current conditions.

B. Off Hours Exception Reporting

The Owner shall specify up to five sites to which off hours exceptions shall be auto-dialed and reported. This shall allow the owner to assign off hours exception responses to various facility personnel as necessary. Selection of the site to be dialed can be programmed by the Owner, and set to change automatically per time of day and day of week.

2.10 MONITORING SYSTEM, SENSORS AND WIRING

A. Sensors and other Devices for Input/Output Summary Schedule:

1. Provide all necessary sensors, relays, panels, conduits and wire for the points indicated in the input/output summary as shown on the contract drawings.
2. Analog sensing elements for remote indication shall be independent of local sensors used for local control loops.
3. Temperature sensors shall be Resistance Temperature Detector (RTD) type of 1000 ohm balco. Space (60-90 degrees F); Duct/Well (-30-250 degrees F); Averaging Duct (-30-225 degrees F) or as required under Division 26.
4. Differential and Static Pressure Sensors and Switches
  - a). Water flow analog sensors shall be provided complete with flow element and shall be an all solid state precision industrial type with stainless steel meter body, maximum error of no more than .5 percent or span, and 4 to 20 ma output. Sensor shall be rated for 250 psi minimum and installed in strict accordance to the manufacturer's instructions complete with three-valve manifold for calibration and maintenance.
5. Overall system accuracy, including electronic analog sensing elements, shall be as follows:
  - a). Water: Plus or minus 0.7 degrees F over full scale range for water points, plus or minus 1.0 degree F for others.
6. Digital inputs from devices with isolated, dry type contacts (no grounds, no voltage) of either normally open (N.O.) or normally closed (N.C.) configuration shall be provided. Live contact inputs, those that have voltage present, shall be provided with isolating devices to meet dry contact requirements.
7. Start-stop relay module shall contain relays for start-stop function at the remote point, with relays mounted and factory wired to numbered terminal strips.

## 8. Outage Devices:

- a). Control Relays: Control relay contacts shall be rated for the application, with a minimum of two sets of Form C contacts, enclosed in a dustproof enclosure. Relays shall have silver-cadmium contacts with a minimum life span rating of one million operations. Operating time shall be 20 milliseconds or less, with release time of 10 milliseconds or less. Relays shall be equipped with coil transient suppression limiting transients to nondamaging levels.
- b). Time Delay Relays: Time delay relay contacts shall be rated for the application with a minimum of two sets of Form C contacts enclosed in a dustproof enclosure. Relays shall have silver-cadmium contacts with a minimum life span rating of one million operations. Relays shall be equipped with coil transient suppression devices to limit transients to nondamaging levels. Delays contact opening or closing shall be adjustable from one to 60 seconds with a minimum accuracy of plus or minus 2 percent of setting.
- c). Latching Relays: Latching relay contacts shall be rated for the application with a minimum of two sets of Form C contacts enclosed in a dustproof enclosure. Relays shall have silver-cadmium contacts with a minimum life span rating of one million operations. Operating time shall be 20 milliseconds or less, with release time of 10 milliseconds or less. Relays shall be equipped with coil transient suppression devices to limit transients to nondamaging levels.
- d). Reed Relays: Reed relays shall be encapsulated in a glass-type container housed in a plastic or epoxy case. Contacts shall be rated for the application. Operating and release times shall be one millisecond or less. Reed relays shall have a minimum life span rating of 10 million operations.
- e). Contactors: Contactors shall be of the single-coil, electrically operated, mechanically held type. Positive locking shall be obtained without the use of hooks, latches, or semi-permanent magnets. Contacts shall be double-break silver-to-silver type protected by arcing contacts. Number of contacts and ratings shall be selected for the application. Operating and release times shall be 100 milliseconds or less. Contactors shall be equipped with coil transient suppression devices to limit transients to nondamaging levels.
- f). Solid-State Relays: Input-output isolation shall be greater than 1000 megohms with a breakdown voltage of 1500 V rms or greater at 60 Hz. The contact life shall be 10 million operations or greater. The ambient temperature range shall be minus 20 degrees to plus 140 degrees F. Input impedance shall not be less than 500 ohms. Relays shall be rated for the application. Operating and release times shall be one millisecond or less. Transient suppression shall be provided as an integral part of the relay to limit transients to nondamaging levels.

## 9. Audible Alarm:

- a). All alarms shall annunciate on the ATC system front end computer and via pagers.

## 2.11 FLOW MEASURING STATIONS

- A. Furnish and install an Onicon Model F-1210, Hersey, Kobold or approved equal dual turbine insertion flow sensor complete with hot tap full port ball valve and installation hardware. The dual turbine element shall have counter rotating axial turbine elements, each with its own rotational sensing system, and an averaging circuit to reduce measurement errors due to swirl and flow profile distortion. Paddle type rotors will not be acceptable. Rotational sensing of each turbine shall be accomplished electronically by sensing impedance change and not with magnetic or photo-electric means. Each sensor shall be individually calibrated and tagged accordingly against the manufacturers primary standards which must be accurate to within 0.1 percent and traceable to the U.S. National Institute of Standards and Technology (NIST).
- B. The sensor shall have a maximum operating pressure of 400 PSI, maximum operating temperature of 220 degrees F (optional 300 degrees F) and a pressure drop of less than 1 PSI at 17 feet per second flow rate. Flow sensor shall have 100:1 turndown ratio. Accuracy shall be  $\pm 2$  percent of actual reading from 0.4 feet per second to 20.0 feet per second.
- C. The sensor shall have integral analog outputs of 0-10 VDC and 4-20 mA current output for connection to the Central Control System. The sensor shall also include three integral frequency outputs, (top turbine, bottom turbine, average frequency) for diagnostic purposes and for connection to peripheral equipment (local display, BTU meter, etc.). All outputs shall be linear with flow rate.
- D. The turbine elements shall be made of polypropylene with sapphire jewel bearings and tungsten carbide shafts. The flow sensor shall be constructed of 316 stainless steel with an aluminum electronics enclosure and gasketed cover.
- E. Install flow measuring stations with minimum straight lengths of pipe upstream and downstream from sensor as prescribed by manufacturer's written instructions.
- F. Make electrical connections to power supply and interlock with ATC system.
- G. Calibrate meters for manufacturers requirements.

## PART 3. EXECUTION

## 3.1 GENERAL

- A. The Automatic Temperature Control System and Central Control and Management System, shall be designed, installed, and commissioned in a turnkey fully implemented and operational manner.

## 3.2 BMS SPECIFIC REQUIREMENTS

- A. Graphic Displays
  - 1. Provide a color graphic system flow diagram display for each new and existing system with all points as indicated on the point list. All terminal unit graphic displays shall be from a standard design library.
  - 2. User shall access the various system schematics via a graphical penetration scheme and/or menu selection.
- B. Custom Reports:
  - 1. Provide custom reports as required for this project:

### 3.3 INSTALLATION & SUPERVISION

- A. All wiring and tubing shall be properly supported and run in a neat and workmanlike manner. All wiring and tubing exposed and in equipment rooms shall run parallel to or at right angles to the building structure. All piping and wiring within enclosures shall be neatly bundled and anchored to prevent restriction to devices and terminals.
- B. The control contractor shall be responsible for all electrical installation required for a fully functional control and automation system and not shown on the electrical plans or required by the electrical specifications. All wiring shall be in accordance to all local and national codes.
  - 1. All line voltage wiring, all wiring exposed, and all wiring in equipment rooms shall be installed in conduit in accordance to the electrical specifications.
  - 2. All electric and electronic wiring shall be minimum #20 AWG minimum THHN and shielded if required.
  - 3. All wiring in the central control room shall be concealed in an approved manner.
- C. The installation and supervision of this project shall be carried out by factory trained personnel who are employed by the Contractor and licensed for this type of work.
- D. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.
- E. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation.
- F. Install in accordance with manufacturer's instructions.
- G. Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun shield.
- H. Provide separable sockets for liquids and flanges for air bulb elements.

- I. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.
- J. Install equipment plumb and level.
- K. Install all equipment to be accessible for service and maintenance.

### 3.4 ACCEPTANCE TESTING

#### A. Point Verification

To verify end-to-end operation of the system the Contractor shall provide a hard copy of an All Points Summary Listing to the Owner of each part or system to be placed in warranty by the Owner. For CHS systems, the Contractor shall additionally provide a print screen of the process display showing real time dynamic point information for all points on the subsystem(s) to be accepted.

#### B. Sequence Verification

1. The Contractor shall notify the Owner's representative of systems which perform all specified sequences.
2. The warranty acceptance test shall be of 5 days duration and the system shall perform as follows:
  - a). During the five days, the FMCS system shall not report any system diagnostics from the subsystem under test.
  - b). The subsystem shall be performance verified as operational using temporary trends of each control loop located in the SDC or MSDC.

During the occupied periods, BAS control loops, under test, shall maintain control of the process variable within the following scales:

Pump Head Pressure	+/-10 percent of control range
Pipe Temperature Loops	+/-2 degrees F

The contractor shall provide a hard copy printout of the process variable, process variable set point and control loop output percent for the period of 2 hours prior to occupancy to 2 hours after occupancy with samples taken every 15 minutes.

### 3.5 COORDINATE WITH TAB AGENCY

- A. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, damper sequences, air and water reset, freeze stats and duct smoke detectors.
- B. Verify that all controlling instruments are calibrated and set for design operating

conditions prior to commencement of TAB work.

- C. Calibrate sensors after installation, and before the sensor control verification tests are performed. Prove the accuracy of final settings by taking temperature readings. The readings shall be in a typical conditional space for each separately controlled zone.
- D. Allow sufficient time in the project to provide assistance and instruction to the balancing agency in the proper use and setting of control components such as, but not limited to, computers, static pressure controllers, or any other device that may need set points changed so that the testing and balancing work can be performed.
- E. All control sequences, software, equipment, and components shall be started-up by a qualified technician. Start-up report shall be submitted to Engineer prior to the commencement of testing and balancing work. Testing and balancing shall not commence until start-up reports are completed, reviewed by Engineer and forwarded to Testing and Balancing Agency.

### 3.6 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that systems are ready to receive work.
- C. Beginning of installation means installer accepts existing conditions.
- D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.
- E. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.
- F. Coordinate installation of system components with installation of mechanical system equipment such as air handling units and air terminal units.
- G. Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices, wiring, and tubing is installed prior to installation proceeding.

### 3.7 INTERLOCK REQUIREMENTS

- A. The fan and equipment interlock requirements are as scheduled on the contract drawings.
- B. Furnish and install all necessary relays, transformer, contactors, wiring, conduit, and accessories to perform fan, equipment, and damper interlocks.
- C. Unless otherwise noted, fan interlocks shall be arranged such that dampers associated with fan shall be open when fan starts and close when fan stops.

### 3.8 SUBMITTALS AT PROJECT CLOSEOUT

- A. Project Record Documents: Record actual locations of components and set points of

controls, including changes to sequences made after submission of shop drawings.

### 3.9 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
  - 1. Install piping adjacent to machine to allow service and maintenance.
- B. Ground equipment.
  - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- C. Connect hand-off-auto selection switches to override automatic interlock controls when switch is in hand position.

### 3.10 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
  - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
  - 2. Test and adjust controls and safeties.
  - 3. Test calibration of electronic controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
  - 4. Test each point through its full operating range to verify that safety and operating control set points are as required.
  - 5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
  - 6. Test each system for compliance with sequence of operation.
  - 7. Test software and hardware interlocks.
- C. DDC Verification:
  - 1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
  - 2. Check instruments for proper location and accessibility.

3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
  4. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
  5. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
  6. Check temperature instruments and material and length of sensing elements.
  7. Check control valves. Verify that they are in correct direction.
  8. Check DDC system as follows:
    - a). Verify that DDC controller power supply is from emergency power supply, if applicable.
    - b). Verify that wires at control panels are tagged with their service designation and approved tagging system.
    - c). Verify that spare I/O capacity has been provided.
    - d). Verify that DDC controllers are protected from power supply surges.
- D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.
- E. All temperature control and interlock wiring shall be installed in conduit unless otherwise noted on the plans. Power or interlock wiring shall be run in separate conduit from sensor and communications wiring.

### 3.11 ADJUSTING

- A. Calibrating and Adjusting:
1. Calibrate instruments.
  2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
  3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
  4. Control System Inputs and Outputs:
    - a). Check analog inputs at 0, 50, and 100 percent of span.
    - b). Check analog outputs using milliampere meter at 0, 50, and 100 percent output.
    - c). Check digital inputs using jumper wire.
    - d). Check digital outputs using ohmmeter to test for contact making or breaking.

- e). Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.
5. Flow:
    - a). Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
    - b). Manually operate flow switches to verify that they make or break contact.
  6. Pressure:
    - a). Calibrate pressure transmitters at 0, 50, and 100 percent of span.
    - b). Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.
  7. Temperature:
    - a). Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
    - b). Calibrate temperature switches to make or break contacts.
  8. Stroke and adjust control valves and dampers.
  9. Provide diagnostic and test instruments for calibration and adjustment of system.
  10. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.
- B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

### 3.12 ON-SITE ASSISTANCE

- A. Occupancy Adjustments: Within one year of date of Substantial Completion, provide up to three Project site visits, when requested by Owner, to adjust and calibrate components and to assist Owner's personnel in making program changes and in adjusting sensors and controls to suit actual conditions.

### 3.13 SCHEDULING

- A. Submit spreadsheet to Owner indicating occupied/unoccupied times for each item controlled by ATC system. Incorporate all scheduling requirements into sequence of operation.

### 3.14 STAGING

- A. Coordinate staging requirements with equipment being controlled. Where multistage units are scheduled or specified, provide all devices, controllers, wiring to control and sequence all stages.

#### PART 4. SEQUENCES OF OPERATION

##### 4.1 SINGLE WATER COOLED CHILLER WITH PRIMARY PUMPING

- A. The chilled water system shall be started and stopped by a signal from the CCMS. Provide a panel mounted hand-off-auto (H-O-A) switch that overrides the CCMS to manually start or stop the chilled water system. The CCMS shall have control of the chilled water system operation when the panel mounted H-O-A switch is in the "Auto" position only.
- B. Provide an outside temperature sensor that shall automatically energize the chilled water system when the ambient temperature is 50 degrees F (adjustable) or above. Outside temperature sensor shall be global unit mounted outside under sun shield.
- C. Provide a panel mounted pump selector switch that shall determine the primary (lead) and standby status of each pump and interlocks to the selected pumps. Provide a pole on the H-O-A switch for the exclusive use of the CCMS for remote monitoring of the switch position. All input and output points listed on the CCMS point schedule that are connected through a control panel provided by the ATC subcontractor, shall be wired through dedicated terminal strips. Digital output (DO) control points shall be a 24 VAC max signal provided by the CCMS to the ATC control panel to drive a pilot relay. The pilot relay, the H-O-A switch, and all control panel and equipment interlock wiring shall be provided by the ATC subcontractor. The 24 VAC signal and all wiring between the ATC control panel and the CCMS shall be provided by the ATC subcontractor.
- D. Provide automatic alternator for lead/lag pump control of the primary pumps. Only one primary pump shall run at one time. If the lead pump fails as sensed by chiller flow switch, the lag pump shall energize after a 15 second time delay and an audible and visual alarm with silence switch shall sound "on" the EMS. The system shall automatically rotate lead/lag assignment every week, adjustable through software.
- E. The differential pressure sensor set point for the variable speed driven pumps shall be field determined. Set point shall be based on maintaining minimum pressure to overcome resistance of any coils, control valve, and runout pipe/fittings. The final differential pressure sensor set point value shall be documented on the as-built ATC drawings.
- F. When the chilled water system is started (manually or automatically), either locally or remotely through the CCMS, the ATC system shall start the lead primary chilled water pump through the ATC panel mounted pump selector switch. The lead primary chilled water pump shall then run continuously. Upon proof of flow via discharge flow switch, (FS), the chiller shall be energized. The chiller system packaged controls shall maintain a leaving water temperature of 42 degrees F (adjustable) as sensed by chilled water supply temperature sensor, TS-1. Provide all interlock wiring required by the chiller manufacturer, including starter interlocks, flow switches, and pump starter auxiliary contact wiring to insure a complete and automated system.
- G. When the chilled water system is started (manually or automatically), either locally or

remotely through the CCMS, the ATC system shall start the lead primary condenser water pump through the ATC panel mounted pump selector switch. The lead condenser water pump shall then run continuously. Upon proof of flow via condenser flow switch, (FS), the chiller shall be energized. The cooling tower controls shall maintain a leaving water temperature of 83 degrees F (adjustable) as sensed by condenser water supply temperature sensor, TS-2. Provide all interlock wiring required including starter interlocks, flow switches, and pump starter auxiliary contact wiring to insure a complete and automated system. When the condenser water system is started (manually or automatically) the condenser water system controls shall sense condenser water supply temperature on the condenser water circuit. Upon a rise in condenser water temperature, the cooling tower shall be energized. Should the temperature continue to rise, the cooling tower fan shall energize. The fan speed shall be modulated to low speed, then high speed to maintain the condenser water temperature set point. The reverse sequence shall occur upon chilled water system shut down or a reduction in condenser water temperature. Furnish all control/interlock wiring for cooling tower on/off and speed signal.

- H. Differential pressure set point shall be adjustable through the Energy Management System.
- I. When the chilled water system is stopped, either manually or automatically, the ATC contractor shall provide a "Time Delay Off" function to keep lead chilled water pump and lead condenser water pump running for an additional 10 minutes (adjustable) after the chiller has been de-energized to ensure that residual refrigerant will pass out of the evaporator.
- J. All field control/interlock wiring between existing cooling tower control panel, existing pumps, ATC system, and devices shall be furnish under this Section of the specifications.
- K. The chilled water loop shall be provided with a flow measuring station (FMS). The flow measuring station shall monitor the flow rate in gallons per minute and shall display the value on the ATC system computer. Provide Algorithm on ATC system program to perform and displaying BTU calculations.
- L. Interlock chiller with existing refrigerant ventilation system to shut down chiller, upon detection of refrigerant in the space and to energize ventilation system. Alarm in ATC system if refrigerant alarm annunciates.

#### 4.3 HYDRONIC FLOW MEASURING STATIONS WITH REMOTE DISPLAY

- A. Interlock all hydronic flow measuring stations with the ATC system.

END OF SECTION

DIVISION 26  
SECTION 260500  
COMMON WORK RESULTS FOR ELECTRICAL  
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## SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

## PART 1 GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

## A. Section Includes:

- 1. Electrical equipment coordination and installation.
  - 2. Common electrical installation requirements.
- B. Provide all labor, materials, equipment, and services necessary for and incidental to the complete installation and operation of all electrical work.
  - C. Unless otherwise specified, all submissions shall be made to, and acceptances and approvals made by the Engineer.
  - D. Contract Drawings are generally diagrammatic and all offsets, fittings, transitions and accessories are not necessarily shown. Furnish and install all such items as may be required to fit the work to the conditions encountered. Arrange conduits, equipment, and other work generally as shown on the Contract Drawings, providing proper clearance and access. Where departures are proposed because of field conditions or other causes, prepare and submit detailed shop drawings for approval in accordance with Article "Submittals" specified below. The right is reserved to make reasonable changes in location of equipment, boxes, conduit/wiring, and devices, up to the time of rough-in or fabrication.
  - E. Conform to the requirements of all rules, regulations and codes of local, state and federal authorities having jurisdiction.
  - F. Coordinate the work under Division 26 with the work of all other construction trades.
  - G. Be responsible for all construction means, methods, techniques, procedures, and phasing sequences used in the work. Furnish all tools, equipment and materials necessary to properly perform the work in first class, substantial, and workmanlike manner, in accordance with the full intent and meaning of the Contract Documents.
  - H. Arrange conduit, wiring, equipment, and other work generally as shown, providing proper clearances and access. Carefully examine all Contract Drawings and fit the work in each location without substantial alteration. Where departures are proposed because of field conditions or other causes, prepare and submit detailed shop drawings for approval in accordance with Article "Submittals" as hereinafter specified. The right is reserved to make reasonable changes in location of equipment, conduit and wiring up to the time of rough-in or fabrication.

## 1.3 PERMITS AND FEES

- A. Obtain all permits and pay taxes, fees and other costs in connection with the work. File necessary plans, prepare documents, give proper notices and obtain necessary approvals. Deliver inspection and approval certificates to Owner prior to final acceptance of the work.
- B. Permits and fees shall comply with Division 01 Section, General Requirements.
- C. Notify Inspection Authorities to schedule inspections of work.
- D. Notify Engineer in advance of scheduled inspections.
- E. An electrical foreman, superintendent or other supervisor shall be in attendance for all scheduled inspections

#### 1.4 EXAMINATION OF SITE

- A. Examine the site, determine all conditions and circumstances under which the work must be done, and make all necessary allowances for same. No additional cost to the Owner will be permitted for Contractor's failure to do so.
- B. Examine and verify specific conditions described in individual Specifications sections.
- C. Verify that utility services are available, of the correct characteristics, and in the correct locations.

#### 1.5 INTERPRETATION OF DOCUMENTS

- A. Any discrepancies between Drawings, Specifications, Drawings and Specifications, or within Drawings and Specifications shall be promptly brought to the attention of the Owner during the bidding period. No allowance shall subsequently be made by reason of failure to have brought said discrepancies to the attention of the Owner during the bidding period or of any error on the Bidder's part.
- B. The locations of products shown on Drawings are approximate. Place the devices to eliminate all interference with piping, etc. Where any doubt exists, the exact location shall be determined by the Owner.
- C. All general trades and existing conditions shall be checked before installing any outlets, power wiring, etc.
- D. Equipment sizes shown on the Drawings are estimated. Before installing any wire or conduit, obtain the exact equipment requirements and install wire, conduit, or other item of the correct size for the equipment actually installed. However, wire and conduit sizes shown on the Drawings shall be taken as a minimum and shall not be reduced without written approval from the Owner.
- E. Where variances occur between the Drawings and Specifications or within either document itself, the item or arrangement of better quality, greater quality, or higher cost shall be included in the Contract Price. The Engineer will decide on the item and manner in which the work shall be installed.

- F. Contract Drawings are generally diagrammatic and all offsets, fittings, transitions, and accessories are not necessarily shown. Furnish and install all such items as may be required to fit the work to the conditions encountered. Arrange conduits, equipment, and other work generally as shown on the Contract Drawings, providing proper clearance and access. Where departures are proposed because of field conditions or other causes, prepare and submit detailed Shop Drawings for approval in accordance with Article "Submittals" as herein after specified. The right is reserved to make reasonable changes in location of equipment, conduit/wiring, and devices, up to the time of rough-in or fabrication.
- G. Work not specifically outlined, but reasonably incidental to the completion of the work, shall be included without additional compensation from the Engineer and Owner.
- H. Perform the work in a first-class, substantial and workmanlike manner. Any materials installed which do not present an orderly and neat workmanlike appearance shall be removed and replaced when so directed by the Engineer, at the Contractor's expense.
- I. The complete set of Mechanical, and Electrical Drawings and Specifications apply to this work. The successful Bidder shall familiarize himself with all other related documents.

#### 1.6 MATERIALS AND EQUIPMENT

- A. Materials and equipment installed as a permanent part of the project shall be new, unless otherwise indicated or specified, and of the specified type and quality.
- B. Where material or equipment is identified by proprietary name, model number and/or manufacturer, furnish named item, or its equal, subject to approval by Engineer. Substituted items shall be equal or better in quality and performance and must be suitable for available space, required arrangement, and application. Submit all data necessary to determine suitability of substituted items, for approval.
- C. The suitability of named item only has been verified. Where more than one item is named, only the first named item has been verified as suitable. Substituted items, including items other than first named shall be equal or better in quality and performance to that of specified items, and must be suitable for available space, required arrangement and application. Contractor, by providing other than the first named manufacturer, assumes responsibility for all necessary adjustments and modifications necessary for a satisfactory installation. Adjustments and modifications shall include but not be limited to electrical, structural, support, and architectural work.
- D. Substitution will not be permitted for specified items of material or equipment where noted.
- E. All items of equipment furnished shall have a service record of at least five (5) years.

#### 1.7 ELECTRICAL WORK UNDER OTHER DIVISIONS

- A. HVAC Equipment and Systems
  - 1. In general, any electrically operated or controlled equipment furnished under HVAC divisions shall be supplied with control wiring, transformers, contacts, etc.

2. Division 26 shall provide power circuits to such equipment and a disconnecting means for each piece of equipment, as well as all electrical control equipment and wiring related thereto.
3. Certain mechanical units are furnished from the factory with motor starters, contactors, transformers, fuses, wiring, etc., required for fans, pumps, etc. When this equipment is supplied from the factory, Division 26 shall coordinate with Division 23 such that only one set of starters, fuses, switches, etc. is provided.
4. In general, control and interlock equipment (including, but not limited to wiring, conduit, transformers, relays, contacts, etc.) for HVAC equipment and systems is furnished under Division 23. Division 26 shall install and connect all equipment as necessary.
5. HVAC equipment refers to, but is not limited to the following:
  - a. Chillers
  - b. Flow Monitoring Stations

#### 1.8 FIRE SAFE MATERIALS

- A. Unless otherwise indicated, materials and equipment shall conform to UL, NFPA and ASTM standards for fire safety with smoke and fire hazard rating not exceeding flame spread of 25 and smoke developed of 50.

#### 1.9 REFERENCED STANDARDS, CODES AND SPECIFICATIONS

- A. Specifications, Codes and Standards listed below are included as part of this Specification, latest edition:
  1. ADA - Americans with Disabilities Act
  2. ANSI - American National Standards Institute
  3. ASTM - American Society for Testing and Materials
  4. CSA - Canadian Standards Association
  5. DNREC - Delaware Department of Natural Resources and Environmental Control
  6. EPA - Environmental Protection Agency
  7. FM - Factory Mutual
  8. IBC - International Building Code
  9. IEEE - Institute of Electrical and Electronics Engineers
  10. NEC - National Electrical Code
  11. NECA - National Electrical Contractors Association

- 12. NEMA - National Electrical Manufacturers Association
- 13. NFPA - National Fire Protection Association
- 14. OSHA - Occupational Safety and Health Act
- 15. UL - Underwriters' Laboratories

- B. Electrical construction materials shall, where a listing is normal for the particular class of material, be listed in *Electrical Construction Materials List* of the Underwriters' Laboratories, Inc. (U.L.) and shall bear the listing label. Electrical equipment shall, where a listing is normal for the particular class of equipment, be listed in the *Electrical Appliance and Utilization Equipment List* of the Underwriters' Laboratories, Inc. (U.L.) and shall bear the listing label. Materials and equipment listed and labeled as "approved for the purpose" by other nationally recognized testing laboratory, inspection agency or approved organization (such as E.T.L. or Factory Mutual) shall be acceptable.

#### 1.10 SUBMITTALS

- A. Product Data: For items specified in Part 2 of this Section.

#### 1.11 SUBMITTALS, REVIEW AND ACCEPTANCE

- A. Equipment, materials, installation, workmanship and arrangement of work are subject to review and acceptance. No substitution will be permitted after acceptance of equipment or materials except where such substitution is considered by the Engineer, to be in the best interest of the Owner.
- B. Submittal List: Within 14 days of the Notice to Proceed, Contractor shall submit a list of proposed submittals arranged by CSI Division or referenced Specification Section.
- C. Electronic Submittal Format and Content: An electronic shop drawing submittal shall be prepared as a PDF file and include as page 1 the Contractor's stamp, followed by the submittal contents. Submittal form shall identify Project, Contractor, Subcontractor or Supplier, and pertinent Contract Document references.
- D. Apply Contractor's stamp, signed and initialed, certifying that review, verification of products required, field dimensions, and coordination of information is in accordance with the requirements of the Work and the Contract Documents.
- E. Electronic Submittal File Naming: Contractor prepared shop drawings shall be named with reference to project number, specification section, submittal number, brief content description and abbreviated submittal type.

##### Example

HH-14-11\_07200\_01\_roof insulation\_PD.pdf

CA-25-11\_Div 8-02R1\_windows\_SYST.pdf (Division 8 2<sup>nd</sup> submittal, 1<sup>st</sup> revision)

##### Submittal Type Abbreviations

CERT Certification

INSTR Installation Instructions

PD	Product Data
PDID	Product and Installation Data
QC	Qualification/Quality Assurance Data
SYST	System Package
	(All Section submittals are bound into one file sized 4 MB or less)
TD	Test Data
WAR	Warranty

- F. Submittals shall consist of Specifications, data sheets, samples, capacity ratings, performance curves, operating characteristics, catalog cuts, dimensional drawings, wiring diagrams, installation instructions, and any other information necessary to indicate complete compliance with Contract Documents. Edit submittal data specifically for application to this project.
- G. After acceptance of Material and Equipment List, submit three (3) copies, or more as required under the General Conditions, of complete descriptive data for all items. Data shall consist of Specifications, data sheets, samples, capacity ratings, performance curves, operating characteristics, catalog cuts, dimensional drawings, wiring diagrams, installation instructions, and any other information necessary to indicate complete compliance with Contract Documents. Edit submittal data specifically for application to this project.
- H. Thoroughly review and stamp all submittals to indicate compliance with contract requirements prior to submission. Coordinate installation requirements and any electrical requirements for equipment submitted. Contractor shall be responsible for correctness of all submittals.
- I. Submittals will be reviewed for general compliance with design concept in accordance with Contract Documents, but dimensions, quantities, or other details will not be verified.
- J. Identify submittals, indicating intended application, location and service of submitted items. Refer to Specification sections or paragraphs and Drawings where applicable. Clearly indicate exact type, model number, style, size and special features of proposed item. Submittals of a general nature will not be acceptable. For substituted items, clearly list on the first page of the submittal all differences between the specified item and the proposed item. The Contractor shall be responsible for corrective action and maintaining the Specification requirements if differences have not been clearly indicated in the submittal.
- K. Submit actual operating conditions or characteristics for all equipment where required capacities are indicated. Factory order forms showing only required capacities will not be acceptable. Call attention, in writing, to deviation from contract requirements.
- L. Acceptance will not constitute waiver of contract requirements unless deviations are specifically indicated and clearly noted. Use only final or corrected submittals and data prior to fabrication and/or installation.
- M. For any submittal requiring more than two (2) reviews by the Engineer (including those caused by a change in subcontractor or supplier) the Owner will withhold Contractor's funds by a change order to the contract to cover the cost of additional reviews. One review is counted for each action including rejection or return of any reason.

#### 1.12 SHOP DRAWINGS

- A. Submit Product Data and Shop Drawings including but not limited to the list below, in addition to provisions of the paragraph above. Identify all shop drawings by the name of the item and system and the applicable Specification paragraph number and Drawing number.
- B. Every submittal including, but not limited to the list below, shall be forwarded with its own transmittal as a separate, distinct shop drawing. Grouping of items/systems that are not related shall be unacceptable.

Items and Systems

- 1. Conductors and Cables - 600V or Less
  - 2. Conduit and Raceway
  - 3. Equipment Nameplates/Labels
  - 4. Junction and Pull Boxes, Standard Sizes
  - 5. Operation and Maintenance Manual
  - 6. Outlet and Device Boxes
  - 7. Panelboard Circuit Directories
  - 8. Record Drawings
  - 9. Tests and Reports
  - 10. Wiring Diagrams
- C. Submittals shall include, but not be limited to, the following information: size, type, functional characteristics, compliance with standards in Division 26, required service access which shall be suitable for intended location and use, electrical service connections and requirements, and deviations from Contract Document requirements.
  - D. Submit for approval any other shop drawings as required by the Engineer or Owner. No item listed above shall be delivered to the site, or installed, until approved. After the proposed materials have been approved, no substitution will be permitted except where approved by the Engineer.
  - E. For any shop drawing requiring more than two (2) reviews by the Engineer (including those caused by a change in subcontractor or supplier) the Owner will withhold Contractor's funds by a change order to the contract to cover the cost of additional reviews. One review is counted for each action including rejection or return for any reason.

1.13 DEFINITIONS

- A. *Approve*: To permit use of material, equipment or methods conditional upon compliance with contract documents requirements.
- B. *Building Line*: Exterior wall of building.
- C. *Concealed*: Hidden from sight in chases, formed spaces, shafts, hung ceilings, embedded in construction.
- D. *Conduits* include conduit, all fittings, identification, and other accessories relative to such conduit.

- E. *Contractor*: The Electrical Contractor and any of his subcontractors, vendors, suppliers, or fabricators.
- F. *EPDM*: Ethylene-propylene-diene terpolymer rubber
- G. *Exposed*: Not installed underground or *concealed* as defined above.
- H. *Finished Spaces*: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceiling, unexcavated spaces, crawl spaces, and tunnels.
- I. *Furnish and install or provide*: To supply, erect, install, and connect to complete for readiness for regular operation, the particular work referred to.
- J. *Location, Damp*: Locations protected from water and not subject to saturation with water or other liquids, but subject to moderate degrees of moisture. Examples of such locations include interior locations such as basements, crawlspaces, attics, cold-storage rooms, etc...
- K. *Location, Dry*: A location not normally subject to dampness or wetness. A dry location may temporarily be subject to dampness or wetness during building construction.
- L. *Location, Wet*: Locations subject to saturation with water or other liquids, locations exposed to weather, and installations underground or in concrete slabs or masonry in direct contact with the Earth. Examples of such locations include all exterior locations (including those under canopies, roofed open porches, etc...) commercial kitchens, and vehicle washing areas.
- M. *NBR*: Acrylonitrile-butadiene rubber.
- N. *Review*: Limited observation or checking to ascertain general conformance with design concept of the work and with information given in contract documents. Such action does not constitute a waiver or alteration of the contract requirements.

#### 1.14 RECORD DRAWINGS

- A. Upon completion of the electrical installations, the Contractor shall deliver to the Engineer one complete set of prints of the electrical Contract Drawings which shall be legibly marked in red pencil to show all changes and departures of the installation as compared with the original design. They shall be suitable for use in preparation of Record Drawings.
- B. Contractor shall incorporate all sketches, addendums, value engineering, change orders, etc., into record drawings prior to delivering the same to the Engineer.

#### 1.15 WARRANTY

- A. Contractor's attention is directed to warranty obligations contained in the General Conditions.
- B. The above shall not in any way void or abrogate equipment manufacturer's guarantee or warranty. Certificates of equipment manufacturer's warranties shall be included in the operations and maintenance manuals.

- C. The Contractor guarantees for a two (2) year period from the time of final acceptance by the Owner:
1. That the work contains no faulty or imperfect material or equipment or any imperfect, careless, or unskilled workmanship.
  2. That all work, equipment, machines, devices, etc. shall be adequate for the use to which they are intended, and shall operate with ordinary care and attention in a satisfactory and efficient manner.
  3. That the Contractor will re-execute, correct, repair, or remove and replace with proper work, without cost to the Owner, any work found to be deficient. The Contractor shall also make good all damages caused to their work or materials in the process of complying with this section.
  4. That the entire work shall be water-tight and leak-proof.

#### 1.16 OPERATION AND MAINTENANCE MANUALS

- A. The Contractor shall have prepared three (3) copies of the Operation and Maintenance Manual and deliver these copies of the manual to the Owner. The manual shall be as specified herein. The manual must be approved and will not be accepted as final until so stamped.
- B. The manual shall be bound in a three-ring loose-leaf binder similar to National No. 3881 with the following title lettered on the front: *Operation and Maintenance Manual – Sussex Tech High School Chiller Replacement - Electrical*. No sheets larger than 8-1/2 inches x 11 inches shall be used, except sheets that are neatly folded to 8-1/2 inches x 11 inches and used as a pull-out. Provide divider tabs and table of contents for organizing and separating information.
- C. Provide the following data in the manual:
1. As first entry, an approved letter indicating the starting/ending time of Contractor's warranty period.
  2. Maintenance operation and lubrication instructions on each piece of equipment furnished.
  3. Complete catalog data on each piece of electrical equipment furnished including approved Shop Drawing/Submittal with Engineer's Comments (if any).
  4. Manufacturer's extended limited warranties on equipment.
  5. Provide sales and authorized service representatives names, address, and phone numbers of all equipment and subcontractors.
  6. Provide supplier and subcontractor's names, address, and phone number.
  7. Catalog data of all equipment, starters, etc. shall include wiring diagrams, parts list and assembly drawing.
  8. Access panel charts with index illustrating the location and purpose of access panels.

9. Approved Electrical Certificates.
  10. Start-up reports for equipment.
- D. Submit Operation and Maintenance Manual prior to anticipated date of Substantial Completion for Engineer review and approval. Substantial Completion requires that Operation and Maintenance Manuals be reviewed and approved.
  - E. Deliver all instruction materials to the Owner prior to the formal instruction period.
  - F. Upon completion of all work, thoroughly instruct the Owner's representatives in the proper operation and maintenance of all electrical equipment and systems.
  - G. Instructions shall be done only after completed systems have been put into operation and tested for proper operation and performance.
  - H. Instructions shall be given only by experts in the equipment or system and shall include descriptions and demonstrations of procedures of operation, data record keeping, etc.
  - I. Where specified in technical sections, provide longer periods required for specialized equipment.
  - J. Instruct the Owner or designated personnel in operation, maintenance, lubrication, and adjustment of systems and equipment.
  - K. The Operation and Maintenance Manual shall be available at the time of the instructions, for use by Instructors and Owner personnel.
  - L. Schedule the general and specialized instruction periods for a time agreed upon by the Owner and Engineer.

## PART 2 PRODUCTS – NOT USED

## PART 3 EXECUTION

### 3.1 TEMPORARY FACILITIES:

- A. General: Refer to the Division 01 Sections for general requirements of temporary facilities.
- B. Remove all temporary power installations and connections after permanent power is established and/or prior to completion of the project.

### 3.2 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Install equipment with working space and dedicated space in strict accordance with 2011 NEC Article 110.
- E. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- F. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- G. Verify exact electrical requirements for each piece of equipment receiving one or more electrical connections, including but not limited to voltage, phase, and maximum fuse/overcurrent protection device rating. Provide electrical circuit of proper characteristics to serve provided equipment.
- H. Include any and all items required by the National Electrical Code and/or field conditions for the proper connection and installation of each piece of equipment.
- I. Make all connections to equipment in accordance with manufacturer's instructions.
- J. Right of Way: Give to piping systems installed at a required slope.
- K. Coordinate electrical work with equipment by others.

### 3.3 SUPPORTS, HANGERS AND FOUNDATIONS

- A. Provide supports, hangers, braces, attachments required for the work. Support and set the work in a thoroughly substantial and workmanlike manner without placing strains on materials, equipment, or building structure, submit shop drawings for approval. Coordinate all work with the requirements of the structural division.
- B. Supports, hangers, braces, and attachments shall be standard manufactured items or fabricated structural steel shapes. All interior hangers shall be galvanized or steel with rust inhibiting paint.

### 3.4 PROTECTION OF WORK

- A. Protect work, material and equipment from weather and construction operations before and after installation. Properly store and handle all materials and equipment.
- B. Remove existing wires from raceway before pulling in new wires and conductors.
- C. Cover temporary openings in conduits and equipment to prevent the entrance of water, dirt, debris, or other foreign matter. Deliver conduits with factory applied end caps.
- D. Cover or otherwise protect all finishes.

- E. Replace damaged materials, devices, finishes and equipment.
- F. Protect stored conduits from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, where stored inside.

### 3.5 OPERATION OF EQUIPMENT

- A. Clean all systems and equipment prior to initial operation for testing, or other purposes. Lubricate, adjust, and test all equipment in accordance with manufacturer's instructions. Do not operate equipment unless all proper safety devices or controls are operational. Provide all maintenance and service for equipment that is authorized for operation during construction.
- B. Where specified, or otherwise required, provide the services of the manufacturer's factory-trained servicemen or technicians to start up the equipment. Where factory start-up of equipment is not specified, provide field start-up by qualified technician.
- C. Upon completion of work, clean and restore all equipment to new conditions; replace expendable items.

### 3.6 TESTING AND ADJUSTMENT

- A. Perform all tests which are specified or required to demonstrate that the work is installed and operating properly. Where formal tests are required, give proper notices and perform all necessary preliminary tests to assure that the work is complete and ready for final test.
- B. Adjust all systems, equipment and controls to operate in a safe, efficient and stable manner.
- C. On all circuits, 600 volts or less, provide circuits that are free from ground faults, short circuits and open circuits.
- D. Other tests of a specific nature for special equipment shall be as specified under the respective equipment.
- E. Submit all test results to the Engineer for approval.

### 3.7 EQUIPMENT BY OTHERS

- A. This Contractor shall make all system connections required to equipment furnished and installed under other divisions or furnished by the Owner. Connections shall be complete in all respects to render this equipment functional to its fullest intent.
- B. It shall be the responsibility of the supplier of the equipment to furnish complete instructions for connections. Failure to do so will not relieve the Contractor of any responsibility for improper equipment operation.

### 3.8 OUTAGES

- A. Provide a minimum of seven (7) days' notice to schedule outages. The Contractor shall include in their bid outages and/or work in occupied areas to occur on weekends, holidays, or at night. Coordinate and get approval of all outages with the Owner.

- B. Submit *Outage Request Form*, attached at the end of this Section, to Owner for approval.

### 3.9 CUTTING AND PATCHING

- A. Accomplish all cutting and patching necessary for the installation of work under Division 26. Damage resulting from this work to other work already in place, shall be repaired at Contractor's expense. Where cutting is required, perform work in neat and workmanlike manner. Restore disturbed work to match and blend with existing construction and finish, using materials compatible with the original. Use mechanics skilled in the particular trades required.
- B. Do not cut structural members without approval from the Architect or Engineer.

### 3.10 CONNECTIONS AND ALTERATIONS TO EXISTING WORK

- A. Where work specified in Division 26 connects to existing equipment, conduits, etc., Contractor shall perform all necessary alterations, cuttings, fittings, etc., of existing work as may be necessary to make satisfactory connections between new and existing work, and to leave completed work in a finished and workmanlike condition.
- B. Where the work specified under Division 26, or under other Divisions, requires relocation of existing equipment, conduit etc., Contractor shall perform all work and make necessary changes to existing work as may be required to leave completed work in a finished and workmanlike condition.
- C. Where the relocation of existing equipment is required for access or the installation of new equipment, the Contractor shall temporarily remove and/or relocate and re-install as required to leave the existing and new work in a finished and workman like condition.

### 3.11 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
  - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
  - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
  - 3. To allow right of way for piping and conduit installed at required slope.
  - 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
  - 5. To provide working space and dedicated space clearances per 2008 NEC Article 110.26.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

### 3.12 DEMOLITION

- A. Unless otherwise noted all existing equipment, conduit, wire, etc., shall remain.

- B. Where existing equipment is indicated to be removed, all associated conduit, power, controls, insulation, hangers, supports and housekeeping pads, etc..., shall also be removed. Patch, paint and repair walls/roof/floor to match existing and/or new finishes.
- C. The Contractor shall be responsible for visiting the site and determining the existing conditions in which the work is to be performed.
- D. The location of all existing equipment, conduits etc., indicated is approximate only and shall be checked and verified. Provide all new electrical work required to connect to or clear existing work as applicable.
- E. Maintain egress at all times. Coordinate egress requirements with the State Fire Marshal, the Owner and the Authority(ies) Having Jurisdiction (AHJ).
- F. Make provisions and include in bid all costs associated with confined entry/space requirements and all other applicable OSHA regulations.
- G. Where required to maintain the existing systems in operation, temporarily backfeed existing systems from new equipment. Contractor shall temporarily extend existing conduit systems to new conduit systems.
- H. At completion of project all temporary conduit, wires, etc., shall be removed in their entirety.
- I. Existing conduit, equipment, wiring, etc., not required for re-use or re-installation in this project, shall be removed from the project site.
- J. Deliver to the Owner, on the premises where directed, existing equipment and materials which are removed and which are desired by the Owner or are indicated to remain the property of the Owner.
- K. All other materials and equipment which are removed shall become property of the Contractor and shall be promptly removed, from the premises, and disposed of by the Contractor, in an approved manner. Contractor shall be responsible for proper disposal of all removed equipment containing PCB's.
- L. Where conduit and wiring are removed, remove all conduit hangers which were supporting the removed conduit. Patch the remaining penetration voids with like materials and paint to match existing construction.
- M. Where required, provide and coordinate removal and re-installation of existing equipment. Take care to protect materials and equipment indicated for reuse. Contractor shall repair or replace items which are damaged. Contractor shall have Owner's representative present to confirm condition of equipment prior to demolition.
- N. Before demolition begins, and in the presence of the Owners representative, test and note all deficiencies in all existing systems affected by demolition but not completely removed by demolition. Provide a copy of the list of system deficiencies to the Owner and the Engineer.

- O. All devices and equipment designated by the Owner to remain the property of the Owner shall be moved and stored by the Contractor at a location on site as designated by the Owner. It shall be the Contractor's responsibility to store all devices and equipment in a safe manner to prevent damage while stored.
- P. All existing equipment refused by the Owner shall become the property of the Contractor and shall be removed from the site by the Contractor in a timely manner and disposed of in a legal manner.
- Q. Work Abandoned in Place: Cut and remove conduit a minimum of 2 inches beyond face of adjacent construction. Cap and patch surface to match existing finish.
- R. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational equipment indicated for relocation.
- S. Terminate services and utilities in accordance with local laws, ordinances, rules and regulations.

END OF SECTION

OUTAGE REQUEST FORM

DATE APPLIED: \_\_\_\_\_ BY: \_\_\_\_\_

DATE FOR OUTAGE: \_\_\_\_\_ FIRM: \_\_\_\_\_

START OUTAGE-TIME: \_\_\_\_\_ DATE: \_\_\_\_\_

END OUTAGE - TIME: \_\_\_\_\_ DATE: \_\_\_\_\_

AREAS AND ROOMS: \_\_\_\_\_

FLOOR(S): \_\_\_\_\_

AREA(S): \_\_\_\_\_

ROOM(S): \_\_\_\_\_

WORK TO BE PERFORMED: \_\_\_\_\_

SYSTEM(S): \_\_\_\_\_

REQUEST APPROVED BY: \_\_\_\_\_  
(FOREMAN OR OTHER PERSON IN CHARGE)

**(FOR OWNER'S USE ONLY):**

APPROVED: \_\_\_\_\_

YES \_\_\_ NO \_\_\_ BY: \_\_\_\_\_ DATE: \_\_\_\_\_

DATE/TIME-AS REQUESTED: \_\_\_\_\_ OTHER : \_\_\_\_\_

OWNER'S PRESENCE REQUIRED: \_\_\_\_\_

YES: \_\_\_ NO: \_\_\_ NAME: \_\_\_\_\_

POINT OF CONTACT: \_\_\_\_\_ PHONE: \_\_\_\_\_

DIVISION 26  
SECTION 260519  
CONDUCTORS AND CABLES  
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## SECTION 260519 - CONDUCTORS AND CABLES

## PART 1 GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section includes building wires and conductors and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

## 1.3 SUBMITTALS

- A. Product Data: Provide for each cable assembly type, wire, cables, conductors, and connectors.
- B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements. Indicate procedures and values obtained.

## 1.4 QUALITY ASSURANCE

- A. Listing and Labeling: Provide wires and conductors specified in this Section that are listed and labeled.
  - 1. The Terms *Listed and Labeled*: As defined in NFPA 70, Article 100.
  - 2. Listing and Labeling Agency Qualifications: A *Nationally Recognized Testing Laboratory* as defined in OSHA Regulation 1910.7.
- B. Comply with NEMA/Insulated Cable Engineers Association (ICEA) Standards.
- C. Comply with NECA Standard of Installation.
- D. Comply with NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- E. American Society for Testing and Materials (ASTM): Comply with requirements of the following:
  - 1. B3: Standard Specification for Soft or Annealed Copper Wire
  - 2. B8: Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
  - 3. D753: Standard Specification for General Purpose Polychloroprene Jacket for Wire and Cable

- F. Electrical Testing Laboratories (ETL): Provide wiring, cabling and connector products which are ETL listed and labeled.
- G. Institute of Electrical and Electronics Engineers (IEEE): Comply with the following standards which apply to wiring systems:
  - 1. 82: Test procedure for Impulse Voltage Tests on Insulated Conductors
  - 2. 241: Recommended Practice for Electric Power Systems in Commercial Buildings
- H. NFPA: Comply with NFPA 70 requirements for construction, installation and color coding of electrical wire, cable and connections.
- I. National Electrical Manufacturer's Association (NEMA): Comply with requirements of the following:
  - 1. WC70: Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.
- J. UL: Provide material conforming to the following standards:
  - 1. UL 83 - Thermoplastic-Insulated Wires and Cables.
  - 2. UL 486A - Wire Connectors and Soldering Lugs for Use with Copper Conductors
- K. UL Labels: Provide wiring, cabling and connector products which are UL listed and labeled.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wires and cables according to NEMA WC 26, *Binational Wire and Cable Packaging Standard*.
- B. Storage: Store wire and cable in a clean dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.
- C. Handling: Handle wire and cable carefully to avoid abrading, puncturing and tearing wire and cable insulation and sheathing. Ensure that dielectric resistance integrity of wires/cables is maintained.

#### 1.6 COORDINATION

- A. Coordinate layout and installation of cables with other installations.
- B. Revise locations from those indicated, as required to suit field conditions and as approved by Engineer.
- C. Determine required separation between cables and other work.
- D. Determine cable routing to avoid interference with other work.

## 1.7 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on the Drawings.
- B. Conductor sizes are based on copper.
- C. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

## PART 2 PRODUCTS

## 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Wires and Cables:
    - a. American Insulated Wire Corp.
    - b. BICC Brand-Rex Company.
    - c. General Cable.
    - d. Senator Wire & Cable Company.
    - e. Southwire Company.
    - f. Colonial Wire Company.
  - 2. Connectors and Accessories for Wires and Cables:
    - a. AMP Incorporated.
    - b. Buchanan.
    - c. General Signal; O-Z/Gedney Unit.
    - d. Monogram Company; AFC.
    - e. NSI Industries, Inc.
    - f. Square D Company; Anderson.
    - g. 3M Company; Electrical Products Division.

## 2.2 BUILDING WIRES AND CABLES

- A. UL-listed building wires and cables with conductor material, insulation type, cable construction and rating as specified herein.
- B. Building wires and cables shall be annealed (soft) copper, 600 volt, Type THHN/THWN (dual-rated) single conductors rated 90°C dry / 75°C wet, with a minimum conductivity of 98 percent at 20°C (68°F), or a maximum resistivity of 1.7 micro-ohms per centimeter.
- C. Conductors shall meet or exceed requirements of all applicable ASTM specifications, UL Standard 83, UL Standard 1581, NEMA WC 70, Federal Specification A-A-59544 and shall be RoHS/REACH Compliant.
- D. Conductors shall be solid for 10 AWG and smaller, and stranded for 8 AWG and larger.
- E. Building wire and cables shall be color-coded using colors factory impregnated throughout the insulation and jacket. The following color code convention(s) shall be used except where existing systems have established another color code convention:
  - 1. 120/208-Volt, 3-Phase, 4-Wire System:
    - a. Phase A: Black
    - b. Phase B: Red
    - c. Phase C: Blue
    - d. Neutral: White
    - e. Ground: Green
  - 2. 277/480-Volt, 3-Phase, 4-Wire System:
    - a. Phase A: Brown
    - b. Phase B: Orange
    - c. Phase C: Yellow
    - d. Neutral: Gray
    - e. Ground: Green

### 2.3 CONNECTORS AND SPLICES

- A. UL-listed, factory-fabricated wiring connectors of size, ampacity rating, material, type, and class for application and service indicated. Comply with Project's installation requirements and as specified in Part 3 Article, "*Wire and Insulation Applications*".
- B. Split Bolt Connectors: Not acceptable.
- C. Solderless Pressure Connectors: High copper alloy terminal. May be used only for cable termination to equipment pads or terminals. Not approved for splicing.
- D. Spring Wire Connectors: Not acceptable.

- E. Mechanical Connectors: Bolted type tin-plated; high conductivity copper alloy; spacer between conductors; beveled cable entrances.
- F. Compression (crimp) Connectors: Long barrel; seamless, tin-plated electrolytic high conductivity copper tubing, internally beveled barrel ends. Connector shall be clearly marked with the wire size and type and proper number and location of crimps.
- G. Heat shrinkable tubing shall meet the requirements of ANSI C119.1-1986 for buried connections to 90 degrees C and shall be material flame-retarded per IEEE 383 *Vertical Tray Flame Test*.
- H. Wire Nut Connectors:
  - 1. Connectors shall be UL listed and appropriately sized according to manufacturer's recommendation for the suitable wire sizes and voltage rating (600 volt minimum).
  - 2. Connector body shall have a color-coded outer shell.
  - 3. Connectors shall be as manufactured by Ideal or approved equal.
- I. Insulated Connectors:
  - 1. Connectors insulated with high-dielectric strength plastisol, molded for precise fit and supplied with removable access plugs over the hex screws.
  - 2. Wire entry ports on one or both sides of the connector as required.
  - 3. Mounting holes at each end of the connector for direct isolated mounting to wiring trough, panel or wireway.
  - 4. UV and cold temperature rated.
  - 5. Dual rated for use with copper and/or aluminum cables.
  - 6. Rated 600V, 90°C.
  - 7. Insulated connectors shall be IPLM or IPLMD Series as manufactured by Polaris, or approved equal by ILSCO, Burndy, T&B or other listed acceptable manufacturer.

#### 2.4 INSULATING TAPE, PUTTY, RESIN AND SUPPORTS

- A. Tape: Provide plastic electrical insulating tape which is flame-retardant, cold and weather-resistant. Tape for use in areas subject to temperatures 30 degrees C to 105 degrees C, or where the tape will be subjected to an oil splash, tape shall have a minimum thickness of 8.5 mils, and shall consist of an oil-resistant acrylic adhesive.

- B. Materials: Provide all insulating materials for splices and connections such as glass and synthetic tapes, putties, resins, splice cases, or compositions of the type approved for the particular use, location, voltage and temperature and apply and install in an approved manner, all in accordance with the manufacturer's recommendations.
- C. Supports: Provide cable supports of the wedge type which firmly clamp each individual cable and tighten due to the cable weight.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine raceways and building finishes to receive wires and cables for compliance with requirements for installation tolerances and other conditions affecting performance of wires and cables. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. By beginning work, the Contractor has accepted conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Owner.

3.2 PREPARATION

- A. Completely and thoroughly swab raceway before installing wire.

3.3 WIRE AND INSULATION APPLICATIONS

- A. No branch circuit wires smaller than 12 AWG shall be used unless otherwise indicated. Conductors shall be continuous from outlet to outlet and from terminal board to point of final connection, and no splice shall be made except within outlet or junction boxes. All conductors shall be of the size indicated. All wires 8 AWG and larger shall be stranded.
- B. Control wiring shall not be less than 14 AWG and shall be color coded using colors impregnated into the insulation. All control wiring shall be color coded with wires of colors different from those used to designate phase wires.
- C. All wiring, contacts, and terminal blocks shall be suitably tagged for ease in identification and tracing of circuits. Identification tags shall be engraved fiber or plastic type, subject to acceptance. Wires shall be numbered and coded, using Brady *Quicklabels*, or equal.
- D. Wiring shall be tagged at terminations, in pull boxes, junction boxes, outlet boxes, panelboards, handholes, etc...
- E. Wiring for general 15 and 20 amp branch circuit work shall be as follows unless otherwise indicated:

HOME RUN LENGTH AND WIRE SIZE		CIRCUIT LENGTH AND WIRE SIZE	
120 Volt		120 Volt	
0 – 60 '	12AWG	0-100 '	12AWG

HOME RUN LENGTH AND WIRE SIZE		CIRCUIT LENGTH AND WIRE SIZE	
60 – 100 '	10AWG	100' & Up	10AWG
100' & Up	8AWG		

- F. Circuit length as given above shall be the wire length between the first and last outlet on the circuit. Home run length as given above shall be the wire length between the first outlet and the panelboard. In accordance with the above, where the size of branch circuit conductors is increased by the minimum required by the NEC for the branch circuit rating, ensure that the termination provisions of all equipment connected to such circuits are listed as suitable for the conductor sizes involved.
- G. Joints of 10 AWG and smaller shall be made with properly insulated solderless type pressure connectors. Where stranded conductors or multiple solid conductors are connected to terminals, solderless lugs manufactured by Thomas and Betts Company or equivalent shall be used.
- H. Joints of 8 AWG and larger in power and lighting circuits shall be of the type indented into the conductor by means of a hand or hydraulic pressure tool. Connectors shall be Burndy *Hy-dent*, T&B *Sta-Kon*, or equivalent. Connectors for control wiring shall be Burndy *Hy-Lug*, or equivalent.

3.4 INSTALLATION

- A. Install wires and cables as indicated, according to manufacturer's written instructions and NECA's *Standard of Installation*.
- B. Remove existing wires from raceway before pulling in new wires and conductors.
- C. Pull Conductors: Use a UL-listed and manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway. Completely and thoroughly swab conduit system before installing conductors.
- E. Install exposed cables, parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Division 26 Section, *Common Work Results for Electrical* and Division 26 Section, *Hangers and Supports*.
- G. Identify wires and cables according to Division 26 Section, *Electrical Identification*.
- H. Conductors installed in parallel shall be of equal lengths.
- I. Wiring at Outlets: Install with at least 12 inches (300 mm) of slack conductor at each outlet.

- J. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.
- K. The Contractor shall provide suitable installation equipment to prevent cutting and abrasion of conductor insulation. The Contractor shall use suitable cable guides, pulleys, and protective sleeving to prevent damage to cable during installation. Ropes used for pulling of wire and cable shall be made of polyethylene or other suitable non-metallic material. Pulling lines shall be attached to cable by means of either woven basket grips or pulling types attached directly to the conductors. Wire pulling lubricants, if used, shall conform to UL requirements applicable to the various insulations and raceway materials. The lubricants shall be certified by the manufacturer to be non-injurious to such insulation and materials.
- L. Each conductor shall be labeled at terminals and at all accessible points in equipment and in pull boxes. Each wire shall be labeled at both ends. Labels shall be self-sticking wire markers.
- M. For rubber and plastic-covered wire and cable, pulling compound Ideal Yellow 77 may be used.
- N. Terminal lugs for wires 8 AWG and larger shall be T&B 54,000 Series or Burndy *HY-Dent*, compression type, unless noted otherwise. One-hole lugs for wires 4/0 AWG and smaller. Two-hole lugs for all wires 250 kcmil AWG and larger.
- O. Install wires and cables using braided rope larger than the cable being pulled to keep twists to a minimum.
- P. Provide an insulated green equipment grounding conductor (EGC), sized per NEC, for all feeder and branch circuits, shown or not shown.
- Q. Multi-wire branch circuits shall not be permitted unless otherwise noted on the Drawings. Provide a separate insulated neutral (grounded) conductor for all feeder and branch circuits requiring a neutral connection.
- R. Install electrical cables, wires, and connectors as indicated in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices.
- S. Coordinate cable and wire installation work with electrical raceway and equipment installation work, as necessary for proper interface.
- T. Conductors installed in runs within 6 inches of heating pipes or equipment shall be suitable for the environment.
- U. No conductors shall be drawn into conduit until all work, which may cause cable damage, is completed.

- V. All wiring over boilers and breechings, and in other high ambient temperature areas, shall be of types required by NEC.
- W. During installation, do not deform cable by improper bending, stretching, twisting, kinking, or pinching, nor do any other abusive handling. Any failure to observe these instructions will be detected and corrected during the demonstrations following completion of the installation. All cable runs shall contain S loops or other means to accommodate expansion or contraction as required. Cable bends will have a radius not less than the value recommended by the cable manufacturer. Cable connected to electronic equipment in the system shall be tagged to show its function and the location of its other end. All labels shall be of durable material and securely fastened to the cable.
- X. Wiring of different system voltages shall not be mixed at pull boxes enclosures, surface metal raceway, wiretrough, etc., unless a barrier (separator) is provided between the differing systems.

### 3.5 CONNECTIONS

- A. Conductor Splices: Keep to minimum.
- B. Install splices and taps that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.
- C. Use splice and tap connectors compatible with conductor material.
- D. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer.
- E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- F. Wire splices and taps shall be adequate to carry full current rating of wire.
- G. Splices and taps in wires up to 8 AWG shall be made with *Scotch-lok* or T&B PT Series or Ideal Wing Nut insulated electrical connectors. Wire nuts installed in wet location boxes shall be silicon gel-filled. For wires 8 AWG and larger, use copper solderless connectors covered with insulating molded body and then wrapped with electrical tape. Use twist-on wire connectors for connecting lighting fixtures and small motor leads up to 8 AWG wire.
- H. Conductors shall be continuous from outlet to outlet, and no splices shall be made except within outlet or junction boxes. Junction boxes may be utilized where required. Wire connectors of insulating material or solderless pressure connections, properly taped, shall be utilized for all splices in wiring.
- I. Splices in branch circuits and feeders shall be made where indicated or as required for the installation. All splices shall be accessible and made in enclosure approved for that purpose.
- J. For splices in branch circuits provide connectors as follows;

1. Wire Sizes 14 AWG to 10 AWG: Provide Ideal Model 74B or 76B or equivalent by T&B.
  2. Wire Sizes 8 AWG and Larger: Provide insulated connectors securely fastened to enclosure as specified in Part 2 of this section.
- K. Thoroughly clean wiring prior to installing lugs or connectors.

### 3.6 IDENTIFICATION

- A. Interface with Other Work:
1. Identify wire and cable using Thomas and Betts Type WM vinyl markers.
  2. Identify each phase and neutral conductor with its circuit number or other designation indicated on the Drawings in all junction, pull, terminal boxes, and cabinets.
- B. Provide identification tags on each conductor entering each panelboard, switch, junction box, and pull box to identify conductor.
- C. Comply with the requirements of Division 26 Section, *Electrical Identification*.

### 3.7 FIELD QUALITY CONTROL

- A. Testing: On installation of wires and conductors and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.3.2. Certify compliance with test parameters.
- B. Correct malfunctioning conductors and cables at Project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.
- C. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.
- D. Verify continuity of each branch circuit conductor.
- E. Tests: Feeder and branch circuit insulation shall be tested after installation, and before connection to equipment.
1. Tests shall be performed with a 1,000-volt megger, and conductors shall test free from short-circuits and grounds.
  2. Conductors shall be tested phase-to-phase and phase-to-ground.
  3. Furnish the instruments, materials, and labor required. Perform the tests in the presence of the Owner's Representative.

4. Actual test readings shall be recorded.
  5. Submit all test reports to the Engineer for approval.
- F. Demonstration: Subsequent to wire and cable hook-ups, energize circuit and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

END OF SECTION

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## SECTION 260526- GROUNDING AND BONDING

## PART 1 GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Refer to Division 26 Section "Conductors and Cables" for conductor and cable requirements.

## 1.2 SUMMARY

- A. This Section includes grounding of electrical systems and equipment and basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other Sections of these Specifications.
- B. Mechanical System Grounding:
  - 1. All mechanical equipment, including but not limited to pumps, motors, packaged equipment, fans, heaters, etc. and their enclosures shall be properly grounded in accordance with Article 250 of the National Electrical Code.

## 1.3 DEFINITIONS

- A. EGC: Equipment grounding conductor.

## 1.4 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 01 Specification Sections.
- B. Product Data for conductors, connectors and connection materials, and grounding fittings. Submit ground system manufacturer's recommended installation procedure for review.

## 1.5 QUALITY ASSURANCE

- A. Comply with NFPA 70 - National Electrical Code.
- B. Comply with UL 467 - UL Standard for Safety Grounding and Bonding Equipment.
- C. Comply with ANSI/IEEE C2 - National Electrical Safety Code.
- D. Comply with ANSI/IEEE 32 - Requirements, terms and test procedures for neutral grounding devices.
- E. Comply with IEEE Standard 142 - Recommended Practice for Grounding of Industrial and Commercial Power Systems.

- F. Comply with ANSI C33.8.
- G. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
  - 1. The Terms *Listed* and *Labeled*: As defined in the National Electrical Code, Article 100.
  - 2. Listing and Labeling Agency Qualifications: A *Nationally Recognized Testing Laboratory* (NRTL) as defined in OSHA Regulation 1910.7.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Erico Inc.; Electrical Products Group.
  - 2. Heary Brothers Lightning Protection Co.
  - 3. Ideal Industries, Inc.
  - 4. ILSCO.
  - 5. O-Z/Gedney Co.
  - 6. Raco, Inc.
  - 7. Thomas & Betts, Electrical.

### 2.2 GROUNDING AND BONDING PRODUCTS

- A. Governing Requirements: Where types, sizes, ratings, and quantities indicated are in excess of National Electrical Code (NEC) requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

### 2.3 WIRE AND CABLE GROUNDING CONDUCTORS

- A. Comply with Division 26, Section “Conductors and Cables”. Conform to NEC Table 8, except as otherwise indicated, for conductor properties, including stranding.
- B. Equipment Grounding Conductors: Size as indicated on the Drawings, or as required by 2011 National Electrical Code (NEC) Table 250-122, whichever is larger. Insulated with green color insulation.
- C. Bare Copper Conductors: Conform to the following:
  - 1. Solid Conductors: ASTM B 3.

2. Assembly of Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.

## 2.4 CONNECTOR PRODUCTS

### A. Mechanical Connectors

1. The mechanical connector bodies shall be manufactured from high strength, high conductivity cast copper ally material. Bolts, nuts, washers and lockwashers shall be made of silicon bronze and supplied as a part of the connector body and shall be of the two-bolt type.
2. Split bolt connector types are NOT allowed unless indicated on the Drawings.
3. The connectors shall meet or exceed UL 467 and be clearly marked with the catalog number, conductor size and manufacturer.

### B. Compression Connectors

1. The compression connectors shall be manufactured from pure wrought copper. The conductivity of this material shall be no less than 99 percent by IACS Standards.
2. The connectors shall meet or exceed the performance requirements of IEEE 837, latest revision.
3. The installation of the connectors shall be made with a compression, tool and die system, as recommended by the manufacturer of the connectors.
4. The connectors shall be clearly marked with the manufacturer, catalog number, conductor size and the required compression tool settings.
5. Each connector shall be factory filled with an oxide-inhibiting compound.

## PART 3 EXECUTION

### 3.1 APPLICATION

- A. Equipment Grounding Conductors: Comply with NEC Article 250 for types, sizes, and quantities of equipment grounding conductors, except where specific types, larger sizes, or more conductors than required by NEC are indicated.
  1. Install Equipment Grounding Conductor (EGC) with circuit conductors for the items below in addition to those required by Code:
    - a. Feeder circuits.
    - b. Single-phase motor or appliance branch circuits.

- c. Three-phase motor or appliance branch circuits.
- d. Flexible raceway runs.

### 3.2 INSTALLATION

- A. General: Ground electrical systems and equipment according to NEC requirements, except where Drawings or Specifications exceed NEC requirements.
- B. Grounding shall satisfy requirements of the applicable publications. All exposed noncurrent-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductor in nonmetallic raceways, and grounded conductors of the wiring system shall be grounded.
- C. The grounded conductor (neutral) of the wiring system shall be connected to the system grounding conductor at a single place in the system by removable bonding jumpers, sized according to the applicable provisions of the National Electrical Code. The grounded conductor (neutral) connection to the grounding conductor (ground) shall be located in the enclosure for the system's overcurrent protection or where otherwise indicated on the Drawings or Specifications.
- D. Ground buses and neutral buses in all switchboards and panelboards, and those provided in any equipment, shall be isolated except where required to be connected as specified above for the service entrance and in transformer terminal compartments.
- E. Equipment grounding conductors shall be extended from the ground bus in the distribution equipment to the receptacle, fixture or device lugs where they are provided. When not provided, they shall be connected to equipment enclosures. The connections shall be arranged such that removal of receptacle, the equipment grounding conductors, or ground jumpers from ground bus, shall not affect the system ground.
- F. Ground bus shall be provided as indicated on the Drawings or as necessary to provide termination for equipment grounding conductor. Non-current carrying metal parts of electric equipment shall be effectively grounded by bonding to the bus.
- G. Raceways shall not be considered as a grounding conductor. Each power, lighting, or control raceway shall have a separate equipment grounding conductor installed. Receptacles shall have a separate grounding pole.

### 3.3 CONNECTIONS

- A. General: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
  - 1. Use electroplated or hot-tin-coated materials to assure high conductivity and to make contact points closer in order of galvanic series.
  - 2. Make connections with clean, bare metal at points of contact.

3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
  4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
  5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- B. Equipment Grounding Conductor (EGC) Terminations: For 8 AWG and larger, use pressure-type grounding lugs. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
- C. Non-Contact Metal Raceway Terminations: Where metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits at both entrances and exits with grounding bushings and bare grounding conductors, except as otherwise indicated.
- D. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. Where these requirements are not available, use those specified in UL 486A and UL 486B.
- E. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by manufacturer of connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

END OF SECTION

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HANGERS AND SUPPORTS  
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## SECTION 260529 – HANGERS AND SUPPORTS

## PART 1 GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Requirements of the following Sections apply to this Section:
  - 1. Division 26 Section, “Common Work Results for Electrical” for general installation requirements.

## 1.2 SUMMARY

- A. This Section includes secure support from the building structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fastenings.
- B. Provide equipment supports consisting of structural members, hangers, rods, racks, and incidental materials.
- C. Provide all labor, supervision, and fabrication. Design and construct supporting structures of strength to safely withstand stresses to which they may be subjected and to properly distribute the load and impact over building areas. Provide all engineering and fabrication as required for installation of support system.
- D. Provide hangers, clamps, anchors, inserts, supports, supplementary steel framing, and hardware of the proper size and load capacity to support electrical equipment and raceways, whether indicated on the drawings or not.

## 1.3 SUBMITTALS

- A. General: Submit the following in accordance with conditions of Contract and Division 01 Specification Sections.
- B. Product data for each type of product specified.

## 1.4 QUALITY ASSURANCE

- A. Electrical Component Standard: Components and installation shall comply with NFPA 70 *National Electrical Code*.
- B. Electrical components shall be listed and labeled by UL, ETL, CSA, or other approved, nationally recognized testing and listing agency that provides third-party Certification follow-up services.
- C. Installation Standard: Installation shall meet or exceed the National Electrical Contractors Association (NECA) Standard of Installation.

- D. Manufacturer's Qualifications:
1. The Manufacturer shall not have had less than ten years' experience in manufacturing Strut Support Systems.
  2. The Manufacturer must certify in writing all components supplied have been produced in accordance with an established quality assurance program.
- E. All Strut Support System components must be supplied by a single manufacturer.
- F. Standards:
1. Work shall meet the requirements of the following standards:
    - a. Federal, State and Local Codes.
    - b. American Iron and Steel Institute (AISI) Specification for the Design of Cold-Formed Steel Structural Members - August 19, 1986 Edition, December 11, 1989 Addendum.
    - c. American Society for Testing and Materials (ASTM).
    - d. Underwriters Laboratories (UL).
    - e. National Electrical Code (NEC).

## 1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. All material is to be delivered to the work site in original factory packaging to avoid damage to the finish.
- B. Upon delivery to the work site, all components shall be protected from the elements by a shelter or other covering.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
1. Slotted Metal Angle and U-Channel Systems:
    - a. American Electric, Kindorf
    - b. Alstrut
    - c. Unistrut Diversified Products
    - d. Power-Strut

e. Thomas & Betts

## 2.2 COATINGS

- A. Dry, Interior Locations: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion-resistance using approved alternative treatment, finish, or inherent material characteristic. All products installed in dry interior locations shall be hot-dip galvanized, unless otherwise noted.

## 2.3 MANUFACTURED SUPPORTING DEVICES

- A. Raceway Supports: Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.
- B. Fasteners: Types, materials, and construction features, as follows:
1. Expansion Anchors - Carbon steel wedge or sleeve type.
  2. Toggle Bolts - All steel springhead type.
  3. Power-Driven Threaded Studs - Heat-treated steel, designed specifically for the intended application.
- C. U-Channel Systems: Sixteen-gauge channels with 9/16-inch-diameter holes at a minimum of eight inches on center in top surface. Provide fittings and accessories that mate and match with U-channel and are of the same manufacturer.

## 2.4 ANCHOR METHODS

- A. Hollow Masonry: Toggle bolts or plastic conical type expansion anchors.
- B. Solid Masonry: Lead expansion anchors or preset inserts.
- C. Metal Surfaces: Machine screws, bolts, or welded studs.
- D. Wood Surfaces: Wood screws.
- E. Concrete Surfaces: Self-drilling anchors or power-driven studs

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. The installer shall inspect the work area prior to installation. If work area conditions are unsatisfactory, installation shall not proceed until satisfactory corrections are completed.

### 3.2 INSTALLATION

- A. Set Strut System components into final position true to line, level and plumb, in accordance with approved Shop Drawings.
- B. Anchor material firmly in place. Tighten all connections to their recommended torques.
- C. Install supporting devices to fasten electrical components securely and permanently in accordance with NEC requirements.
- D. Coordinate with the building structural system and with other electrical installation.
- E. Raceway Supports: Comply with the NEC and the following requirements:
  - 1. Conform to manufacturer's recommendations for selection and installation of supports.
  - 2. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four. Where this determination results in a safety allowance of less than 200 pounds, provide additional strength until there is a minimum of 200 pounds safety allowance in the strength of each support.
  - 3. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.
  - 4. Support parallel runs of horizontal raceways together on trapeze-type hangers.
  - 5. Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners may be used in lieu of hangers only for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings only. For hanger rods with spring steel fasteners, use 1/4-inch-diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.
  - 6. Space supports for raceways in accordance with Table I of this Section. Space supports for raceway types not covered by the above in accordance with NEC.
  - 7. Support exposed and concealed raceway within one foot of an unsupported box and access fittings. In horizontal runs, support at the box and access fittings may be omitted where box or access fittings are independently supported and raceway terminations are not made with chase nipples or threadless box connectors.
  - 8. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminations.
- F. Miscellaneous Supports: Support miscellaneous electrical components as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting disconnects, light fixtures, and other devices.

- G. In open overhead spaces, cast boxes threaded to raceways need not be supported separately except where used for fixture support; support sheet metal boxes directly from the building structure or by bar hangers. Where bar hangers are used, attach the bar to the raceways on opposite sides of the box and support the raceway with an approved type of fastener not more than 24 inches from the box.
- H. Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the building structure, including, but not limited to conduits, raceways, boxes, disconnect switches, and control components in accordance with the following:
1. Fasten by means of toggle bolts on hollow masonry units, concrete inserts or expansion bolts on concrete or solid masonry, and machine screws, welded threaded studs, or spring-tension clamps on steel. Threaded studs driven by a powder charge and provided with lock washers and nuts may be used instead of expansion bolts and machine screws. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures.
  2. Holes cut to depth of more than 1-1/2 inches in reinforced concrete beams or to depth of more than 3/4-inch in concrete shall not cut the main reinforcing bars. Fill holes that are not used.
  3. Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration-and shock-resistant fasteners for attachments to concrete slabs.
  4. Concrete: Double-plated expander type anchors. Phillips, Hilti, or approved equivalent. Loads shall not exceed 1/4 of tested pullout (or shear) strength.
- I. General Supporting Installations:
1. Provide appropriate concrete anchors for hanger rods. Rods shall be screwed into or extended through frame construction (with washer and nut). Supports shall secure conduit in place, and shall prevent vibration, provide for expansion and contraction and shall make neat appearance. Strap hangers or chains are not permitted.
  2. Electrical raceways 1-1/2-inches and smaller shall be secured with 1-hole malleable iron straps or brackets to walls. Trapeze supports shall be used for groups or parallel raceways with raceways secured to trapeze with approved clamps. Individual runs of raceways 2-inches and larger shall be supported by Clevis type hangers.
  3. Provide all steel supports including roof curbs for all equipment provided under this Section.
  4. Electrical raceway supports to be spaced on the following maximum centers, unless otherwise required by the NEC:
    - a. 3/4-inch to 1-inch conduit - 8 feet
    - b. 1-1/4-inch and larger conduit - 10 feet

5. Provide additional hangers or steel members to distribute the load among two or more structural members when required or directed.

J. Locations:

1. Anchor bolts, sleeves, inserts, hangers, and supports required for the electrical work shall be furnished and installed under Division 26.
2. Coordinate with other trades the location of anchors, sleeves, inserts, and supports and insure that they are properly installed.
3. Openings and sleeves shall be set true to line, level, plumb, and position and shall be set true to line, level, plumb, and position and shall be so maintained during construction. Where sleeves and openings are provided in poured concrete, inspect same during and after concrete is poured to insure proper position and correct any deviation.

K. Hangers and Supports:

1. Provide hangers, angles, channels, and other supports required by field conditions to install items of electrical equipment. Design of supports and methods of fastening to building structure shall be acceptable to the Owner.
2. Use of power-actuated fasteners and devices is permitted in the vertical surfaces of the building only with the following requirements.
  - a. For fastening conduits 1-1/2-inch and smaller and lighting fixtures 50 lbs or less.
  - b. Load capacity per manufacturers' recommendations.
  - c. Fasteners shall be located in the thickest part of the slab.
  - d. Devices shall comply with OSHA requirements.
3. Use of lead shield expansion anchors is not permitted.
4. No electrical items shall rest on, or depend for support on suspended ceiling media (tiles, lath, plaster, splines, etc.).
5. Provide weight-distribution facilities, where required so as not to exceed the load bearing capabilities of floor or walls that bear the weight of, or support, electrical items.
6. For point-of-attachment weight of 100 lbs. or less, fasten items as follows:
  - a. On wood, use wood screws.
  - b. On concrete and solid masonry that is already in place, use self-drilling concrete anchors or expansion bolt and couplings.

- c. On hollow construction, use toggle bolts.
  - d. On structural steel, use beam clamps.
7. Equipment shall not be held in place by its own dead weight. Provide base anchor fasteners in each case.
  8. Trapeze type hangers may be used where several conduits are to be installed at the same elevation. The spacing of such trapeze hangers shall be in accordance with the NEC for the smallest conduit in the run.

L. TABLE I: SPACING FOR RACEWAY SUPPORTS

<b>TABLE I: SPACING FOR RACEWAY SUPPORTS</b>			
Raceway Size (Inches)	No. of Conductors in Run	Location	EMT (Ft.)
<b>HORIZONTAL RUNS</b>			
3/4	1 or 2	Flat ceiling or wall.	5
3/4	1 or 2	Where it is difficult to provide supports except at intervals fixed by the building construction.	7
1/2, 3/4	3 or more	Any location.	7
1/2 - 1	3 or more	Any location.	
1 & larger	1 or 2	Flat ceiling or wall.	6
1 & larger	1 or more	Where it is difficult to provide supports except at intervals fixed by the building construction.	10
1 & larger	3 or more	Any location.	10
<b>VERTICAL RUNS</b>			
1/2, 3/4	---	Exposed.	7
1, 1-1/4	---	Exposed.	8
1-1/2 & larger	---	Exposed.	10
<b>ABBREVIATIONS</b>			
EMT		Electrical Metallic Tubing	

3.3 CLEANUP

- A. Upon completion of this Section of work, remove all protective wraps and debris. Repair any damage due to installation of this section of work.

3.4 PROTECTION

- A. During installation, protect this work from damage.
- B. Upon completion of this scope of work, it shall become the responsibility of the General Contractor to protect this work from damage during the remainder of construction on the project and until substantial completion.

END OF SECTION

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SECTION 260533  
RACEWAYS AND BOXES  
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## SECTION 260533 - RACEWAYS AND BOXES

## PART 1 GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
  - 1. Division 26 Section "Conductors and Cables" for conductors installed in raceways and boxes and conductor terminations.
  - 2. Division 26 Section "Hangers and Supports" for raceways and box supports.
  - 3. Division 26 Section "Wiring Devices" for devices installed in boxes.

## 1.2 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
  - 1. Raceways include the following:
    - a. EMT
    - b. LFMC
    - c. Wireways
  - 2. Boxes, enclosures, and cabinets include the following:
    - a. Device boxes
    - b. Outlet boxes
    - c. Pull and junction boxes
  - 3. Miscellaneous Products include the following:
    - a. Bushings

## 1.3 DEFINITIONS

- A. EMT: Electrical Metallic Tubing.
- B. LFMC: Liquidtight Flexible Metal Conduit.

## 1.4 SUBMITTALS

- A. Product Data: For raceways, wireways and fittings, hinged-cover enclosures, and cabinets.

#### 1.5 QUALITY ASSURANCE

- A. Listing and Labeling: Provide raceways and boxes specified in this Section that are listed and labeled.
  - 1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100
  - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.
- B. Comply with NECA's "Standard of Installation" and NECA 101 "Recommended Practice for Installing Steel Conduits".
- C. Comply with NFPA 70.

#### 1.6 COORDINATION

- A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.
- B. Verify routing and termination locations of conduits and boxes prior to rough-in.
- C. Conduit routing shown on Drawings is only approximate and diagrammatic. Route conduits as required for a complete conduit and wiring system.
- D. Coordinate installation of outlet boxes, mounting heights, orientation, and locations of outlets.
- E. Coordinate mounting heights and locations of outlet boxes thoroughly with approved casework shop drawings.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Metal Conduit and Tubing:
    - a. Allied Tube & Conduit Corporation.
    - b. Anamet, Inc.; Anaconda Metal Hose.
    - c. AFC/Monogram Company.
    - d. Carol Cable Co., Inc.

- e. Cole-Flex Corp.
  - f. Electri-Flex Co.
  - g. Flexcon, Inc.; Coleman Cable Systems, Inc.
  - h. Grinnell Co.; Allied Tube and Conduit Div.
  - i. Monogram Co.; AFC.
  - j. Spiraduct, Inc.
  - k. Triangle PWC, Inc.
  - l. Wheatland Tube Corporation
2. Conduit Bodies and Fittings:
- a. American Electric; Construction Materials Group.
  - b. Crouse-Hinds; Div. of Cooper Industries.
  - c. Emerson Electric Co.; Appleton Electric Co.
  - d. Hubbell, Inc.; Killark Electric Manufacturing Co.
  - e. Lamson & Sessions; Carlon Electrical Products.
  - f. O-Z/Gedney; Unit of General Signal.
  - g. Scott Fetzer Co.; Adalet-PLM.
  - h. Spring City Electrical Manufacturing Co.
  - i. Thomas & Betts Corporation.
3. Metal Wireways:
- a. Hoffman Engineering Co.
  - b. Keystone/Rees, Inc.
  - c. Square D Co.
4. Boxes, Enclosures, and Cabinets:
- a. American Electric; FL Industries.
  - b. Butler Manufacturing Co.; Walker Division.

- c. Crouse-Hinds; Div. of Cooper Industries.
- d. Electric Panelboard Co., Inc.
- e. Erickson Electrical Equipment Co.
- f. Hoffman Engineering Co.; Federal-Hoffman, Inc.
- g. Hubbell Inc.; Killark Electric Manufacturing Co.
- h. Hubbell Inc.; Raco, Inc.
- i. Lamson & Sessions; Carlon Electrical Products.
- j. O-Z/Gedney; Unit of General Signal.
- k. Parker Electrical Manufacturing Co.
- l. Robroy Industries, Inc.; Electrical Division.
- m. Scott Fetzer Co.; Adalet-PLM.
- n. Spring City Electrical Manufacturing Co.
- o. Thomas & Betts Corp.
- p. Woodhead Industries, Inc.; Daniel Woodhead Co.

## 2.2 METAL CONDUIT AND TUBING

- A. EMT and Fittings: Hot galvanized steel O.D. with an organic corrosion-resistant I.D. coating. Listed to UL Safety Standard 797 and manufactured in accordance with ANSI C80.3.
  - 1. Fittings: Compression type, NEMA FB1.
- B. LFMC: Flexible steel conduit with PVC jacket.
- C. Fittings: NEMA FB 1; compatible with conduit/tubing materials.

## 2.3 METAL WIREWAYS

- A. Material: Sheet metal sized and shaped as indicated.
- B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- C. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

- D. Wireway Covers: Screw-cover type.
- E. Finish: Manufacturer's standard enamel finish.

#### 2.4 OUTLET AND DEVICE BOXES

- A. Sheet Metal Boxes: NEMA OS 1, galvanized flat-rolled sheet steel.
- B. Cast-Metal Boxes: NEMA FB 1, Type FD, cast box, deep type, with gasketed cover, and threaded hubs.
- C. Outlet Box Accessories: Provide outlet box accessories as required for each installation, including corrosion-resistant screws, mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps, and metal straps for supporting outlet boxes which are compatible with outlet boxes being used and fulfilling requirements of individual wiring situations.
- D. Nonmetallic: NEMA OS2.

#### 2.5 PULL AND JUNCTION BOXES

- A. Small Sheet Metal Boxes: NEMA OS 1, galvanized flat-rolled sheet steel.
- B. Sheet metal boxes over 12" in any dimension shall comply with the requirements of Article "Enclosures and Cabinets" of this Section.
- C. Boxes for Outdoor and Wet Locations: Flat flanged, surface-mounted, UL listed as raintight, galvanized cast iron box and cover with neoprene gasket and stainless steel cover screws.

#### 2.6 BOX EXTENSIONS

- A. Prohibited on new work.

#### 2.7 ENCLOSURES AND CABINETS

- A. Hinged-Cover Enclosures: NEMA 250, Type 1 in dry locations, and Type 4 in wet or damp locations, with continuous hinge cover and flush latch.
  - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
- B. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage, and include accessory feet where required for freestanding equipment.

#### 2.8 BUSHINGS

- A. Bushings for 1-inch conduit and smaller shall be self-extinguishing thermoplastic type - 150°C temperature rating.
- B. Bushings for 1-1/4" conduit and larger shall be malleable iron body with 150 degrees C insulating ring. Insulating material shall be locked in place and non-removable.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 RACEWAY AND BOX REQUIREMENTS

- A. Conduit Application Schedule:

APPLICATION	CONDUIT TYPE	REMARKS
Exposed dry interior locations	EMT	
Equipment connections in interior locations.	LFMC (e.g. Sealtite)	Short lengths only (maximum 6 feet). Use threaded or rain-tight fittings.

- B. General Requirements
  - 1. Aluminum conduit is prohibited.
- C. Fittings:
  - 1. All fittings to match conduit material and to be suitable for the purpose intended. Join conduit with fittings designed and approved for the purpose and make joints tight.
  - 2. Provide UL listed compound filled sealing fittings for NEC-required locations, for conduits passing from interior to exterior, and at the interface of widely different space temperatures such as refrigeration or cold storage rooms where conduits pass from warm locations to cool locations, such as the boundaries of air conditioned spaces and non-conditioned air spaces. For concealed conduits, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.
  - 3. Provide expansion fittings with bonding jumpers where conduits cross expansion joints or where otherwise required to compensate for thermal expansion and contraction. Provide expansion fittings in each straight uninterrupted run of surface-mounted conduit, both horizontal and vertical, in excess of 200 feet. Distance between fittings shall not exceed 200 linear feet. The Contractor shall refer to the Architectural Drawings for expansion joint locations.

4. Fasten EMT conduit with concrete-tight or rain-tight compression fittings made from zinc-plated steel. Fittings using set screw or indentations as a means of attachment or made from cast "white metal" are prohibited. All connectors shall have insulated throats.
5. Fasten liquid-tight conduit with fittings incorporating a threaded ferrule, nylon sealing ring, and steel or malleable iron compression nut and body. Furnish Crouse Hinds metallic liquid-tight fittings, or equal.
6. Watertight fittings shall use a copper base anti-corrosive conductive compound. Provide watertight fittings in conduits exposed to weather, in wet locations, in underground locations, and in slabs.

D. Box Locations:

1. Electrical boxes shall accommodate wire pulling, splices, taps, equipment connections and Code compliance.
2. Coordinate access doors as required to provide access to boxes in hard ceilings and similar inaccessible areas.

E. Outlet Boxes:

1. Outlet boxes for interior work shall be zinc-coated or cadmium-plated sheet steel boxes suitable for the service and type outlet. Extra large boxes shall be provided in accordance with the National Electrical Code where necessary to prevent crowding of wire in the box. Plastic boxes and cast "white metal" boxes classified as NEMA 4 will not be acceptable.
2. All boxes, whether outlet, junction, pull, or equipment, shall be furnished with appropriate covers.
3. No sectionalized boxes shall be used.
4. Provide knockout closures for unused openings in outlet boxes.
5. Provide blank coverplates for all unused boxes.
6. For multiple device installations, provide multi-gang boxes. Sectional boxes are not permitted. Provide barrier separation of different voltage conductors in the same box.
7. Thoroughly coordinate mounting heights of boxes with casework and backsplash heights.

F. Junction and Pull Boxes:

1. Junction and pull boxes shall be furnished and installed as shown or where required to facilitate pulling of wires or cables. Such boxes shall be installed in accessible

locations. All boxes for interior work shall be constructed of 12 gauge USS galvanized sheet steel minimum, unless otherwise specified or indicated and provided with mounting brackets and flat screw covers secured in position by round head brass or stainless steel 300 grade machine screws.

2. Pull or junction boxes shall be supported independently of conduit.

### 3.3 INSTALLATION OF RACEWAYS

- A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.
- B. Furnish and install a separate and independent raceway system as shown on the Drawings for each of the various wiring systems including, but not limited to, the following:

Control Wiring  
Power 120/208 volt  
Power 277/480 volt

- C. All raceway systems shall be completely wired as specified herein, shown on drawings and/or required for satisfactory operation of the various systems.
- D. Raceways, generally, shall be concealed conduit as specified herein. Where wiring troughs are required or used to facilitate the wiring installation, they shall be equal to Square D Company's Square-Duct and fittings, with hinged cover arranged for total removal, all finished in baked enamel and all components U/L listed. The gutters shall be of ample size to accommodate conductors therein and as required by the NEC.
- E. Support all conduit not embedded in concrete or masonry such that strain is not transmitted to outlet boxes and pull/junction boxes, etc. Supports to be sufficiently rigid to prevent distortion of conduits during wire pulling.
- F. Minimum Raceway Size:
  1. 3/4-inch trade size (DN21) for interior work
- G. Electrical Metallic Tubing (EMT) shall be used for the following unless otherwise indicated:
  1. Branch circuits and feeders for power and control.
  2. Exposed in equipment room areas as needed to serve fixed equipment.
- H. Where exposed conduits runs are shown or required, they shall be run parallel to building construction and shall be suitably supported at required intervals.
- I. Conduit may be run exposed in Mechanical Equipment rooms, Electrical rooms, and where necessary in Storage rooms and unfinished areas. Where conduit is run exposed, it shall be run as close as possible to walls and ceilings and shall not interfere with equipment, ductwork and piping.

- J. Keep raceways at least 12 inches (300 mm) away from parallel runs of flues, steam or hot-water pipes and other hot surfaces above 77 degrees F. Install horizontal raceway runs above water and steam piping.
- K. Install raceways level and square and at proper elevations. Provide adequate headroom.
- L. Complete raceway installation before starting conductor installation.
- M. Support raceways as specified in Division 26 Section "Hangers and Supports". Arrange supports to prevent misalignment during wiring installation.
- N. Use capped bushings or "push-penny" plugs to prevent foreign matter from entering the conduit system during construction. Clean and plug or cap all conduits left empty for future use.
- O. Make bends and offsets so the inside diameter is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.
- P. Use raceway fittings compatible with raceways and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings, unless otherwise indicated.
- Q. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.
- R. Run parallel or banked raceways together, on common supports where practical.
- S. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
- T. Join raceways with fittings designed and approved for the purpose and make joints tight.
  - 1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
  - 2. Use insulating bushings to protect conductors.
- U. Tighten set screws of threadless fittings with suitable tools.
- V. Install pull wires in empty raceways. Use 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of the pull wire.
- W. Lubricants for pulling wires shall be approved for use with the types of wire and conduit installed.

- X. Install no more than equivalent of three 90° bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use factory elbows for bends in metal conduit larger than 2 inches (50 mm) in size.
- Y. Die-cast fittings of pot metal will not be accepted.
- Z. Conduits shall be free of any burrs, foreign objects, and water prior to conduit installation.
- AA. Conduit placed against concrete or masonry above ground shall be fastened to the concrete or masonry with pipe straps or one screw clamp attached to the concrete by means of expansion screw anchors and screws. "Caddy Clip" type hangers or straps will be permitted only in non-exposed areas and restricted to 3/4" conduit.
- BB. Electrical Metallic Tubing (EMT) shall not be strapped or fastened to equipment subject to vibration or mounted on shock-absorbing bases.
- CC. Conduits run to and from cabinets shall be run neatly, in accurate manner and shall emerge from the floors and ceilings at right angles thereto.
- DD. Exposed conduit installed on or adjacent to ventilating ducts shall be installed after the ducts are in place, and shall be run from ceiling or wall junction boxes in such manner as to retain accessibility to junction box covers and to permit future removal or replacement of ducts.
- EE. Conduits and other electrical items shall not be fastened to, or supported from ventilating ducts but shall be separately supported. The method of supporting and details of the supporting members shall be reviewed by the Owner's Representative. In no case shall screws penetrate the sheet metal of the ducts.
- FF. Exposed conduit run on surface shall be supported according to Code and within three feet of each outlet, junction box, or cabinet, by galvanized malleable conduit clamps and clamp backs. Suspended conduits shall be supported every five feet by conduit hangers and round rods, or where two or more conduits are run parallel, by trapeze hangers suitably braced to prevent swaying.
- GG. Screws for all exposed work shall be stainless steel, unless otherwise noted.
- HH. Zinc coated galvanized steel screws may be used for interior dry locations only.
- II. No running threads shall be cut or used.

### 3.4 INSTALLATION OF BOXES

- A. Provide grounding connections for raceway, boxes, and components as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors.
- B. Provide junction boxes, pull boxes, cable support boxes, and wireways as required for proper installation of the electrical work. Covers shall be accessible. Small junction boxes shall be similar to outlet boxes.

- C. Pull boxes, cable support boxes, and large junction boxes for indoor use shall be made of Code gauge steel or no less than 12 gauge. Covers shall be held in place with zinc-coated galvanized steel screws. Pull boxes and covers shall be hot-dipped galvanized.
- D. Pull boxes shall be installed at all necessary points to prevent injury to the insulation or other damage that might result from pulling resistance or for other reasons necessary for proper installation. Pull box locations shall be approved by the Owner's representative prior to installation.
- E. Where boxes are used in connection with exposed conduit, plain covers attached to the box with a suitable number of countersunk flat head machine screws shall be used.
- F. Location of pull boxes shall be coordinated with piping, ductwork, and other equipment so as to permit sufficient clearance for maintenance and access.
- G. Outlet boxes and covers shall be sheet steel knockout type, zinc-coated, or cadmium-plated and shall be of proper Code size for the number of wires of conduits passing through or terminating therein, but in no case shall any box be less than 4" square. Additional pull boxes shall be installed as required to facilitate pulling of wires.
- H. Each circuit in each pullbox shall be marked with a tag guide denoting panels to which they connect.
- I. Outlet boxes shall be provided with suitable plaster rings and covers or plates.
- J. Unused knockout holes shall remain closed and those opened by error shall be closed with factory-made knockout seals.
- K. Outlet boxes shall not be smaller than required by Code for the number and size of wires to be installed.
- L. Outlet boxes shall be installed true and plumb so that the covers or plates will be level and at uniform elevations for the types of outlets contained.
- M. Outlet box locations as indicated shall be considered to be approximate only. Determine exact locations from architectural details or from field instructions and coordinate outlet box locations with the work of other trades.
- N. Install junction and pull boxes to be accessible.
- O. Locations of junction and pull boxes requiring access panels shall be reviewed by the Owner's Representative.
- P. Install hinged-cover enclosures and cabinets plumb. Support at each corner at minimum.

### 3.5 INSTALLATION OF TERMINATIONS

- A. Where raceways are terminated with lock nuts and bushings, align the raceway to enter squarely, and install the lock nuts with dished part against the box. Where terminations

cannot be made secure with one lock nut, use two lock nuts, one inside and one outside of the box.

- B. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.
- C. Open ends shall be capped with approved manufactured conduit seals as soon as installed and kept capped until ready to pull in conductors.
- D. Where conductors 10 AWG or larger enter a raceway, cabinet, pull box, and junction box, the conductors shall be protected by an insulated bushing providing a smoothly rounded surface.
- E. Ends of conduits shall be equipped with insulating bushings for 1" and smaller, and insulated metallic bushings for 1-1/4" and larger. Ends of conduit shall be temporarily capped prior to installation and during construction to exclude foreign material.

### 3.6 FLEXIBLE CONNECTIONS

- A. Provide Liquidtight Flexible Metal Conduit (LFMC), e.g. Sealtite, in short lengths (maximum 6 feet) for the connection of equipment as defined in Division 26 Section "Common Work Results for Electrical".
- B. Grounding conductors with green colored insulation shall be extended through all flexible connections and fastened to terminals within the first junction boxes on either side of the flexible length.
- C. Flexible connections shall be sized per the Contract Drawings, or as required in accordance with Code; the more stringent requirement shall apply.

### 3.7 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to Manufacturer and Installer that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.
- B. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
- C. Steel conduit: Conduit that shows corrosion within the guarantee period shall be replaced.

### 3.8 CLEANING

- A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.
- B. After conduits and accessories have been installed, conduit runs shall be satisfactorily cleared of obstructions and foreign matter. Defects which might damage cable upon

installation shall be corrected. Where new conduits installed are connected to existing conduits, the entire run to the nearest box or other termination point shall be cleaned.

END OF SECTION

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## SECTION 260553 - ELECTRICAL IDENTIFICATION

## PART 1 GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section includes electrical identification materials and devices required to comply with ANSI C2, NFPA 70, OSHA standards, and authorities having jurisdiction.
- B. This section includes labeling of all terminations and related subsystems; including, but not limited to, nameplates, wire markers labeling and identification of conductors, equipment and other products.

## 1.3 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Schedule of Nomenclature: An index of electrical equipment and system components used in identification signs and labels. Provide a schedule of nameplates.

## 1.4 QUALITY ASSURANCE

- A. Comply with ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with ANSI A13.1 and NFPA 70 for color-coding.
- D. Comply with applicable EIA/TIA Standards.
- E. Comply with OSHA Standards.

## PART 2 PRODUCTS

## 2.1 CONDUCTOR LABELS

- A. Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
  - 1. Color: Black letters on orange field.
  - 2. Legend: Indicates voltage and service.
- B. Adhesive Labels: Preprinted, flexible, self-adhesive vinyl with legend, overlaminated with a clear, weather- and chemical-resistant coating.

- C. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick by 3/4 inch wide, in appropriate colors for system voltage and phase.
- D. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

## 2.2 WIRING DEVICE FACEPLATE LABELS

- A. Adhesive Labels:
  - 1. Thermal transfer printable, clear polyester material with glossy finish, 1/2" high, width as required. Printed lettering shall be 1/4" high black text.
  - 2. Labels shall be backed with permanent acrylic adhesive and shall exhibit good adhesion to many metal and other types of surfaces, including textured surfaces and low surface energy plastics.
  - 3. Labels shall be resistant to humidity, temperature and UV light.
  - 4. Labels shall meet requirements of UL 969 *Labeling and Marking Standard* and shall be RoHS compliant.
  - 5. Provide Brady B-432 Series, or approved equal by acceptable manufacturer.

## 2.3 NAMEPLATES AND SIGNS

- A. General Nameplate Requirements:
  - 1. Use colors prescribed by ANSI A13.1, NFPA 70 and as follows:
    - a. Normal Power System: White lettering on black background.
  - 2. Backed with adhesive material formulated for the type of surface, intended use and installed location.
- B. Nameplates for Dry, Interior Locations:
  - 1. Engraving stock, melamine 3-layer plastic laminate.
  - 2. Minimum 1/16-inch (1.6-mm) thick for signs up to 20 sq. inches (129 sq. cm)
  - 3. Minimum 1/8-inch (3.2-mm) thick for signs larger than 20 sq. inches.
- C. Refer to Contract Drawings for typical nameplate details.
- D. Refer to Paragraph "Equipment Identification Labels" under Part 3 of this Section for installation requirements.

## PART 3 EXECUTION

### 3.1 INSTALLATION

#### A. General:

1. Where mixed voltages are used in one building (e.g., 480 volts, 208 volts), each piece of equipment, including but not limited to, outlet/pull/junction boxes, etc., on each system must be labeled for voltage in addition to other requirements listed herein.
2. Before attaching labels, clean all surfaces with the label manufacturer's recommended cleaning agent.
3. Install all labels firmly, as recommended by the label manufacturer.
4. Labels attached to wiring device faceplates and electrical equipment shall be installed plumb and neatly on all equipment.
5. Install nameplates parallel to equipment lines.
6. Secure nameplates to equipment fronts unless otherwise noted.
7. Embossed tape will not be permitted for any application.
8. Stenciling is prohibited.
9. Labels: All labels shall be permanent and be machine-generated. **NO HANDWRITTEN OR NON-PERMANENT LABELS SHALL BE ALLOWED.**
10. Label size shall be appropriate for the conductor size(s), and wiring device faceplate layout. All labels to be used shall be self-laminating, white/transparent vinyl and be wrapped around the conductor. Flag type labels are not allowed. The labels shall be of adequate size to accommodate the circumference of the cable being labeled and properly self-laminated over the full extent of the printed area of the label.

B. Identification Materials and Devices: Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout Project.

D. Self-Adhesive Identification Products: Clean surfaces before applying.

E. Caution Labels for Boxes and Enclosures for Power: Install pressure-sensitive, self-adhesive labels identifying system voltage with black letters on orange background. Install on exterior of door or cover.

F. Circuit Identification Labels on Boxes: Install labels externally.

1. Exposed Boxes: Pressure-sensitive, self-adhesive plastic label on cover.
  2. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.
- G. Apply identification to conductors as follows:
1. Power Circuits: Identify each conductor with source, voltage, circuit number, and phase. Use color-coding to identify circuits' voltage and phase.
- H. Apply warning, caution, and instruction signs as follows:
1. Warnings, Cautions, and Instructions: Install to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
- I. Equipment Identification Labels: Install on each unit of equipment. Unless otherwise noted, labels/nameplates shall identify equipment designation(s), voltage rating, and source (including source locations). Labels for disconnect switches, etc..., shall indicate the designation of the load served as the "equipment designation". In general, labels requiring one or two lines of text shall be 1-1/2 inches high. Labels requiring three lines of text shall be 2 inches high. The first line of text, which shall indicate equipment designation/load served, shall utilize 1/2 inch high lettering. Remaining lines of text, which shall indicate voltage ratings and source information shall utilize 1/4 inch high lettering. Refer to the Drawings for nameplate examples. Apply labels to each unit of the following categories of equipment:
1. Disconnect Switches.
  2. Electrical Cabinets and Enclosures.
- J. Surfaces shall be cleaned and painted, if specified, before applying markings.
- K. Place markings so that they are visible from the floor.
- L. Protect finished identification to ensure that markings are clear and legible when project is turned over to the Owner.

END OF SECTION

DIVISION 26  
SECTION 262726  
WIRING DEVICES  
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## SECTION 262726 - WIRING DEVICES

## PART 1 GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section includes the following:

- 1. Toggle switches.
- 2. Device plates.

## 1.3 SUBMITTALS

- A. Product Data: For each product specified, indicating configurations, finishes, dimensions, and manufacturer's instructions.

## 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- B. Comply with NFPA 70.
- C. Comply with NECA Standard of Installation.
- D. Codes: Provide wiring devices conforming to the following:
  - 1. American National Standards Institute (ANSI): Provide lugs and receptacle devices constructed in accordance with ANSI C73, *Attachment Plugs and Receptacles, Dimensions of*.
  - 2. Institute of Electrical and Electronics Engineers (IEEE): Construct and install wiring devices in accordance with requirements of IEEE 241, *Recommended Practice for Electric Power Systems in Commercial Building*.
  - 3. National Electrical Manufacturers Association (NEMA): Provide wiring devices constructed and configured in accordance with the requirements of
    - a. WD1: General Requirements for Wiring Devices
    - b. WD6: Wiring Devices - Dimensional Requirements.
  - 4. National Fire Protection Association (NFPA): Comply with NFPA 70, *National Electrical Code*, as applicable to construction and installation of electrical wiring devices.

5. Underwriters Laboratories, Inc. (UL): Provide wiring devices which are UL listed and comply with the requirements of:
  - a. 20: General-Use Snap Switches.
  - b. 498: Attachments, Plugs and Receptacles
  - c. 514A: Metallic Outlet Boxes.
  - d. 514B: Fittings for Conduit and Outlet Boxes.
  - e. 514C: Non-Metallic Outlet Boxes, Flush-Device Boxes, and Covers
  - f. 943: Ground-Fault Circuit Interrupters

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include. No other manufacturers are acceptable.

1. Wiring Devices:

- a. Hubbell, Inc.; Wiring Devices Div.
- b. Pass & Seymour/Legrand; Wiring Devices Div.

### 2.2 SWITCHES

- A. General Requirements

1. Switches shall have the following basic features:

- a. Heavy-gauge one-piece copper alloy contact arm.
- b. Fast "make" and positive "break" to minimize arcing.
- c. Heavy-duty bumper pads for quiet operation.
- d. High strength thermoplastic polycarbonate toggle.
- e. Oversized silvery alloy contacts for long life and heat dissipation.
- f. Nickel-plated steel strap with integral ground.
- g. Auto-ground clip to assure positive ground.

- B. Toggle Switches

1. Toggle switches shall be quiet-type, extra heavy-duty, horsepower-rated, industrial grade, 120/277V, 20A: Comply with NEMA WD 1, UL 20 and Federal Specification W-S-896.
2. Hubbell HBL1221 (single-pole), or Pass & Seymour PS20AC1 (single-pole).

- C. Lockable Switch Handle Guards

1. Provide handle guards with provisions for padlocking at all toggle switches serving as disconnecting means and where indicated on the Drawings.

2. Handle guards shall be steel construction, and shall mount directly over standard switch faceplates.
3. Provide Square D Class 2510 FL1, or approved equal by listed manufacturer.

### 2.3 DEVICE PLATES

- A. Device plates shall be provided for all switches and receptacles. Device plates shall be as manufactured to fit each type of single device, to fit devices which are ganged together, and they shall be same manufacturer as wiring devices with finish as follows:
  1. Material for Unfinished Spaces: Galvanized steel.
  2. Plate-Securing Screws: Metal with heads colored to match plate finish.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verification of existing conditions before starting work.
- B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.
  1. Verify that outlet boxes are installed at proper height.
  2. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- C. By beginning Work, accepts conditions and assume responsibility for correcting unsuitable conditions encountered at no additional cost to the Owner.

### 3.2 INSTALLATION

- A. Install devices and assemblies plumb, level, and secure.
- B. Switches shall be located as indicated on the drawings.

### 3.3 IDENTIFICATION

- A. Comply with Division 26 Section "Electrical Identification".
  1. Switches: Switches shall be labeled as to lights/load controlled and with circuit number and panel identification.
  2. Mark all conductors with the panel and circuit number serving the device at the device.
  3. Mark the panel and circuit number serving the device on the device plate with a permanent marking system, machine-generated.

### 3.4 CONNECTIONS

- A. Connect wiring device grounding terminal to outlet box with bonding jumper.
- B. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor.
- C. Tighten electrical connectors and terminals according to manufacturers published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.5 FIELD QUALITY CONTROL

- A. Test wiring devices for proper polarity, continuity, short circuits, and ground continuity. Operate each device at least six times.
- B. Replace damaged or defective components.

### 3.6 CLEANING

- A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION